~~Presented by~~
~~Rosie A. Wood.~~

THE

ANATOMY AND DISEASES

OF THE

BREAST,

WITH

SURGICAL PAPERS.

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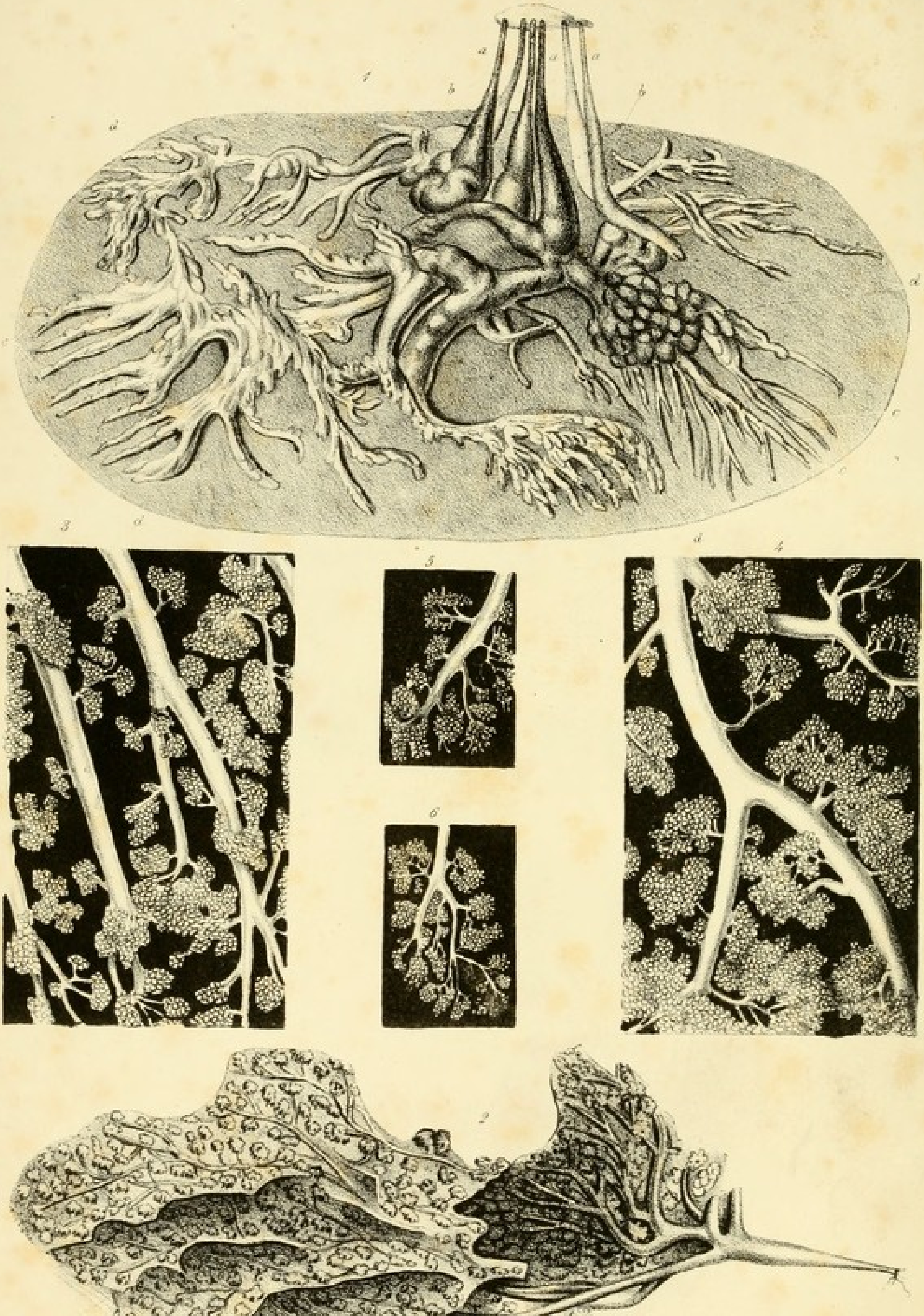

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THE

ANATOMY AND DISEASES

OF THE

BREAST.

WITH NUMEROUS PLATES.

BY

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

SERGEANT SURGEON TO HIS MAJESTY;
CONSULTING SURGEON OF GUY'S HOSPITAL; LECTURER ON
ANATOMY AND SURGERY, &c. &c. &c.

TO WHICH ARE ADDED,

HIS

VARIOUS SURGICAL PAPERS,

NOW FIRST PUBLISHED IN A COLLECTED FORM.

PHILADELPHIA:
LEA & BLANCHARD.

1845.

PUBLISHERS' NOTICE.

This volume, with those already published in this country upon the subject of "Hernia," "The Structure and Diseases of the Testis, and Thymus Gland," "Fractures and Dislocations of the Joints," and "Lectures on Surgery, edited by Tyrrell," making five volumes in all, complete the valuable series of the works of Sir Astley Cooper. The present corresponds in size with the other ILLUSTRATED works of the author. Great care has been taken in the reduction and execution of the plates in Lithography—and the publishers trust the figures will be found to be faithful copies of the larger and more expensive originals.

The sources from which the Surgical Papers and Contributions have been collected, are stated at the head of each article, and were pointed out in the list appended to a slight Biography of Sir Astley, published in the last edition of his work on "Dislocations and Fractures."

The publishers feel that they have fully redeemed the pledge given by them, of presenting the productions of the great modern English Surgeon, in a form, which at the same time, that it places them within the reach of all members of the profession, is worthy of the fame of the illustrious Author.

Philadelphia, August, 1845.

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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 any thing 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 a 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 mamilla, 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 nip ple 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 on 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 distention 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 by 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, $2\frac{1}{4}$ inches.
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.

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.

* 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.

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 distention and in the process of suckling.

There is no transverse wrinkling of the lactiferous tube internally, 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 network 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 cephalic 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 deposite 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 deposite 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.

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.

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

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 sensibilities 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 delivered—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 network.

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 the 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 circumference 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 discoloured 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, and to 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 forepart 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 every where 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, 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 the 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, but 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 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 size, 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, every where 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, size, 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 fulness 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 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.

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

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

more of the milk tubes, producing great enlargement, pain, and distention, 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 precludes the possession of proper covering, or the caprice 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.

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.

* 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.

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 distention, 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 junction 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 plaster 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 follow:—

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 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 muscles, 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 distention 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 connexion; 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 connexion 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 connexion. 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 XV.*

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 apppear. *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 colour 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 development 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 development 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 is from the cow, but we will compare this history with 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 stopped 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	,,	2½
,, 5 ,,	21	,,	2½
,, 7 ,,	14	,,	2
,, 8 ,,	16	,,	2½
,, 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 in 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*.

"Any thing 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 constitute 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 a 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 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 of 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 buttermilk, 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	Never less than *twelve*, but more generally for *sixteen* or *eighteen* months.

QUESTIONS.	ANSWERS.
of the child continuing to be suckled for a long period?	I have known many instances of children being suckled for *two* years, much to 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 the 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 re-appear 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 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 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 Chevalier, 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 week she 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 disease 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 grand-children, 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 yours,

"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 XVI.*, 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 XVI.*)

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 orifice 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 becomes 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* XV. 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, and 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* III.

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* XIV., 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 internal side. *See Plate* XVII.

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* XV., 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* XV., 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* XV., 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* XV., 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 great pectoral muscle. *Plate* XV., 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 DEVELOPMENT 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* XV., 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 colours 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* XV., 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* XV., figs. 2 and 3; the voice becomes broken; the beard grows; and the figure denotes manhood.

In *Plate* XV., 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* XVI., 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* XVI., 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 development of that organ, so that in 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 XIV.*, 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 XIV.*, 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 X*,, 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 XIV.*

Arteries from the mammary intercostal also pass into the posterior surface of the gland, the nipple, and the areola.

16

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 XVI*, fig. 3, 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 of 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* XVII., 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* XVII., 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 muscle 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* XIV., 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 forepart 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 XV.* I have given several sections showing the gland and its connexions 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 the 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 XV.*, figs. 6, 7, 8.

EXPLANATION OF THE PLATES.

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.

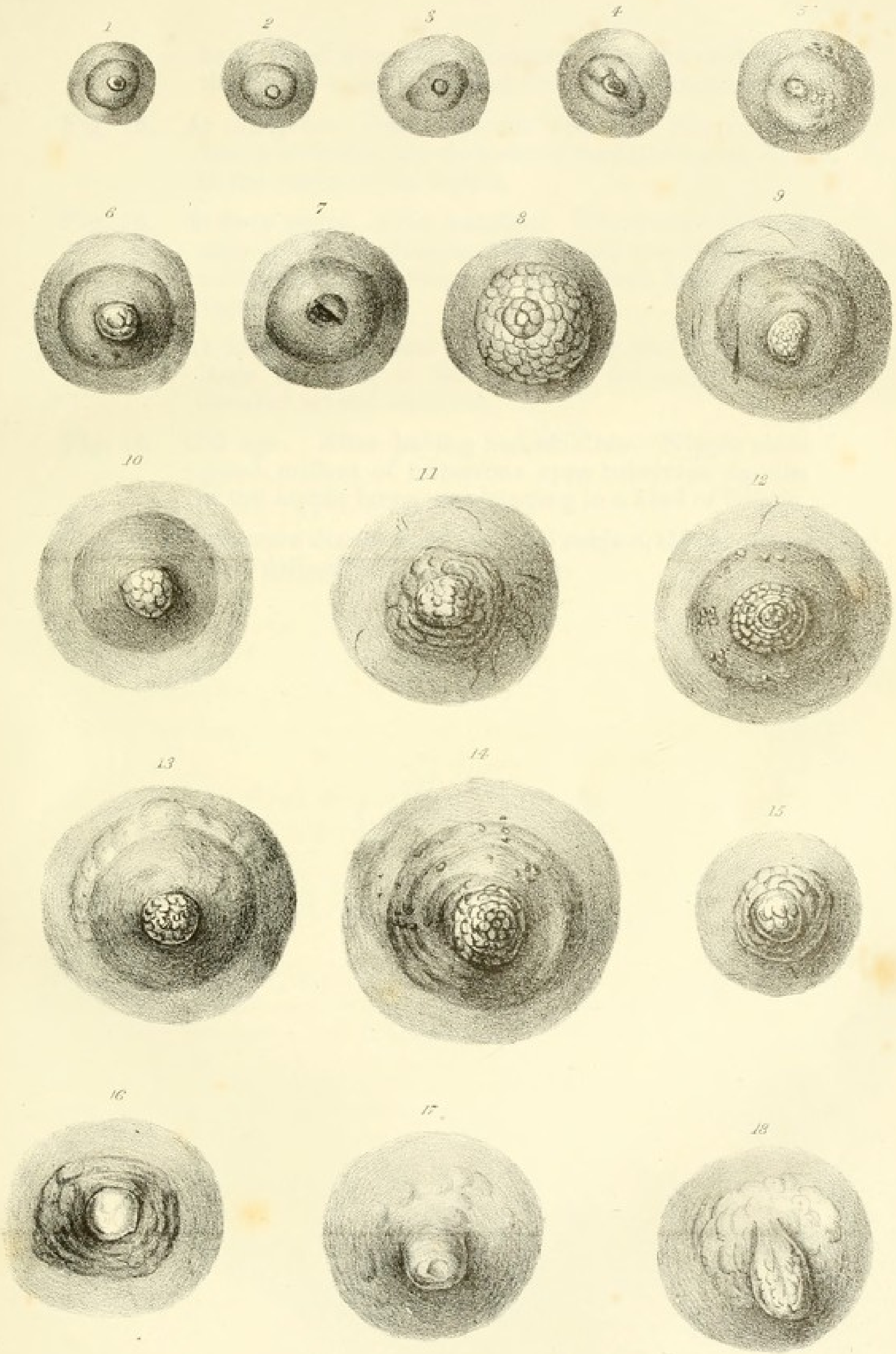
Fig. 11. At twenty-four years. Woman who had borne a child. Nipple papillous, tubercles enlarged, areola contracted in its diameter, several hairs appearing.

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

Pl. I.



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 permanent, 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.

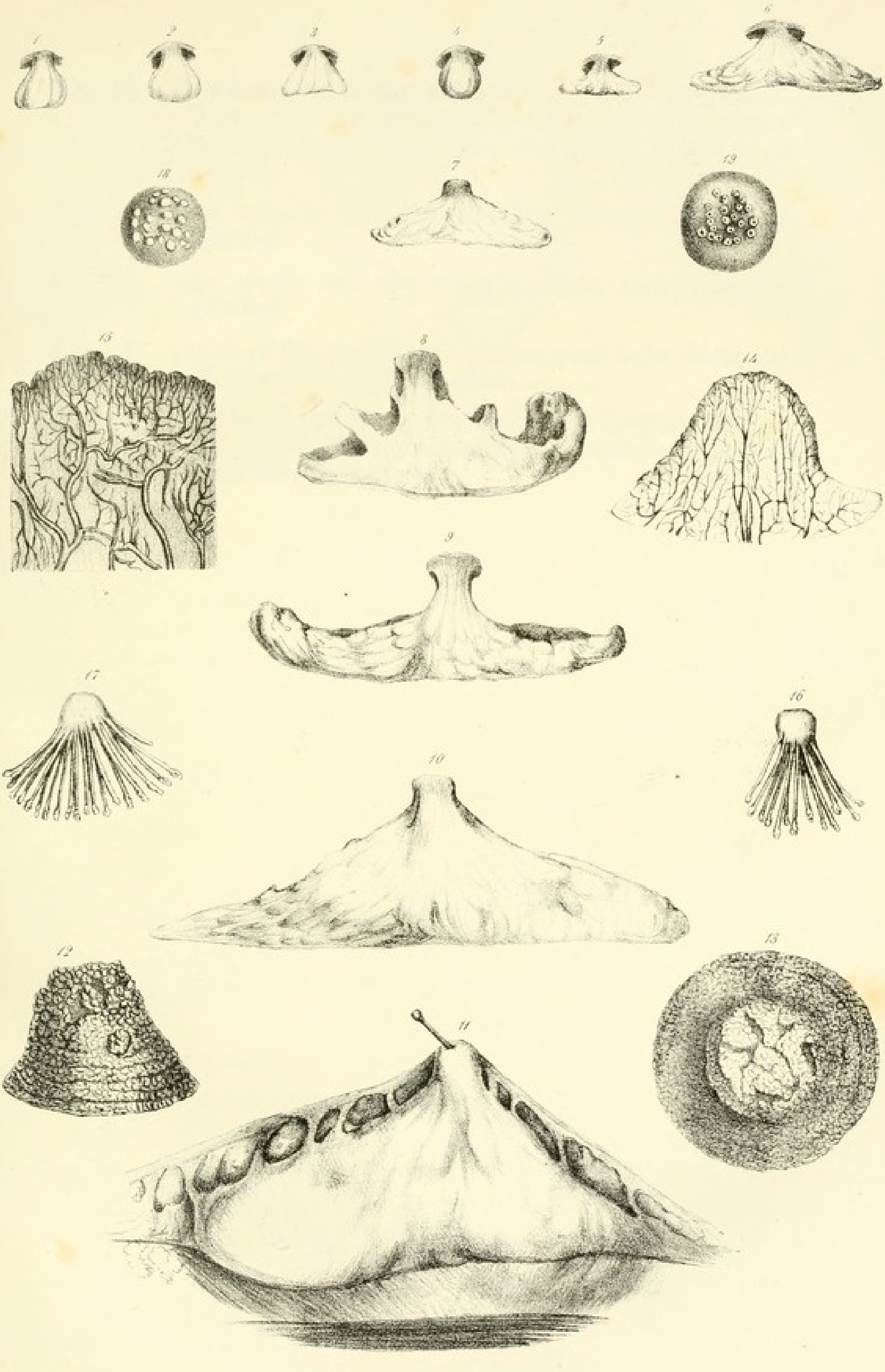
Fig. 10. At sixteen years. Gland very much increased. In all the preceding figures the fascia is removed.

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,) 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.

Fig. 14. The arteries of the nipple (magnified,) terminating in veins in the papillæ.



J. T. French del.

Sinclair's Lith.

Fig. 15. The branches of the veins in the papillæ 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. (Magnified.)

Fig. 3. 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. 4. Rete mucosum on the *cutis* of the black (magnified.)

Fig. 5. Nipple and areola, with numerous cutaneous glands, filled with 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 injection, and magnified.

Fig. 8. One of the glands magnified twenty times.

Fig. 9. A gland filled with 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 injection, and twenty-three times magnified.

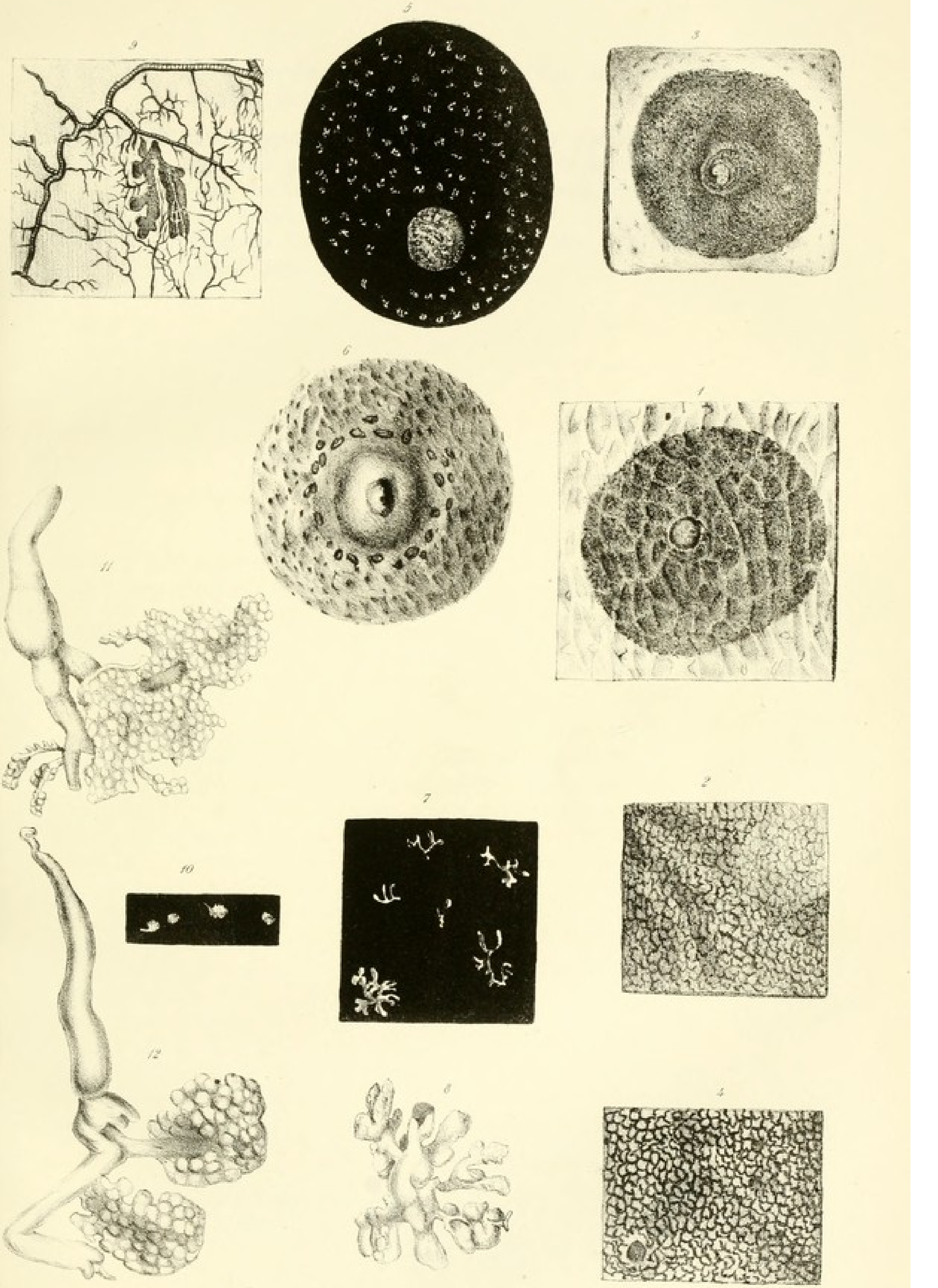


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Fig. 12. A Tubercle filled with injection, and magnified twenty times.

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 connexion with it is here cut off. Thus the surface of the breast is greatly increased, while 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.

Pl. IV

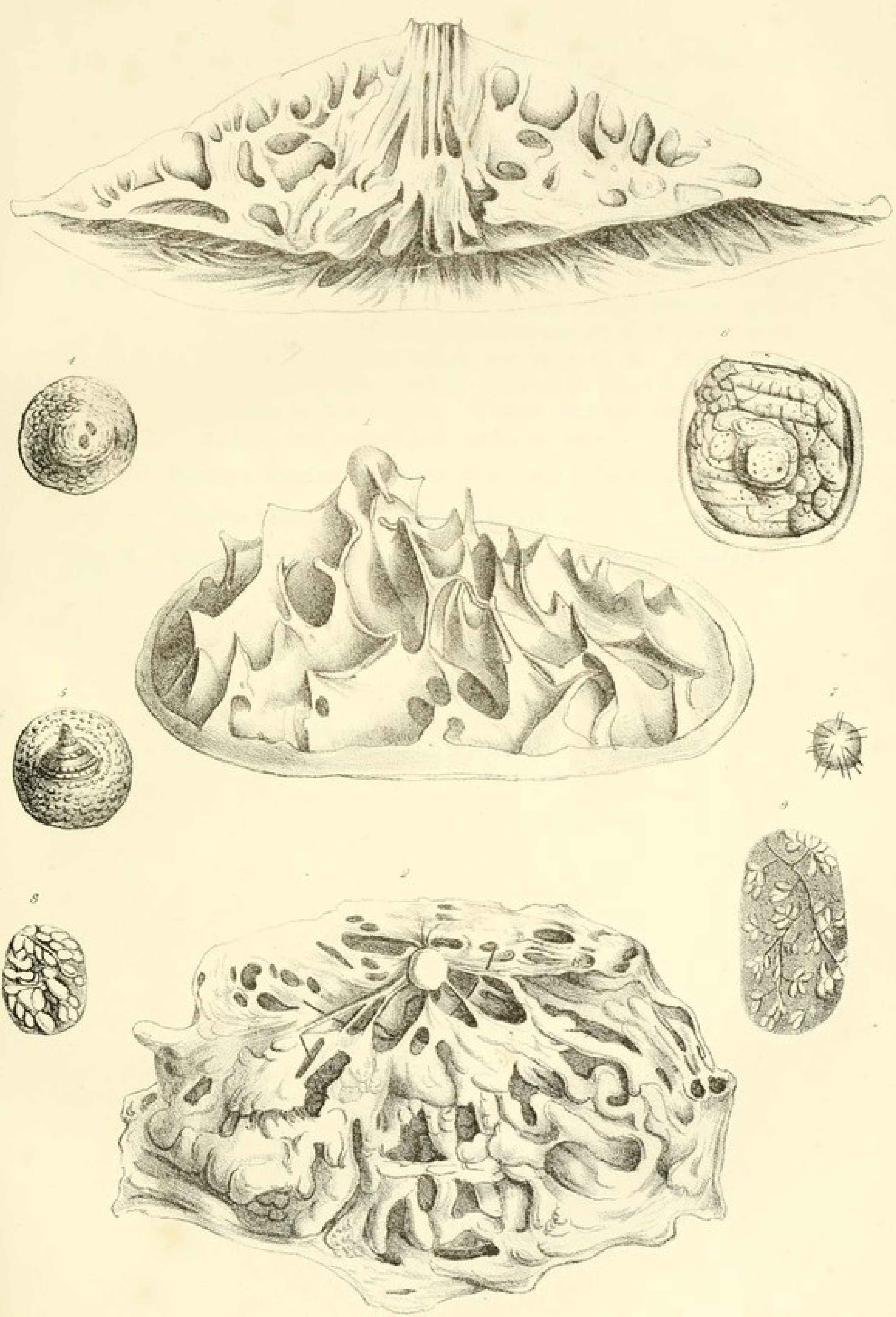

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Fig. 4. Shows the depressions of the nipple, in which the orifices of the lactiferous tubes are placed.

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 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 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.

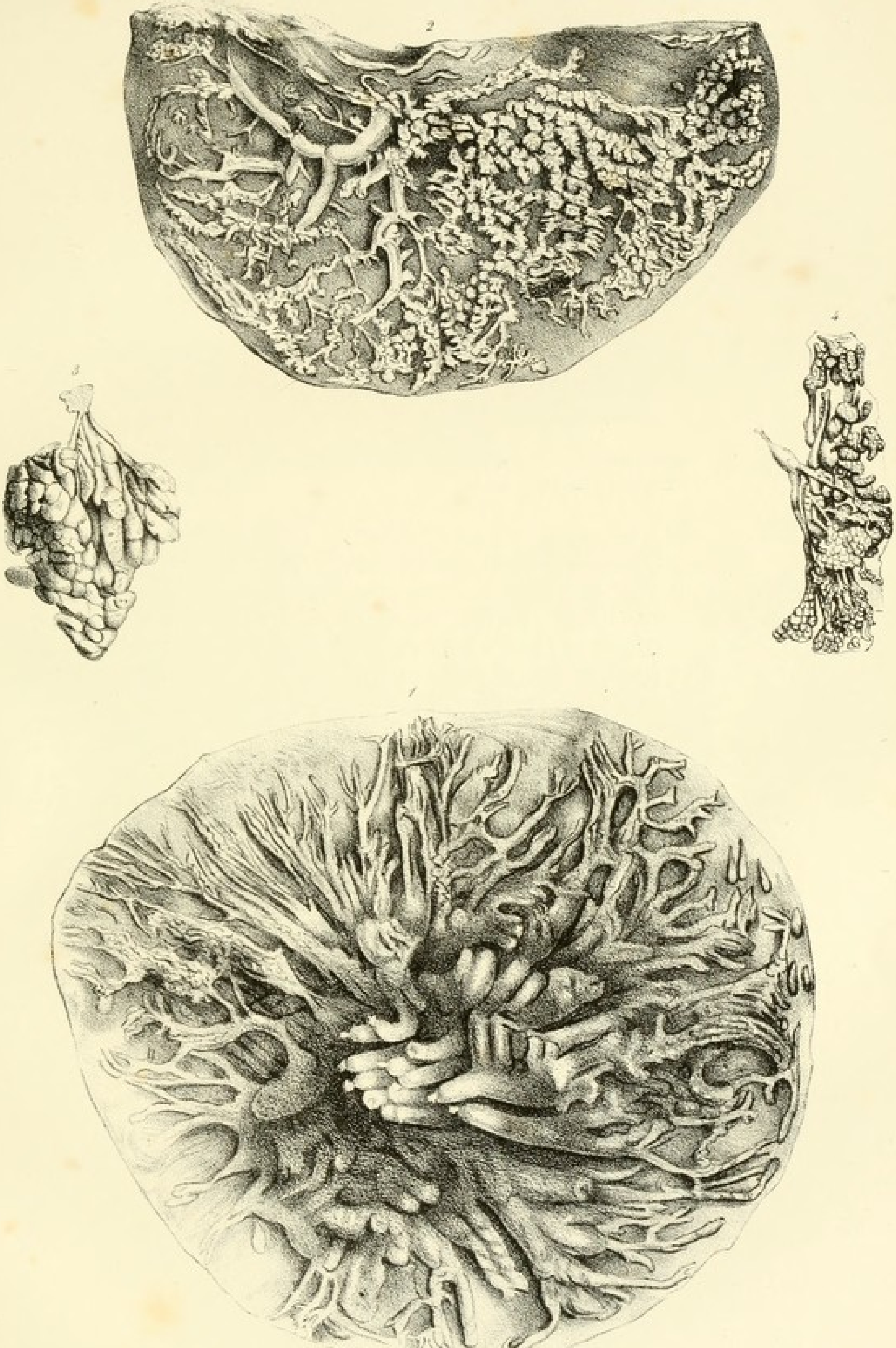

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Plate VI.

Ducts and Glandules.

Fig. 1. Lactiferous tubes or ducts injected with wax, showing their radiated direction, and, in some places, their inter-ramification.

Fig. 2. Mammary ducts injected, and seen less intermixed than the former.

Fig. 3. Ducts injected more minutely. 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.

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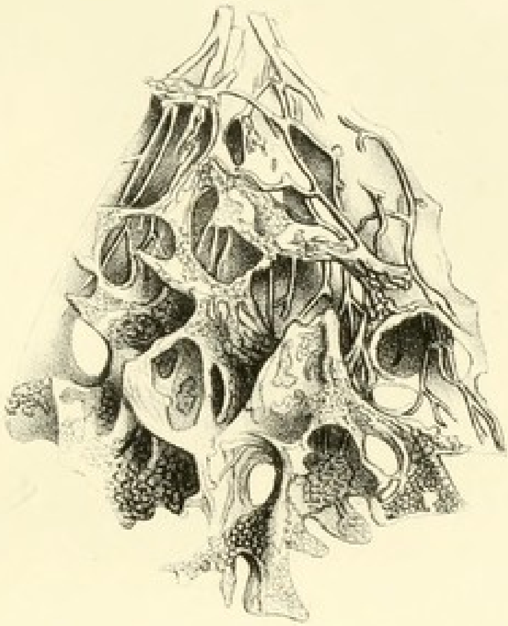

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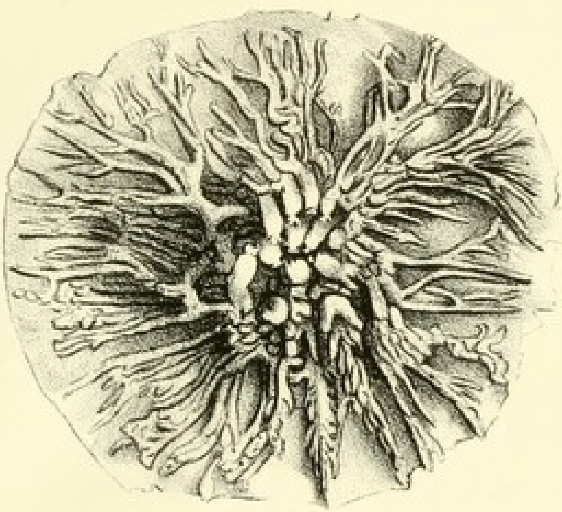

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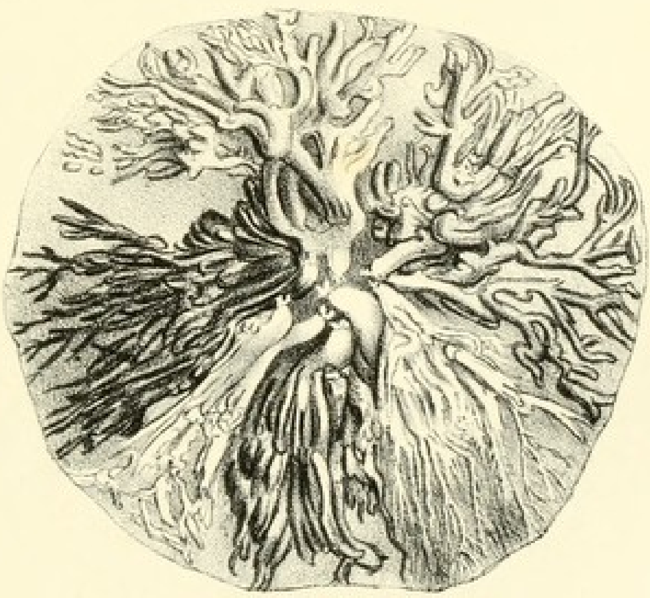

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Plate VII.

Ducts, Glandules, and Cells.

Fig. 1. A view of the preparation of six milk tubes injected from the nipple.

a, a, a, The straight or mamillary tubes, proceeding from
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 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 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.)

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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 goes 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, (considerably 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.

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.

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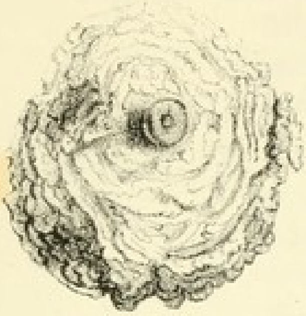

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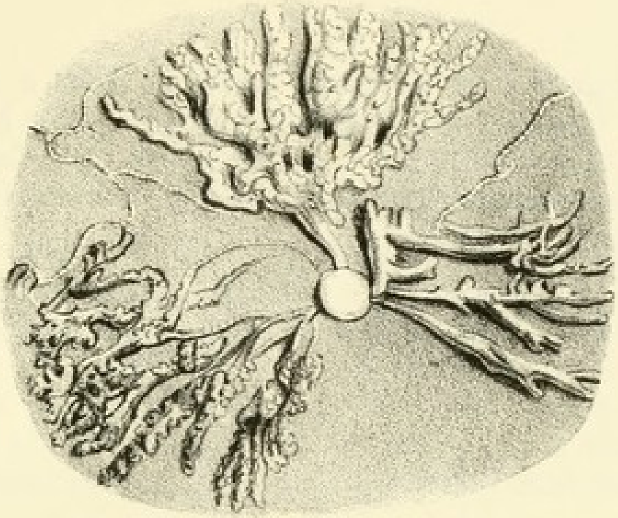

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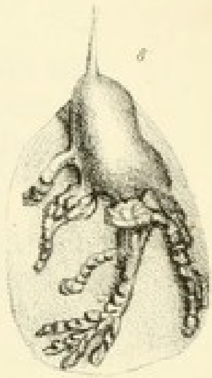

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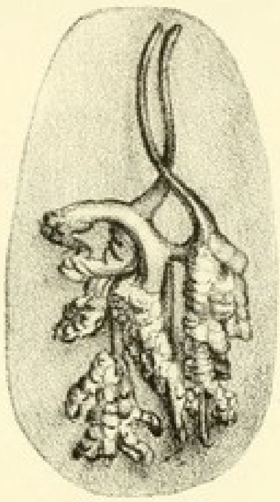

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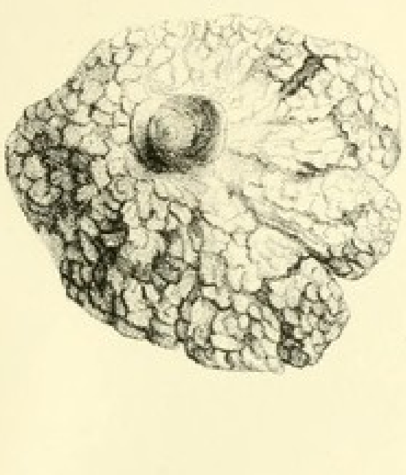

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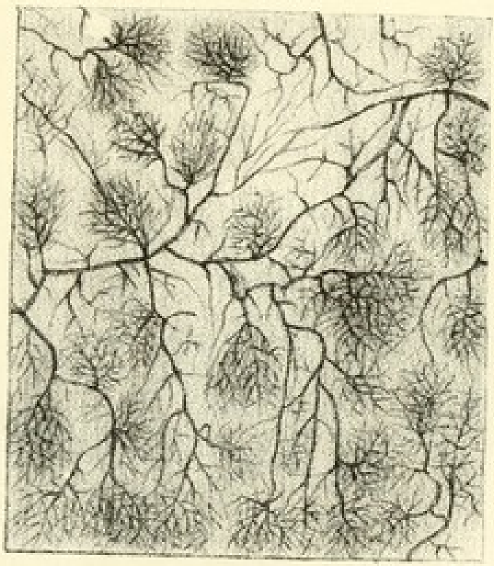

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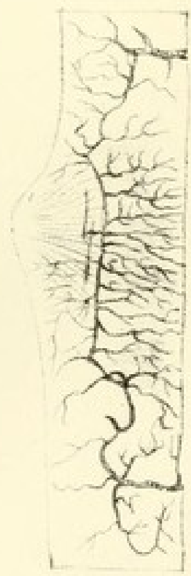

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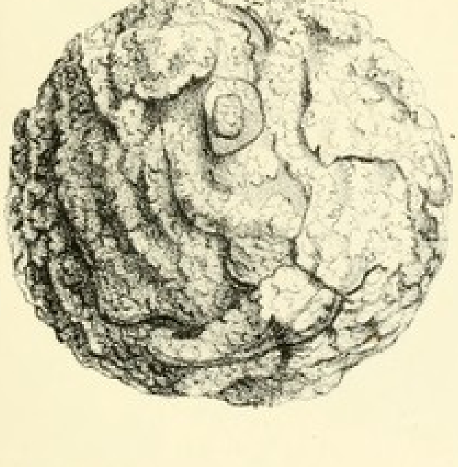

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Fig. 8. Shows a duct of great diameter in old age. It was filled with mucus, which I evacuated, and I then injected and preserved the duct, which sent forth a few branches, but the rest were obliterated.

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, 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.

Fig. 1

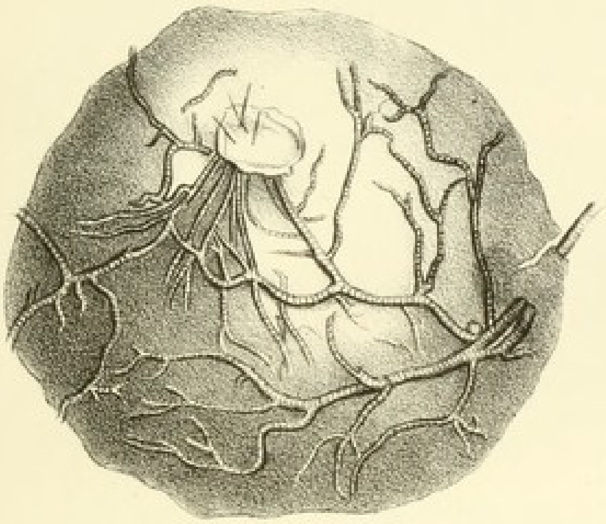

Fig. 2

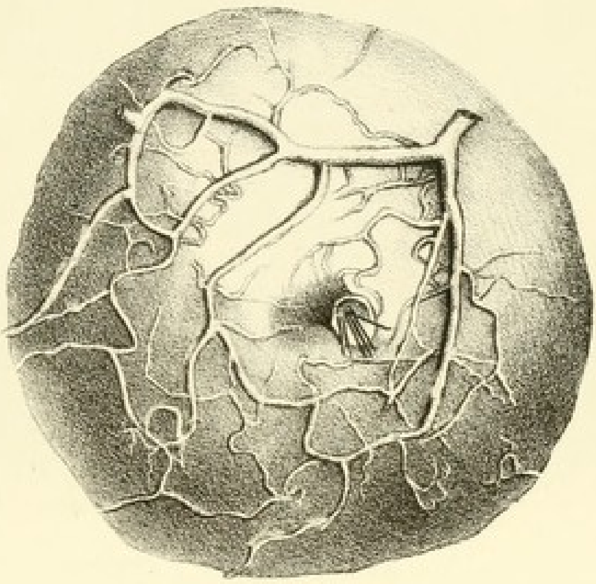

Fig. 3

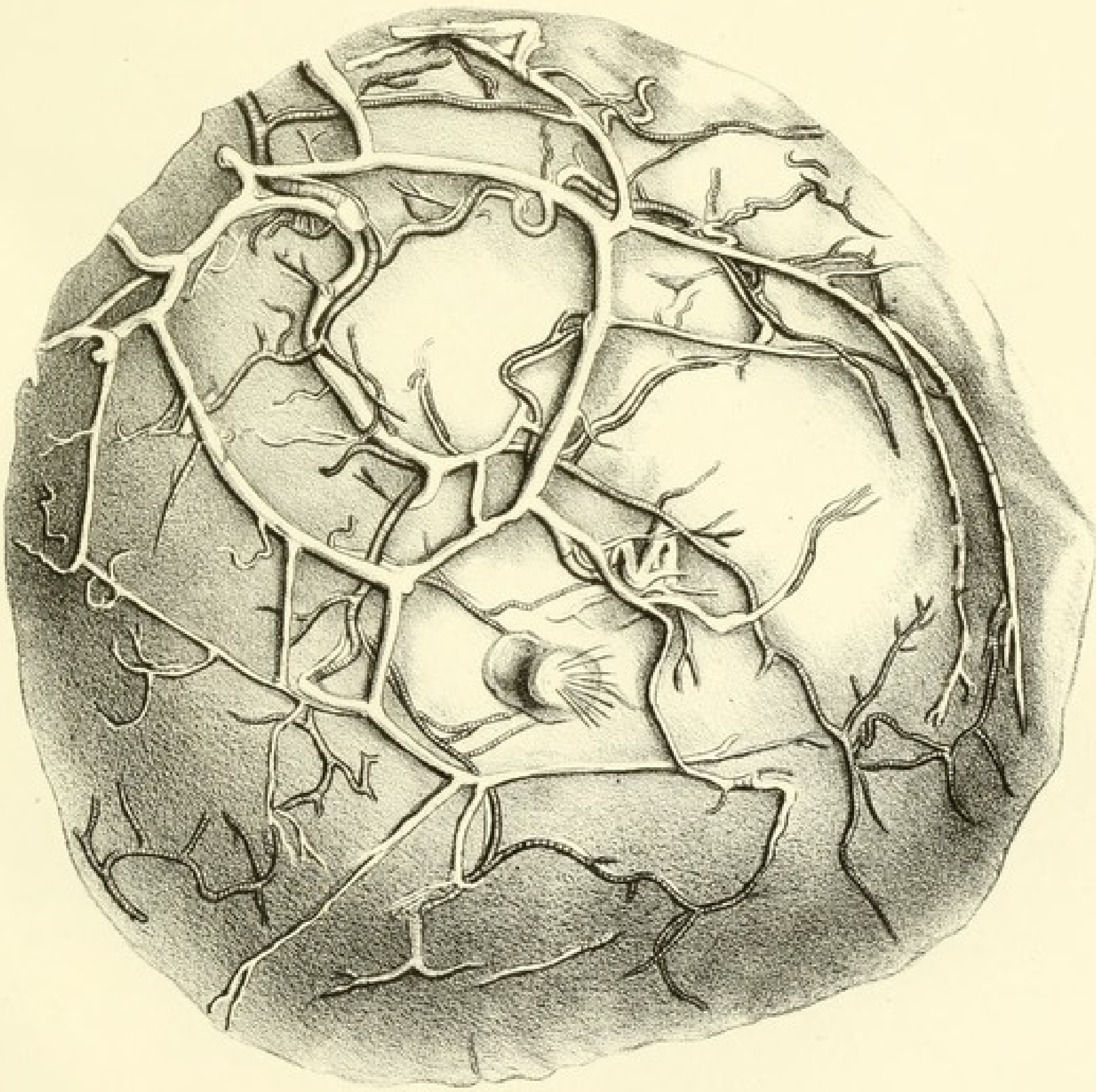

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Plate X.

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 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.

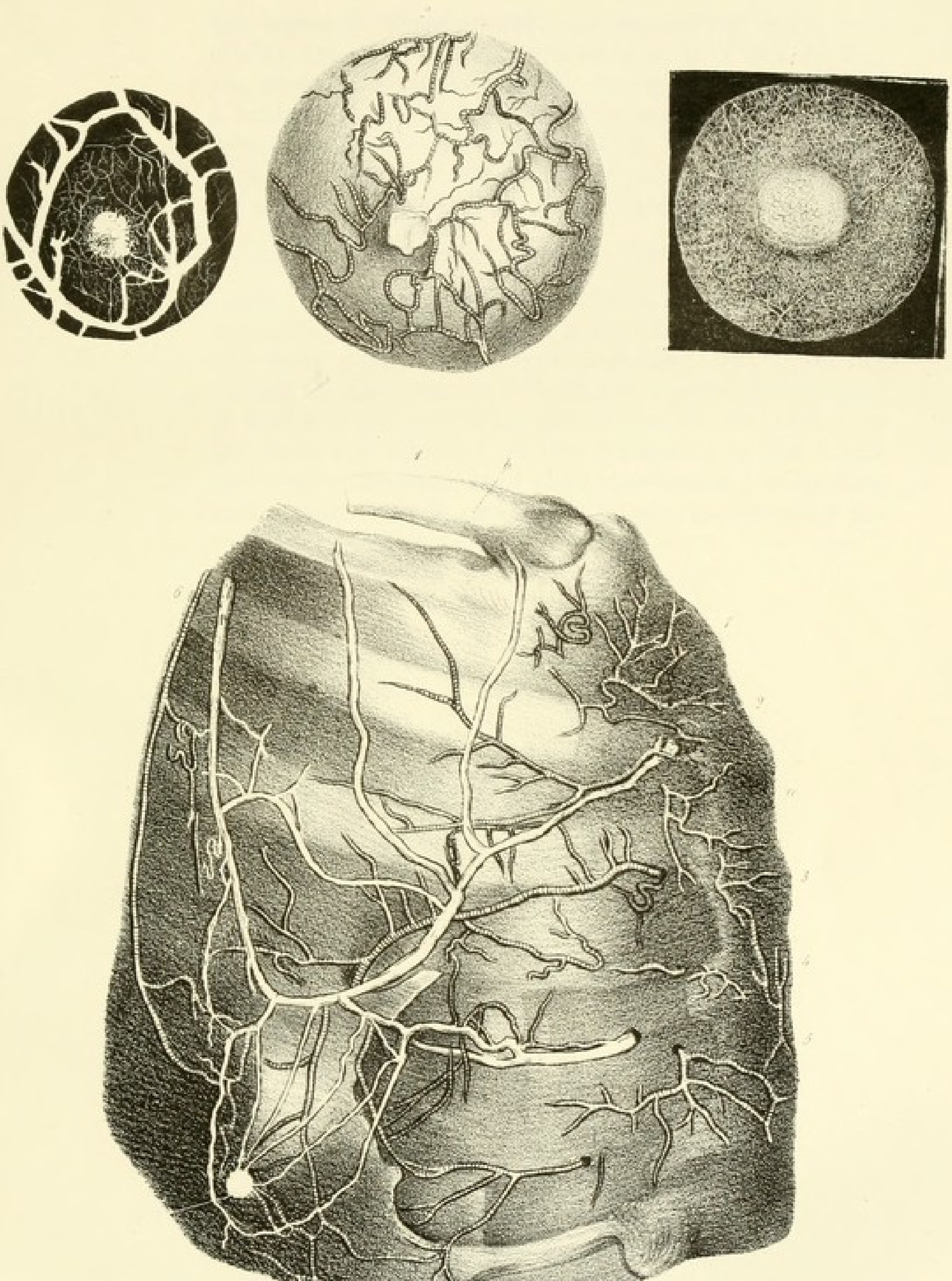
The posterior artery, 6, and the third, fourth, and fifth anterior may be seen to send branches to the nipple, *c*, and to the breast. A posterior mammary vein accompanies the artery, 6. An anterior vein accompanies an anterior artery, 2, and another vein accompanying artery 5, enters the chest between 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 erec



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tile tissue of these vessels corresponding with that which exists in the arteries as seen in *Plate II.* 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 aborescent, the veins form a net-work.

Thus I have seen in the artery and vein of the tail of the tad-pole, 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, 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, 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.

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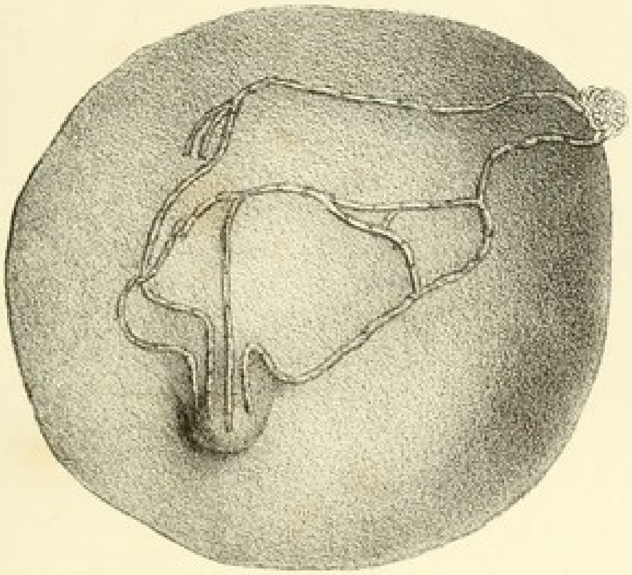

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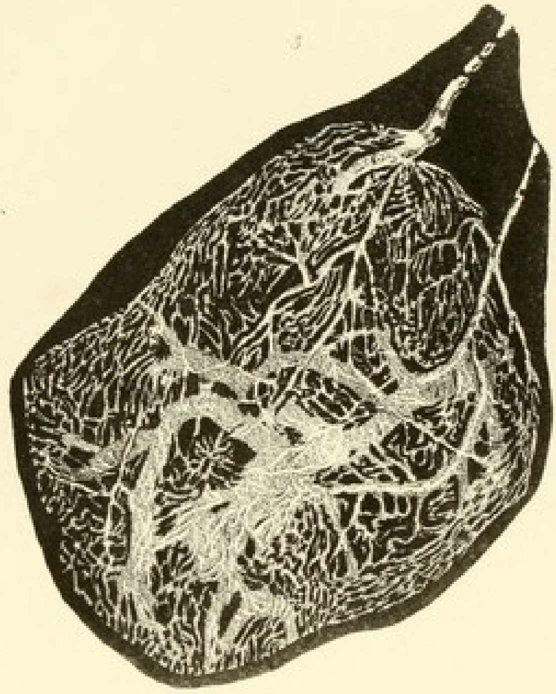

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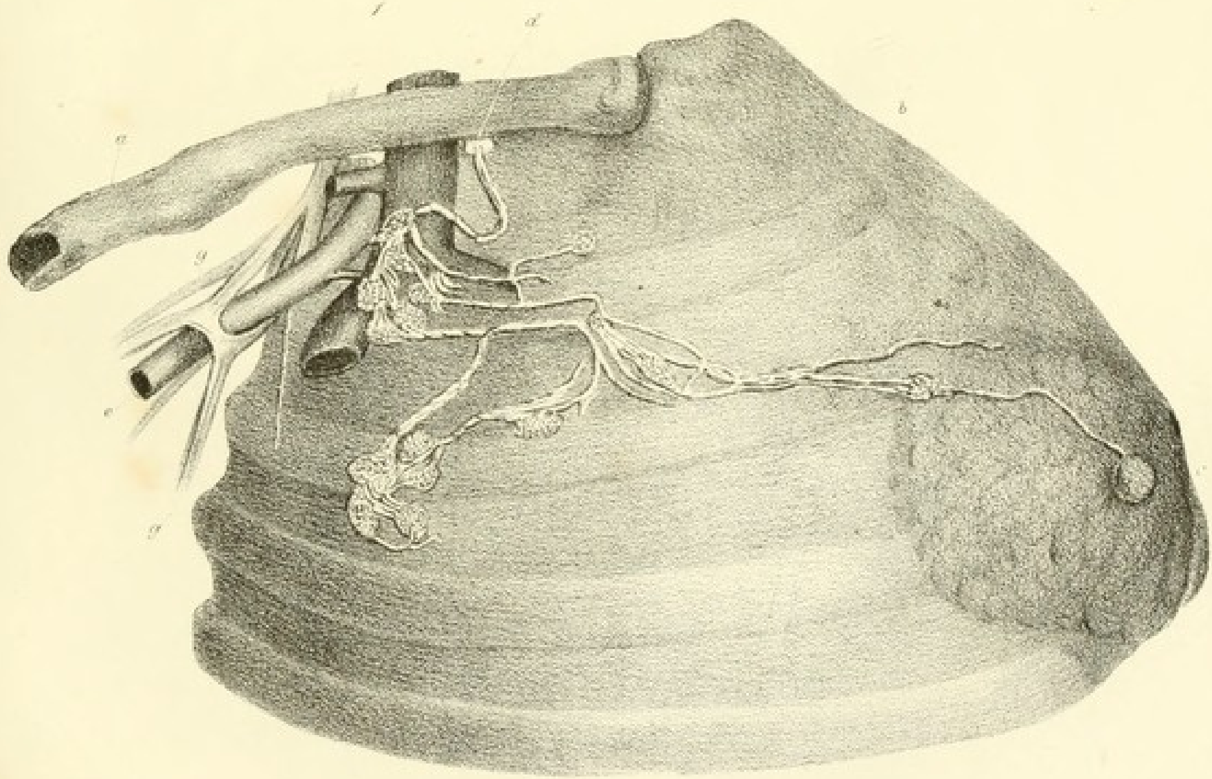

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Plate XII.

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.

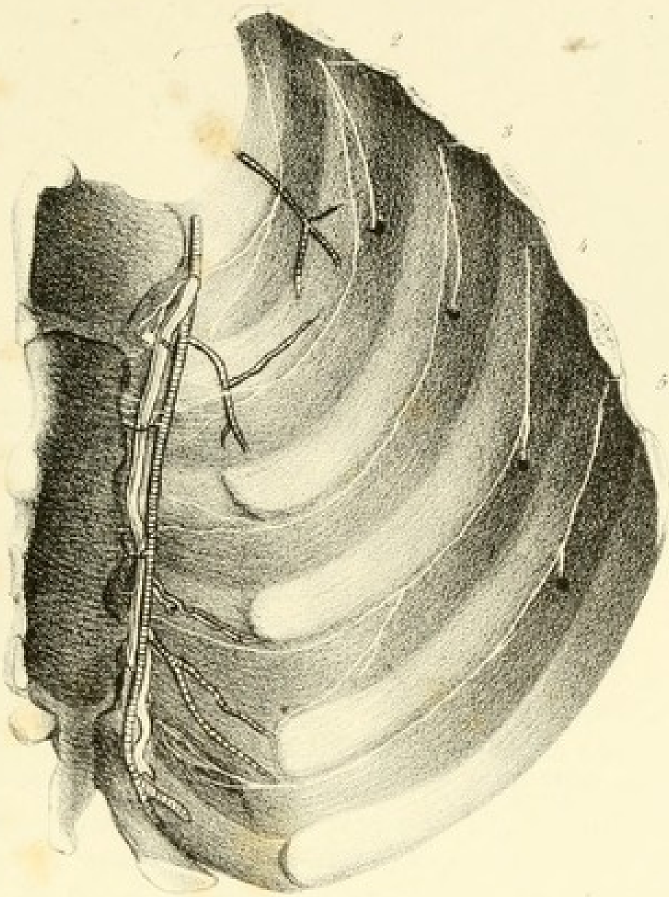
e, The cephalic vein.

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.



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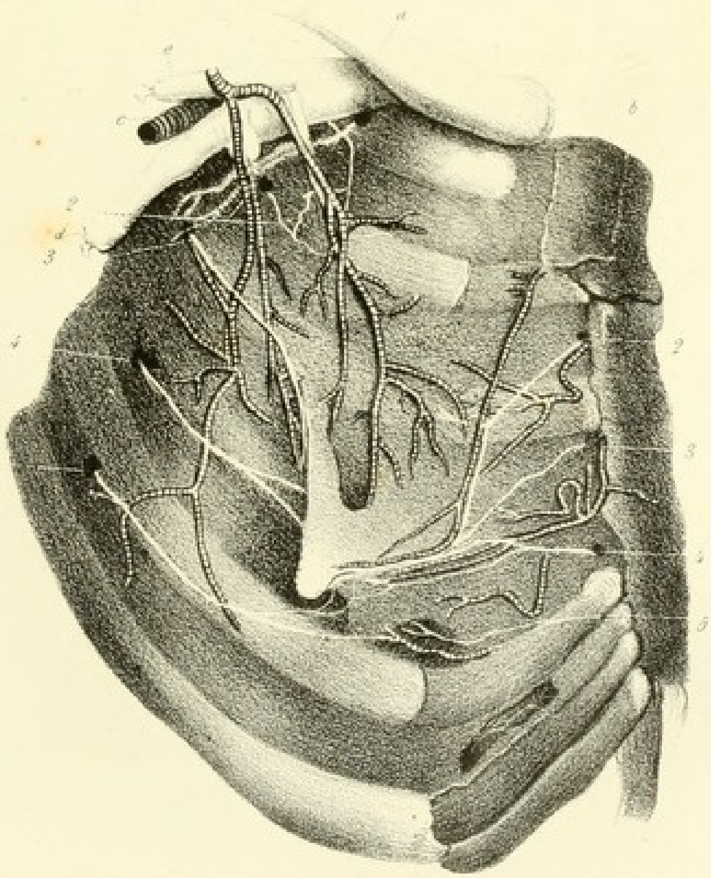

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PLATE XIII.

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 of the 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.

Pl. XIII.

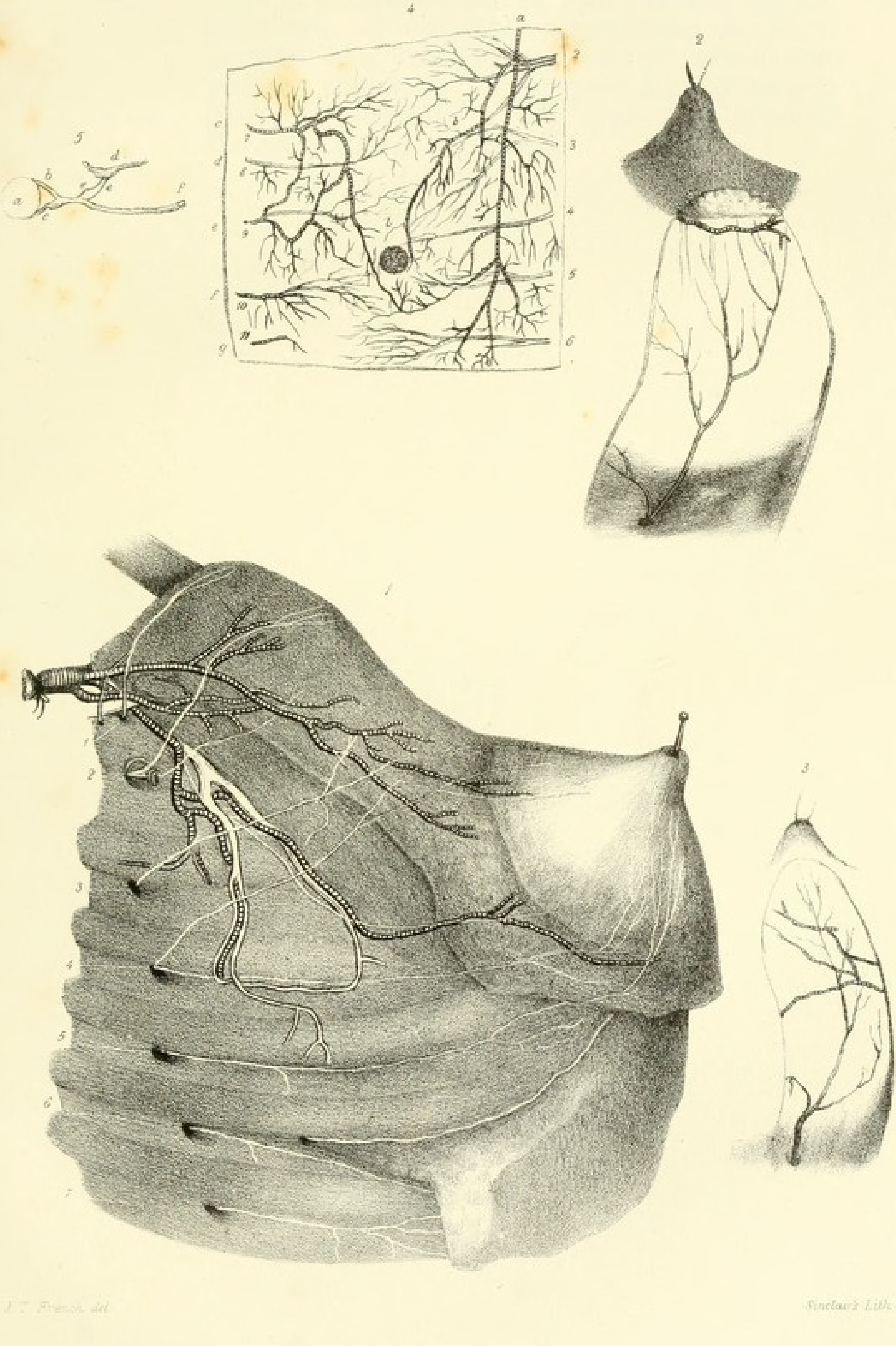

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Fig. 5. Outline of a dorsal nerve proceeding from the spinal cord. *a*, Spinal cord. *b*, Anterior nerve. *c*, Posterior or ganglionic, joining with *b* to form the dorsal nerve. *d*, Sympathetic nerve and one of its ganglia. *e*, *e*, Two filaments 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.

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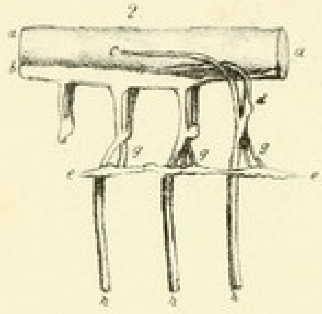

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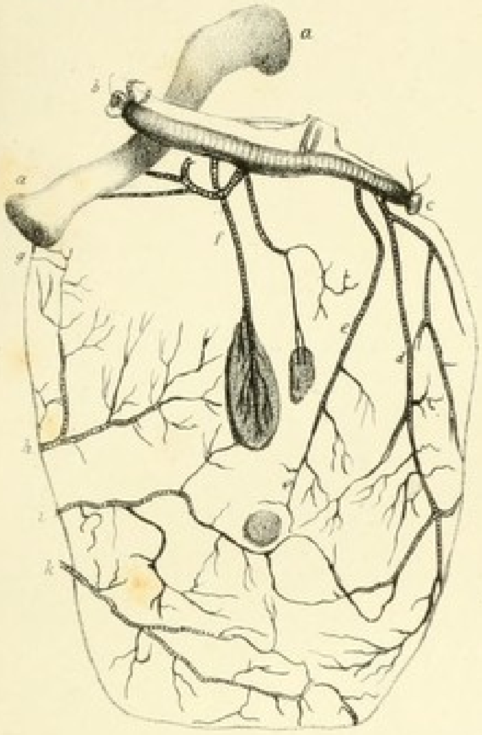

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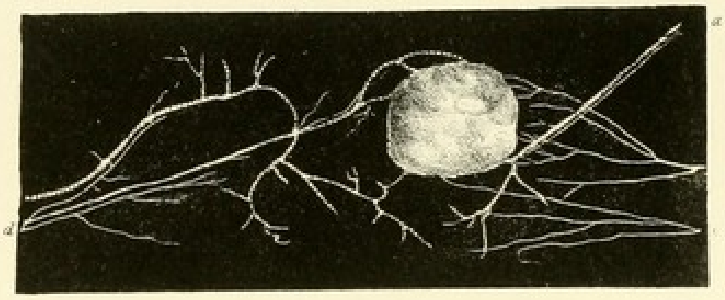

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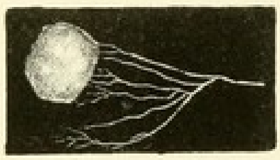

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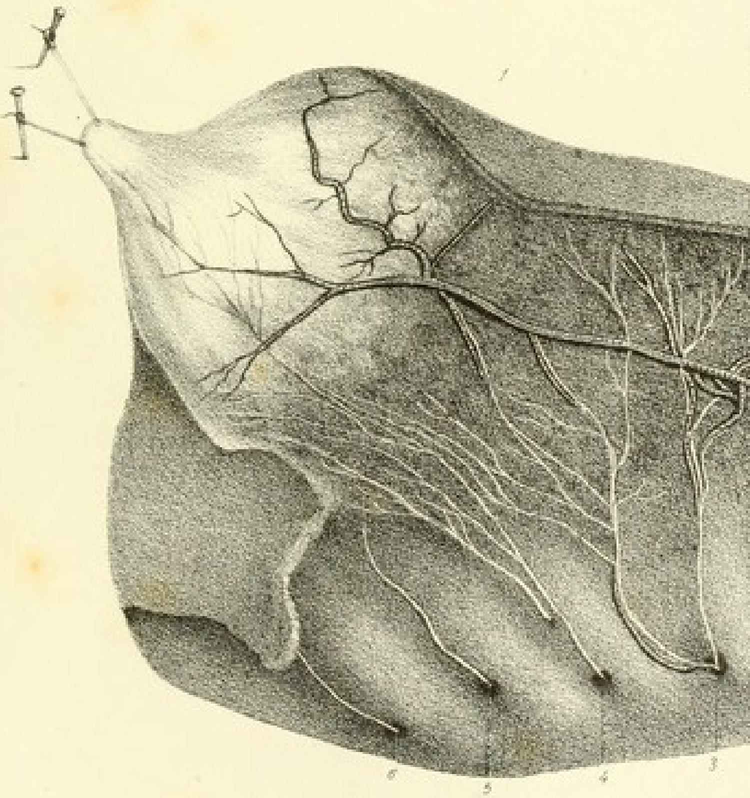

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Plate XV.

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.

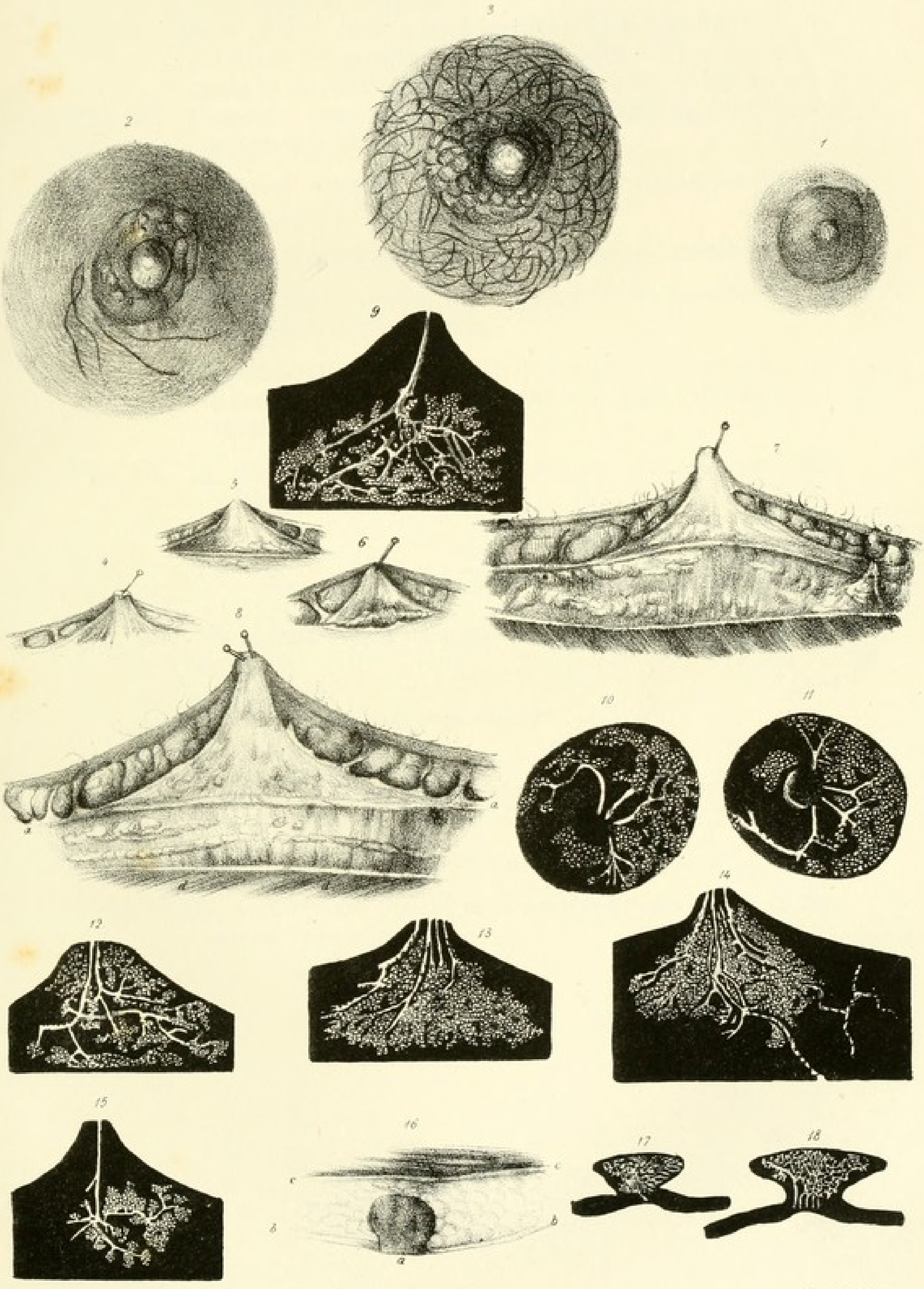
Fig. 6. Age, thirteen years. Section of the gland, ligamenta suspensoria, and fat.

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.*

Pl. XV.



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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 XVI.

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.

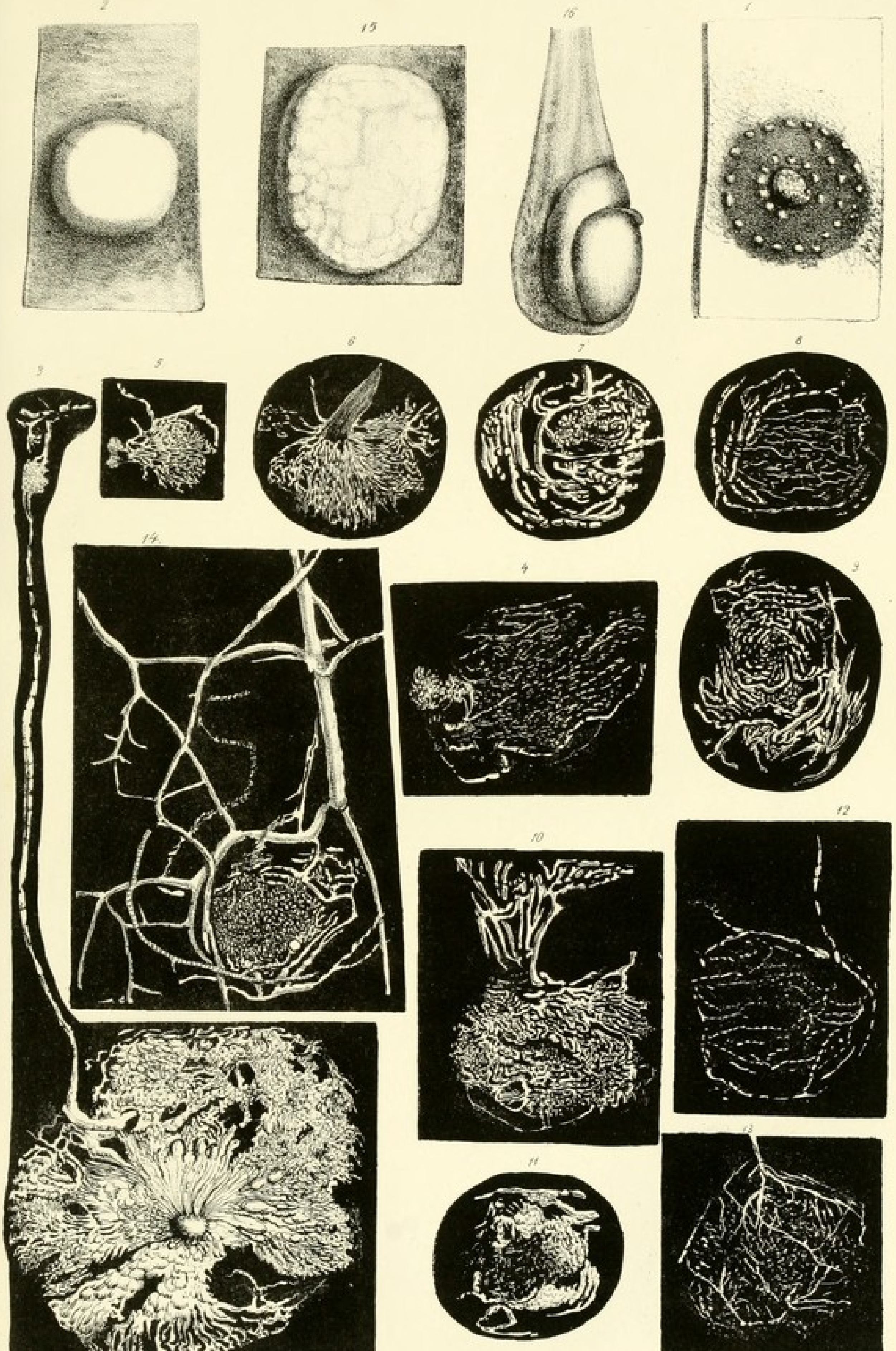


Plate XVII.

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*.

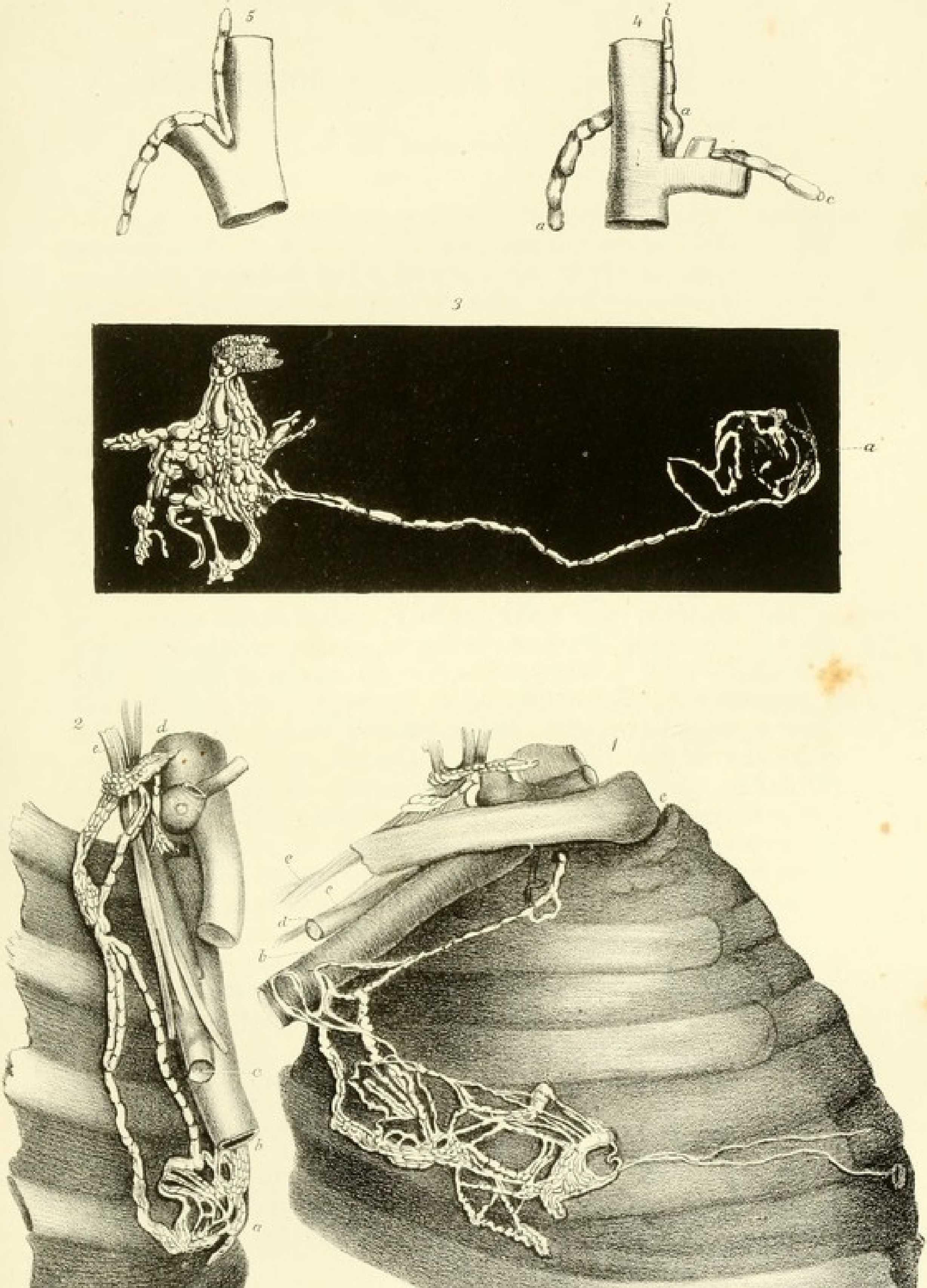
e, The axillary plexus of nerves.

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.

Pl. XVII.



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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 was 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 headach, 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 ornithoryncus 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 aborescent, 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 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 nipple 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 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.

* See Morgan, Professor Owen, &c.

† 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.

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.

Plate XVIII.

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.

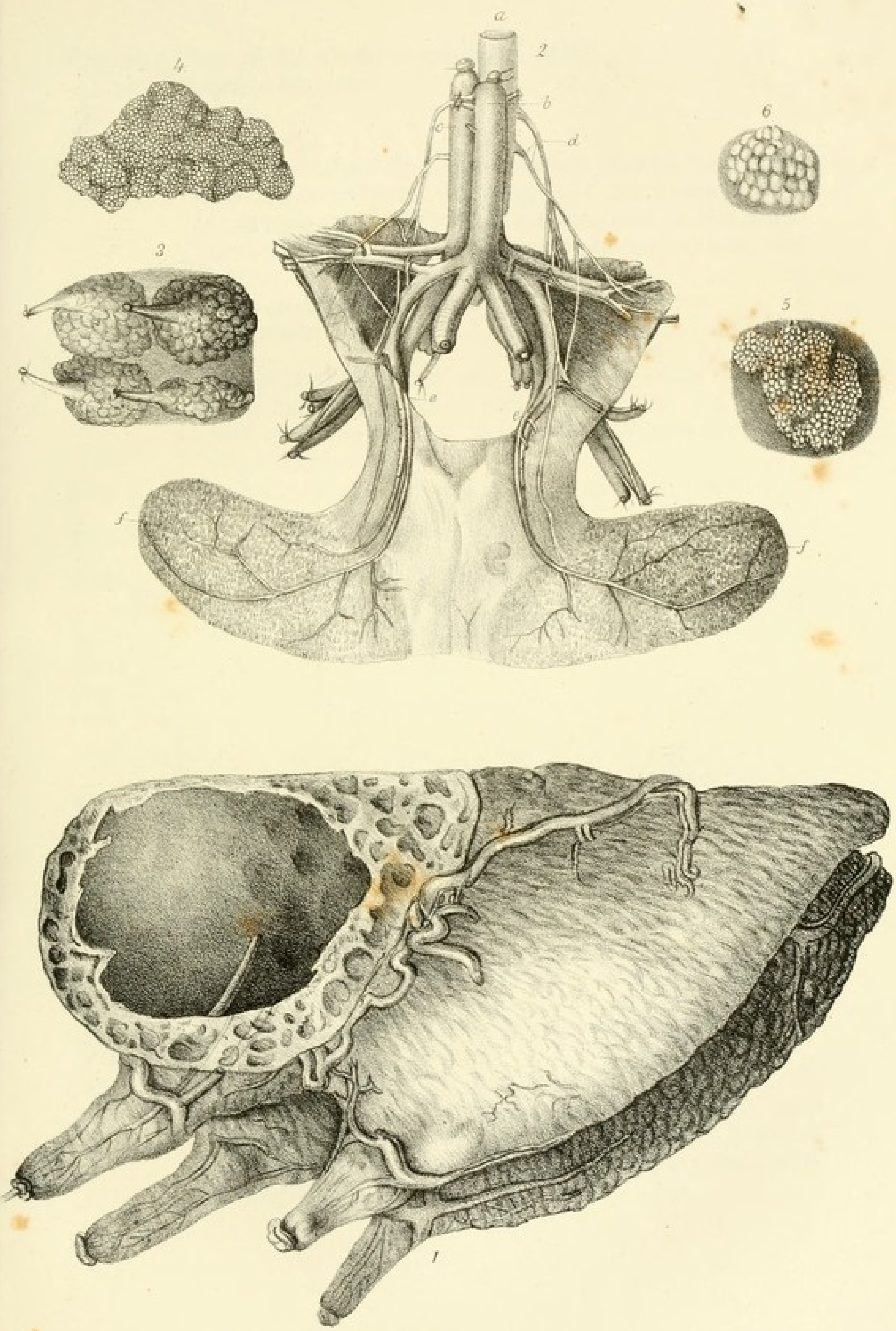
The two anterior teats are much larger than the two posterior, and are directed forwards, and so are the two posterior, and their direction renders them more easy of access to the offspring.

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 integument next invests 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 the 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. 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.



J. T. French. del.

Sinclair's Lith. Philad.

Fig. 2. View of the gland 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 connexion 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.

Fig. 6. The milk-cells highly magnified.
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 the 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 deposites 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 XIX.

The Dug of the Ass.

Fig. 1. Shows the two teats of the 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 still 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.

Cream $\frac{3}{45}$ or $\frac{1}{15}$

Pl. XIX.

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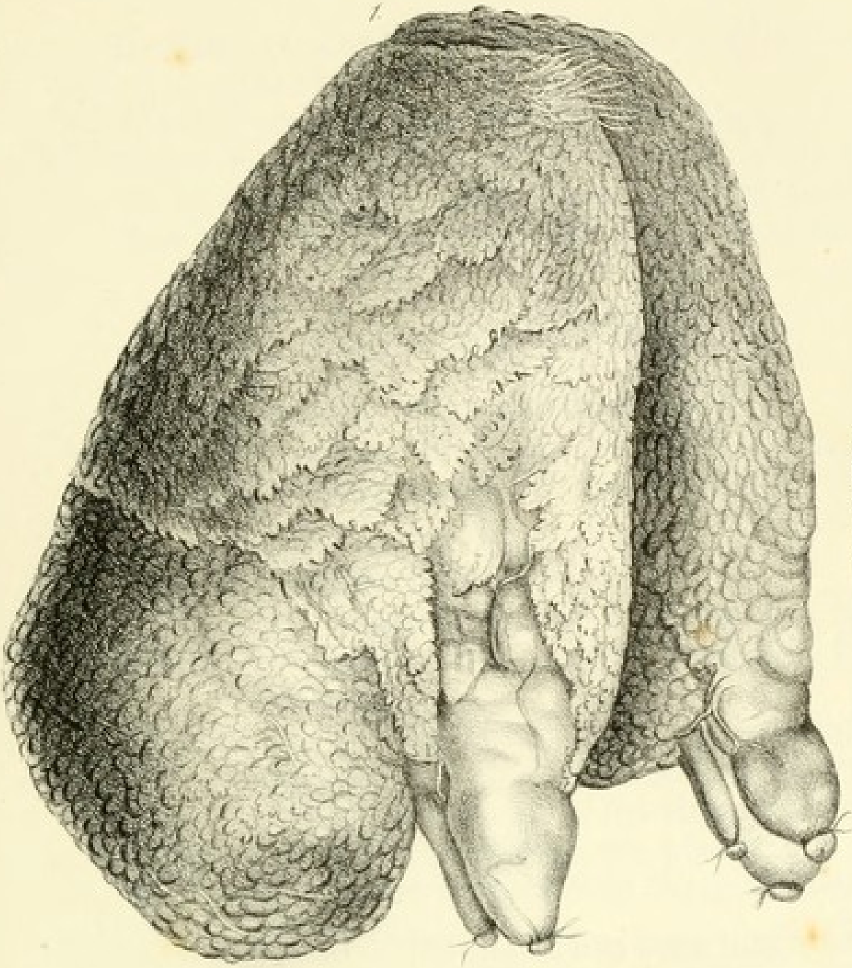

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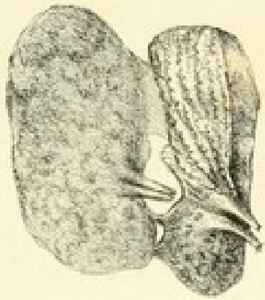

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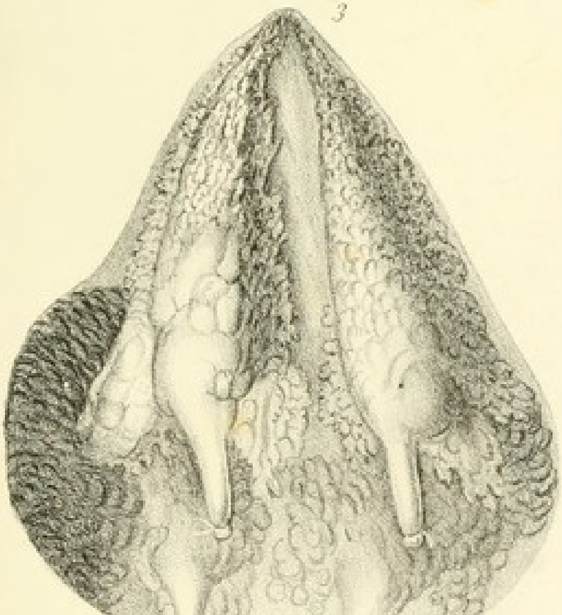

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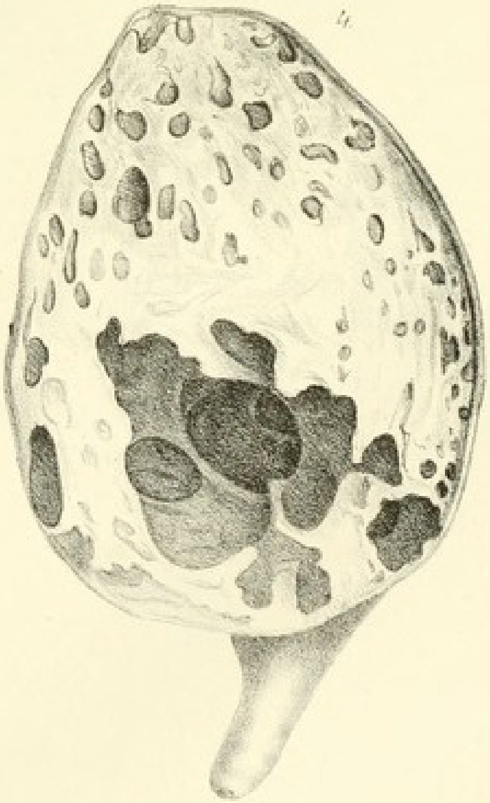

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It does not curdle so soon as cow's milk, but at length it deposites curd.
Alcohol precipitates curd from the whey.
Sugar is readily obtained from the whey by evaporation.
By agitation, it produces a loose butter in broken fragments.
The taste resembles 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 readiy 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 XX.

Showing the Udder of the Ewe.

There are in the ewe two teats, leading into two large glands, and there are sometimes imperfect teats behind.

This 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.

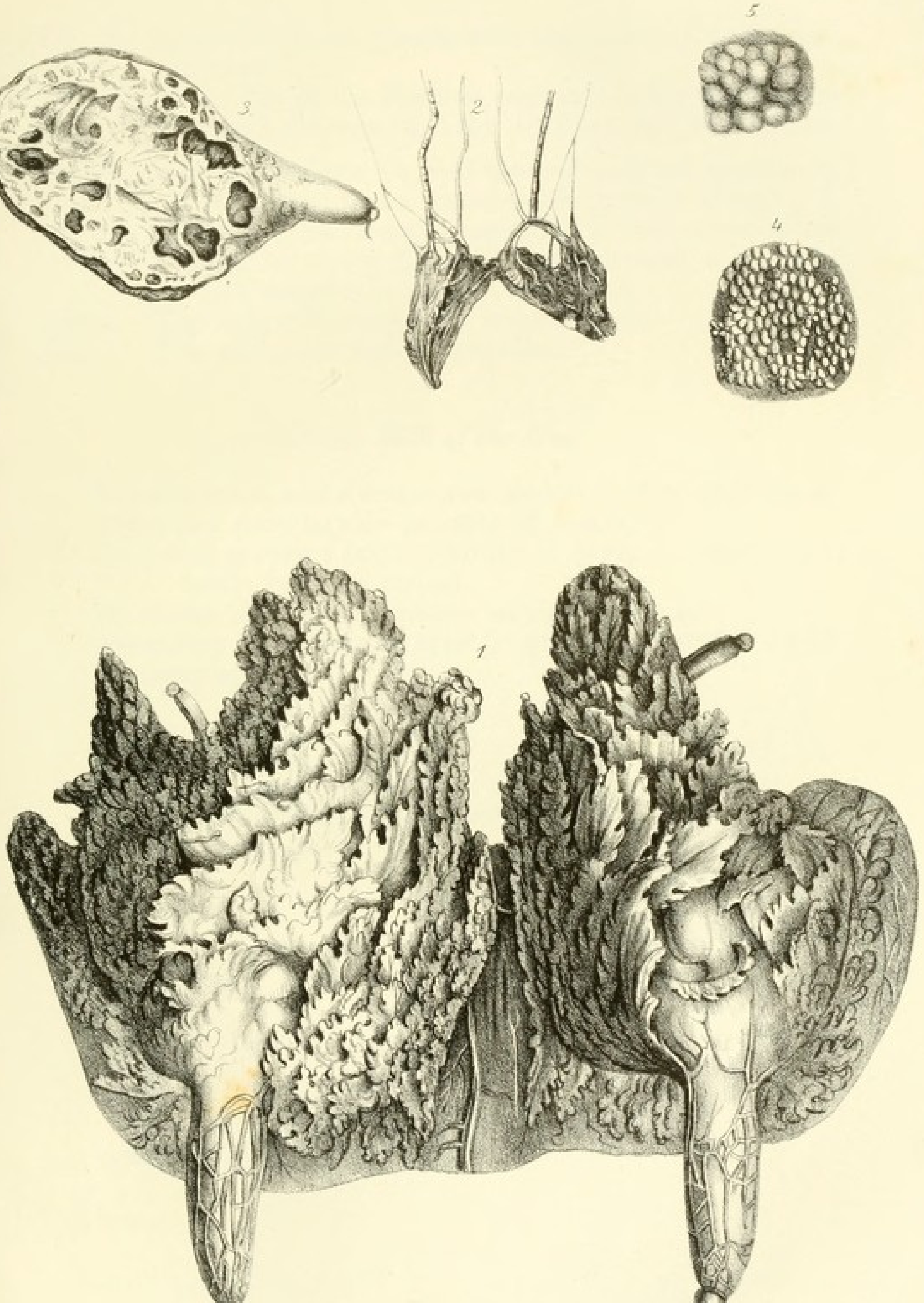

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Fig. 2. Shows the fœtal glands, with their arteries, veins, and nerves.

The inner line of the three on each side is the artery; the second, the vein; 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 a half before it is usually with lamb.

Fig. 4. The milk-cells magnified twenty times.

Fig. 5. The milk-cells highly magnified.

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 XXI.

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 greatly magnified. 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 cow's. 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.

Pl. XXI.

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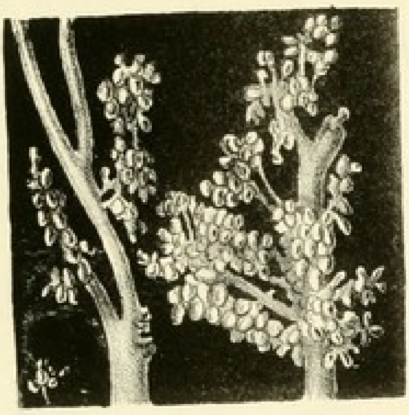

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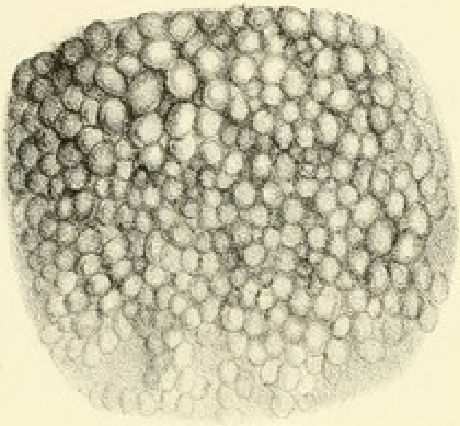

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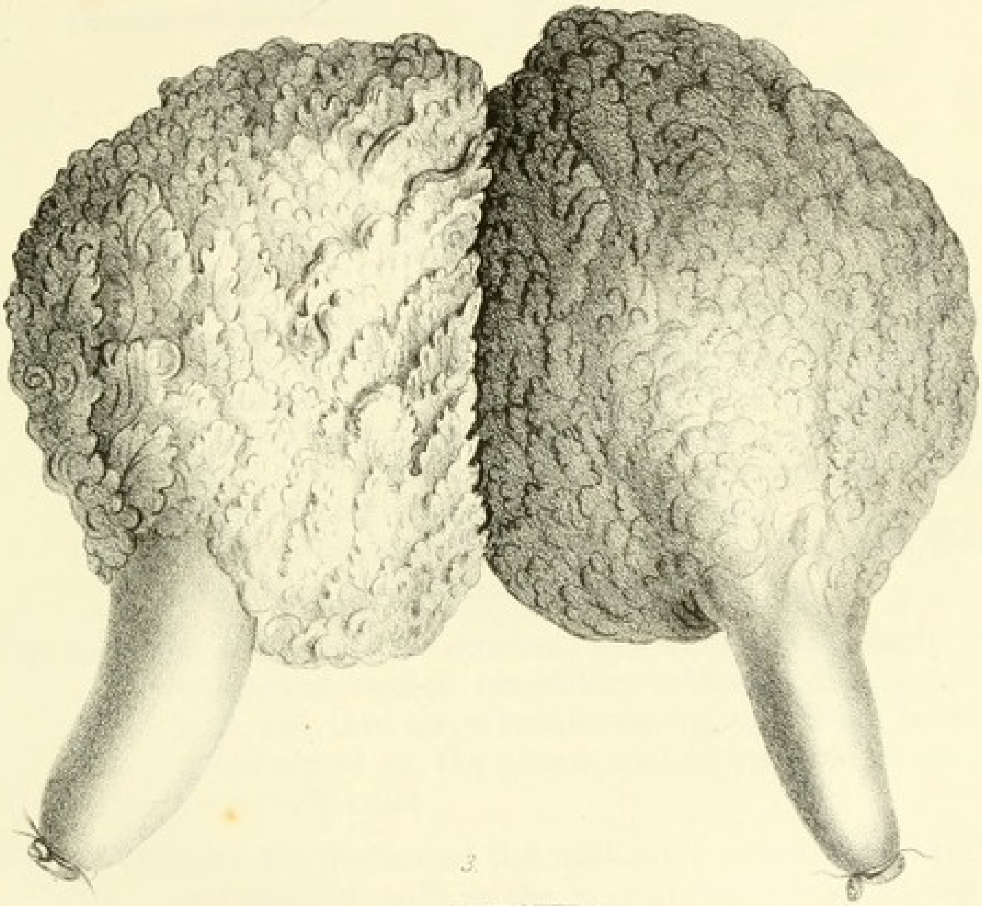

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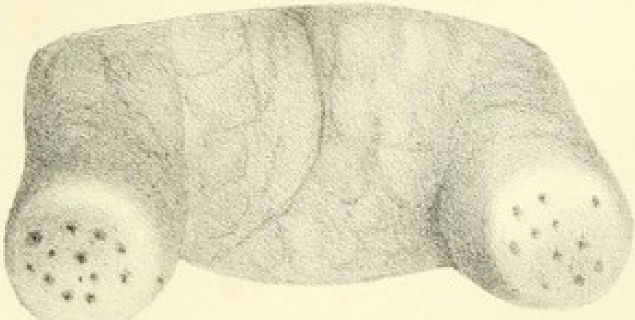

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In seven days abundance of curd or albumen was precipitated.

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 odour of the animal.

Specific gravity, 1·036.

100 parts of the milk contain,—

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 magnified. It did not contain milk as the animal was not in a state of lactation.

Plate XXII.

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.

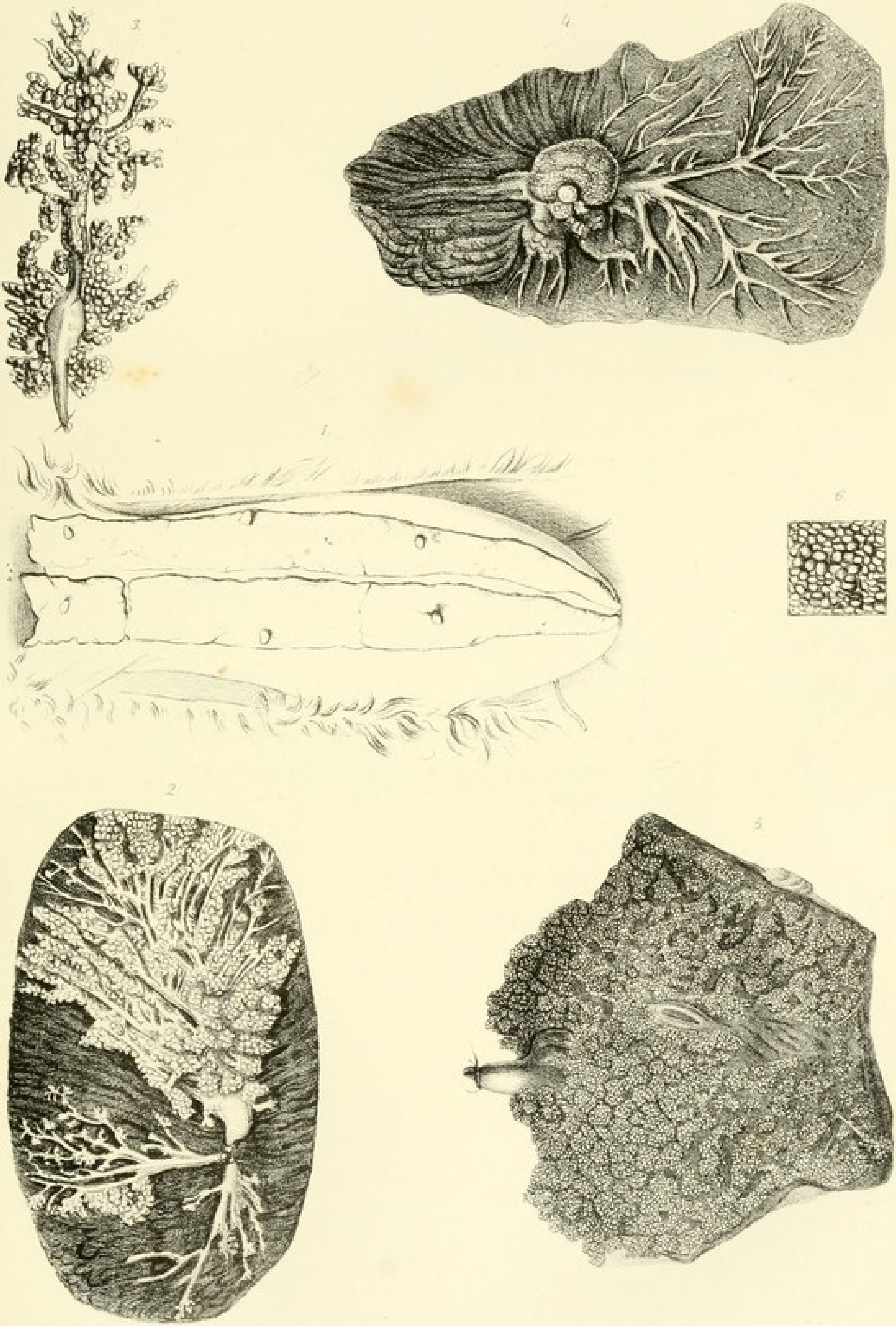
Fig. 3. The duct injected with wax. The duct at the nipple is seen tied. The reservoir is large and distinct. The branches of the milk tubes are shown with numerous glandules on their extreme branches.

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 considerably.

Pl. XXII.



J. T. French, del.

Sinclair's Lith. Philad.

Plate XXIII.

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.

Pl. XXIII

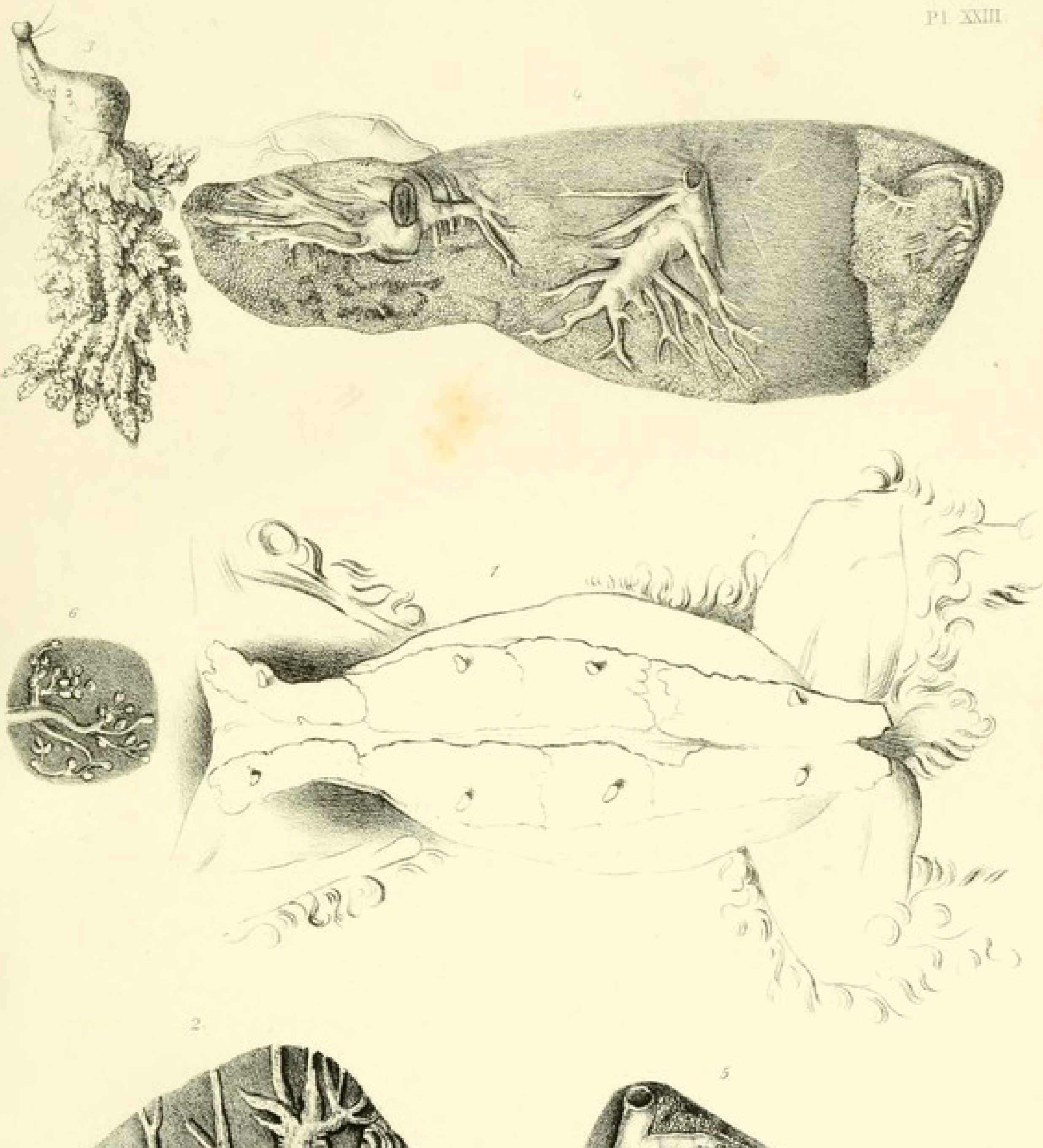


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Plate XXIV.

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.

Fig. 3. Exhibits the milk-cells greatly magnified, 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

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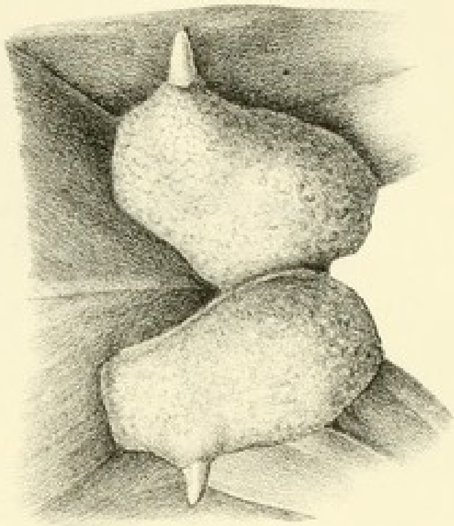

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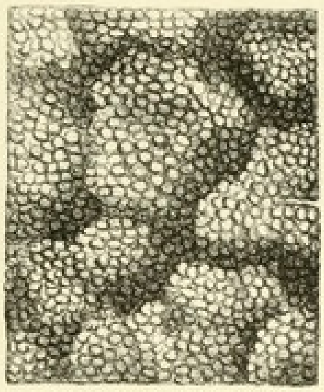

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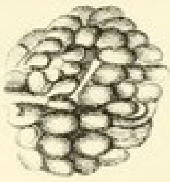

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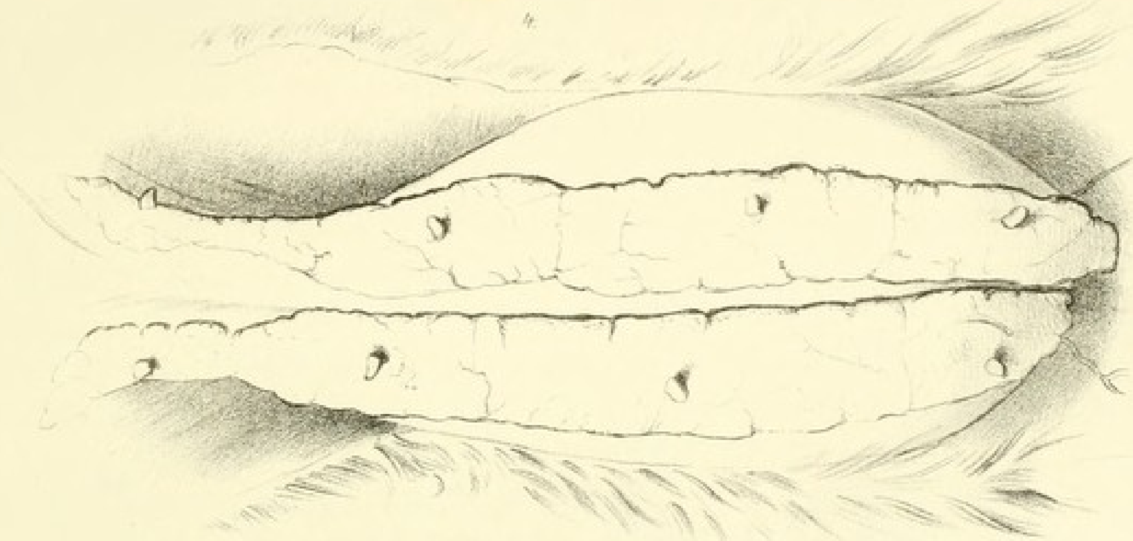

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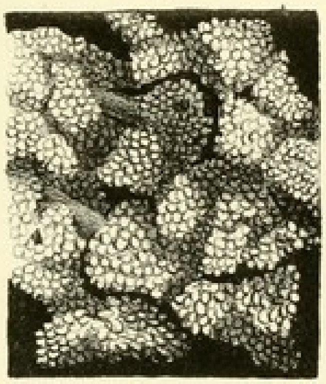

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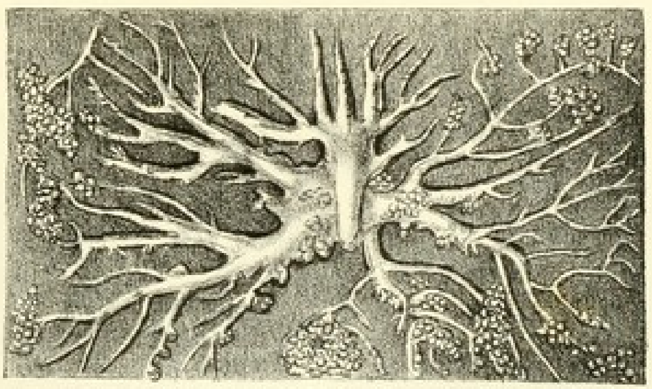


J. T. French del.

Sinclair's Lith. Philad.

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 wax, and magnified.

Plate XXV.

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 mik 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.

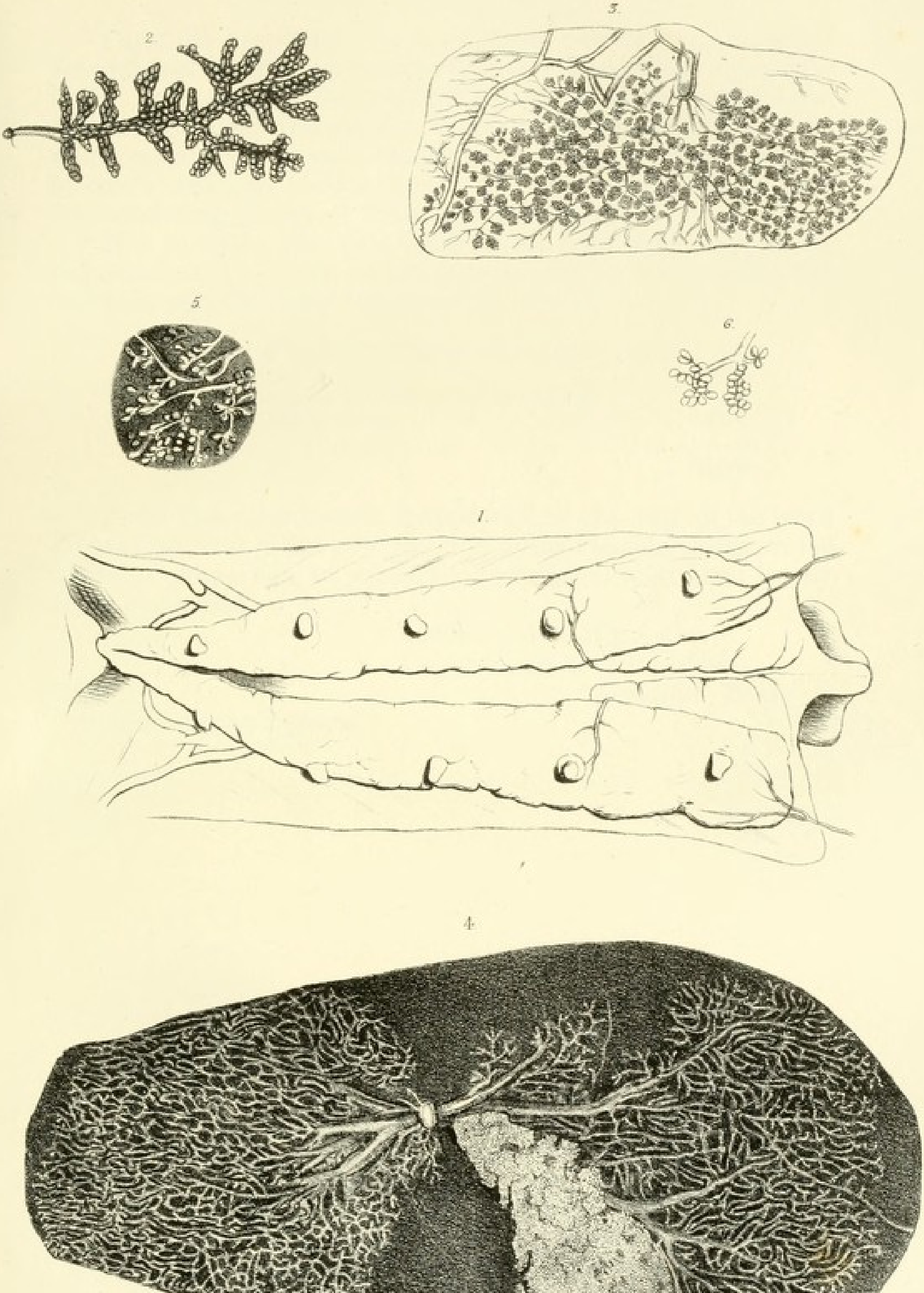
" My dear Sir Astley,

" 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.

Pl. XXV.



J. T. French del.

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"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,
"Yours very faithfully,
"GOLDING BIRD."

"*Wilmington Square.*"

Plate XXVI.

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 gelatine.

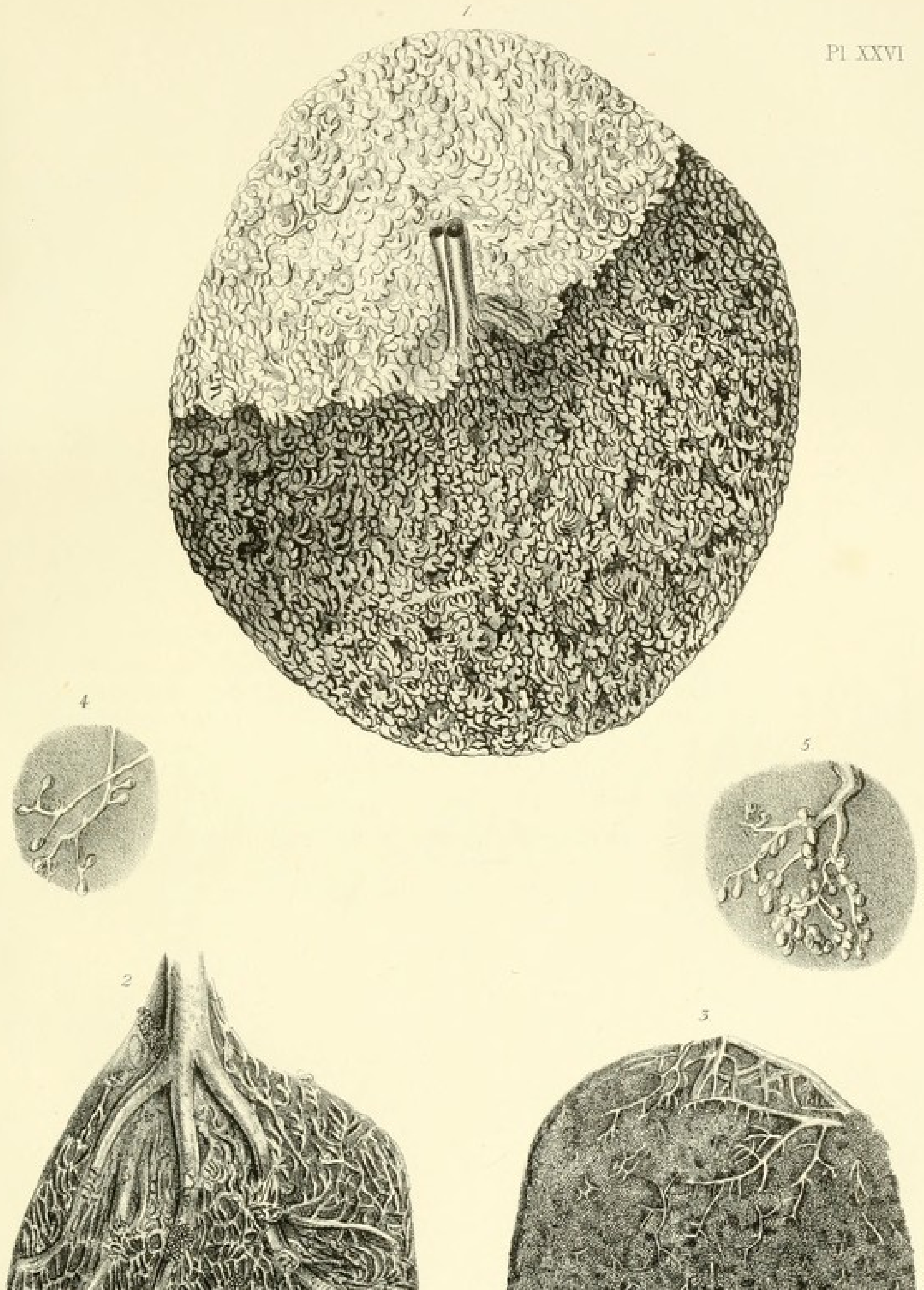
The two tubes or ducts are of unequal size; one with its glandules occupying one-third, and the other about two-thirds of the gland.

Fig. 2. Shows a portion of a lactiferous tube, injected with quicksilver to exhibit its minute ramifications through the substance of the gland.

Fig. 3. A view of a portion of a preparation, with milk-cells of the gland very minutely injected, and magnified.

Figs. 4 and 5. Milk-cells twenty times magnified.

Pl XXVI



J. T. French del.

Sinclair's Lith. Philad.

Plate XXVII.

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.

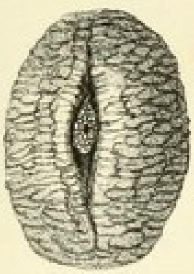
Fig. 3. One of the clefts a little open, to show the end of the mamillæ buried in it.

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

Pl. XXVII

3.



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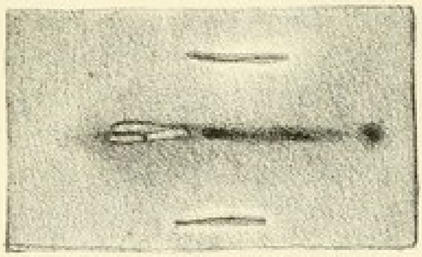

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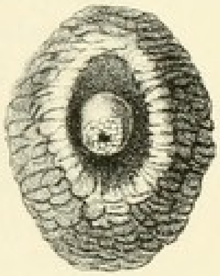

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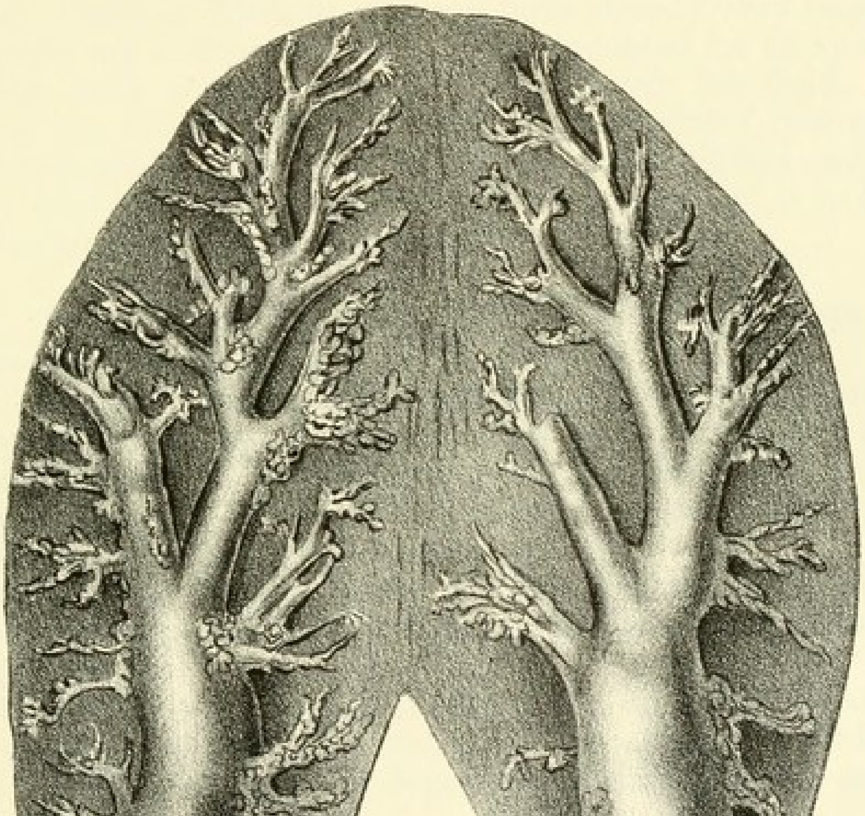


J. T. French del.

Sinclair's Lith. Philad.

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 its mother's teat, of which it immediately laid hold.

To Dr. Golding Bird, to whom I have already very imperfectly stated my acknowledgments, 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 any thing 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 the porpoise felt like butter upon the tongue.

ILLUSTRATIONS

OF THE

DISEASES OF THE BREAST;

BY

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

SERGEANT SURGEON TO HIS MAJESTY;

Consulting Surgeon of Guy's Hospital: Lecturer on Anatomy and Surgery, &c., &c., &c.

1

DEDICATION.

To BENJAMIN HARRISON, Esq.

TREASURER OF GUY'S HOSPITAL, &c.

MY DEAR SIR,

In feelings of respect for the zeal, ability, humanity, and love of science which you have manifested as Treasurer of Guy's Hospital—in admiration of all the virtues which can adorn the man, in your private character—and with heartfelt gratitude for numerous and continued acts of kindness to myself, this Work is dedicated by

Your sincere and faithful Friend,

ASTLEY COOPER.

January 1st, 1829.

PREFACE.

I have divided these Illustrations of the Diseases of the Breast into two Parts, *viz.* into those which are, and into those which are not malignant.*

In this Part, I have confined myself to the description of the diseases which are not malignant; distinguishing those which do not arise from a vitiated state of the system, nor produce any dangerous constitutional effects; and do not contaminate the parts in their neighbourhood, nor affect those at a distance from their original seat.

However, it is right to observe, that some of these swellings, when they have existed long in a dormant state, will have alterations produced in them by changes of the constitution, by which their extirpation may be rendered necessary; for malignancy may be lighted up in them by constitutional disease—by anxiety of mind—and by the cessation of the menstrual secretion.

* The Second Part of this Work, on the Disease of the Breast, referred to by Sir Astley, was never Published.—*American Publishers.*

CONTENTS.

INTRODUCTORY OBSERVATIONS

ON THE

DISEASES OF THE BREAST.

CHAPTER I.

GREAT advantages may be derived from the examination of morbid structures, and from a comparison of their external character and symptoms with their internal appearances. In the first place, such a comparison facilitates the treatment and cure of diseases; and, secondly, even in those cases for which a remedy has not yet been found, it powerfully assists the Surgeon in forming a diagnosis of the various complaints to which any organ of the body is liable.

The difference between the experienced and scientific, and the ignorant and unobserving member of the profession, is manifested, in the former readily discovering the distinctive character of disease as soon as it is presented to his attention; while the other guesses at its nature, and if right, is right only by accident.

It must likewise be admitted, that though no specific remedy may yet have been discovered for the cure of some diseases, it is still a great advantage to be able to discriminate curable from incurable cases; the dangerous from the slight; those which require surgical operations from those which do not demand them; and such as admit of a trifling operation from those which call for one of extreme severity.

The truth of these observations cannot be more fully exemplified in the Pathology of any part of the body than in the diseases incidental to the female Breast; for this organ is liable to almost all the complaints of other structures, and to some which are peculiarly its own. The uninformed Surgeon is too apt to fall in with the opinion of the vulgar, and to confound all the swellings of the breast under the general term of Cancer; and yet every Surgeon who has fully investigated the character of these swellings, by examination of the diseased parts after operation, must be aware of the great variety which prevails in their nature and appearances; and is therefore led to the conclusion, that far from their being all of one family, a great number of genera of tumours actually exist. He will soon learn that some are the effect of acute inflammation; that others are of a simple chronic kind; that some are chronic accompanied with specific action; and that others are specific and malignant. It is therefore the Surgeon's duty to discriminate these differences in the living body; and this he can only accomplish by a very careful and nice manipular examination of the complaint, by having repeatedly inspected the parts which have been removed in operations, by examining those which have been met with in the body after death, and by an accurate and minute history of the case. The experience arising from these different sources gives him the power of accurately judging of the nature of the disease when it is presented to his attention in the living body.

The result of such knowledge is frequently the source of great security and happiness to a person afflicted with a disease in the breast, as well as of great satisfaction to the Surgeon. I have scarcely witnessed a stronger expression of delight than that which has illuminated the features of a female—perhaps the mother of a large family dependant upon her for protection, education, and support—who, upon consulting a Surgeon for some tumour in her bosom, and expecting to hear from him a confirmation of the sentence she had pronounced upon herself, receives, on the contrary, an assurance that her apprehensions are unfounded. Pale and trembling, she enters the Surgeon's apartment, and baring her bosom, faintly articulates—Sir, I am come to consult you for a Cancer in my breast;—and when, after a careful examination, the Surgeon states, he has the pleasure of assuring her that the disease is not cancerous—that it has not the character of malignancy—that it is not dangerous, and will not require an operation; the sudden transition from apprehension to joy brightens her countenance with the smile of gratitude; and the happiness of the moment can hardly be exceeded, when she returns with delighted affection to the family, from which she had previously considered herself destined soon to be separated by death, with the alternative only of being saved by a dubious and painful operation.

The diseases of the breast may be divided into three classes:—

First, into those which are the result of common inflammation, whether it be acute or chronic.

Secondly, into complaints which arise from peculiar or specific action, but which are not malignant, and do not contaminate other structures.

Thirdly, into those which are not only founded on local, malignant, and specific actions, but which are connected with a peculiar and unhealthy state of the constitution.

By a malignant complaint, I mean to describe a local diseased action, which not only affects the parts in which it is originally situated, but contaminates those in its neighbourhood; it is produced by a morbid state of the constitution, and is frequently accompanied by similar disease in other, and even remote, parts of the body.

The first of these classes comprehends the acute inflammation of the organ, as the milk abscess; the chronic inflammation, which remains for a length of time in a state of indolent swelling, and often terminates after a lapse of weeks or months in an indolent abscess; and, thirdly, a lacteal tumour, in which a chronic inflammation is followed by an obstruction in one of the lactiferous tubes, and produces a large lacteal or lactiferous swelling.

In the second class of diseases of the breast we find several species of tumour, and they are as follow:—

1st, the Hydatid.
2d, the Chronic Mammary Tumour.
3d, the Ossific.
4th, the Adipose.
5th, Large and pendulous Breast.
6th, the Scrofulous.
7th, the Irritable Breast.
8th, Ecchymosis of the Breast.

In the third Class we find the two malignant diseases, which consist of the scirrhous and fungous tubercle.

It will be my object in the following pages, with the aid of engravings, to detail the symptoms, describe the external characters, and exhibit the internal appearances of each of these diseases, so far as I have been able to observe and examine them; and in doing this, I shall endeavour to point out their discriminating marks, so as to enable the Surgeon to distinguish them in the living body.

I am fully aware of the difficulty of the task, and am ready to acknowledge that I have been often mistaken in my diagnosis;

but if such errors of judgment occur to one who has had a considerable share of practice and experience, and trusts he has not been an idle or inattentive spectator of what has been presented to his observation, how often must those be liable to error who do not industriously investigate the nature of disease by dissection, and compare it with its external characters in the living body? What I sincerely hope is, that this Work will have a good effect in inducing others to exert their best endeavours to pursue the subject with greater zeal and ability, and to attain the grand object which we ought always to have in view—to exercise our profession in the most scientific manner, and to do all in our power to diminish the evils and sufferings of humanity.

CHAPTER II.

On the effects of common Inflammation in the Breast.

Having divided the Diseases of the Breast into those which are the result of common inflammation, whether acute or chronic, into those which are of a peculiar or specific nature, and into such as are specific and malignant, I shall now proceed shortly to describe the effects which are produced upon it by acute and chronic inflammation.

It is unnecessary that I should enter into any long detail of the symptoms, character, and treatment of acute inflammation in this organ, as it differs little from the same inflammation in other parts of the body, excepting in the severity of suffering which it produces.

It is adhesive in the first stage, suppurative in the second, and ulcerative in the third. A firm and sensitive swelling of the whole or part of the mammary gland is produced in the first stage; and the dense cellular or fascial membrane with which it is enveloped, and by which all its parts are united, not easily yielding to the inflammatory swelling, often occasions most excessive suffering. The serous and fibrous portions of the blood are poured into, and fill the interstices of the inflamed structure, and the latter thus produces the solid swelling. To this enlargement succeeds a blush of inflammation upon the surface of the breast; throbbing, pulsatory, and very acute pain follows it; a particular prominence and smoothness are observed at one part of the tumour, with a sense of fluctuation from the presence of matter. The constitution is also highly irritated, which is evinced by the occurrence of shivering, succeeded by heat, and profuse perspiration. Over the most prominent part of the swelling the cuticle separates, ulceration follows in the cutis, and the matter becomes discharged through the aperture thus produced.

This process requires from ten days to three weeks for its completion; but varies considerably in time in different persons, according to the irritability of their constitution, and to the depth at which the abscess is formed.

Its principal cause is the rush of blood which takes place each time the child is applied to the bosom, and which by nurses is called the draught, and is the preparatory step to the secretion of milk. Such occasional irregular, violent, and frequent determinations of blood produce inflammation; and the necessary frequent exposure of the bosom in suckling, as well as the active exertions of the child in sucking, add to the occasional irregularities of the circulation. The nurse also often produces these abscesses immediately after the lying-in, by refusing to put the child early to the breast, and by stimulating the mother with strong drinks. By the first, the child is refused a secretion which precedes that of pure milk, and which often acts as a wholesome aperient to it, and the breast of the mother is excited by being permitted to remain full; whilst by the latter, the mother is heated, and a disposition to inflammation is engendered.*

The best mode of treatment in these cases is to use, in the adhesive stage, a lotion of one ounce of spirit of wine, and five ounces of water, or of liquor plumbi dilutus to the part, and to purge the patient, by giving repeated doses of castor oil, or sulphate of magnesia. But if the patient suffer from the cold produced by the evaporation of the spirit, a simple tepid poultice may be substituted for it, occasionally applying leeches to the swelling, still recollecting that the chief dependence is upon purging.

By these means the suppurative stage will often be prevented; but if matter should form, fomentations of poppy decoction, and poultices made with the same decoction, mixed with bread, should be applied upon the breast three or four times a day; as these by their warmth encourage secretion, by their moisture sooth and relax the part, and by their narcotic qualities diminish the sensibility of the nerves.

In order still further to mitigate the sufferings of the patient, to diminish irritability and to calm the symptoms of irritation, it is necessary to give opium combined with the liquor ammoniæ acetatis, or simple saline draughts, with small doses of magnesiæ sulphas.

* I have heard Dr. Key say that puerperal fever is often excited by the early and injudicious use of stimulants.

It is a question with Surgeons, whether these abscesses ought to be opened by art, or be left to the processes of nature; and the following should be the reply to this query:—If the abscess be quick in its progress, if it be placed on the anterior surface of the breast, and if the sufferings which it occasions are not excessively severe, it is best to leave them to their natural course, rather than to employ the lancet for the discharge of the matter. But if on the contrary, the abscess in its commencement be very deeply placed—if its progress be tedious—if the local sufferings be excessively severe—if there be a high degree of irritative fever, and the patient suffer from profuse perspiration, and want of rest, much time is saved, and a great diminution of suffering produced, by discharging the matter by the lancet.

Still it is wrong to penetrate with the lancet through a thick covering of the abscess, as the opening does not succeed in establishing a free discharge of matter; for the aperture closes by adhesion, the accumulation of matter proceeds, and the ulceration will still continue: on this account, the opening should be made where the matter is most superficial, and the fluctuation is distinct, and it should be in size proportioned to its depth.

The varieties which I have seen in these abscesses, are that several sometimes form in the same breast, quickly succeeding each other, and leading to a very protracted suffering. In these cases opium and quinine will be required, to lessen irritability, and support the strength of the system. Sometimes an abscess is produced at a great depth in the breast, and discharges itself by several different apertures, forming sinuses of various extent. The best mode of treatment of these cases, as far as I have had an opportunity of observing, is to inject them with a solution of two or three drops of the strong sulphuric acid to an ounce of rose-water, and to apply the same solution by folds of linen over the bosom, by which the secretion of matter is checked, and adhesion is produced.

Now and then a deep-seated abscess forms between the posterior surface of the breast and the ribs, which, when it breaks, leaves a sinus which leads to the ribs. An exfoliation of part of the rib afterwards occurs, occasioning a very protracted suffering; and in these cases, as well as in the former, injecting the diluted acids is the best practice.

The division of the sinus by the knife is unnecessary, as it will heal by adhesion in the former case, and in the latter, unless the exfoliating bone be loose, no advantage will be derived from the incision.

I once saw a lady of a very delicate constitution, and who suffered under very great anxiety of mind, from her husband having been confined in prison for debt, who after her lying-in had a milk abscess in her bosom, which broke, and discharged large quantities of matter; and then, instead of healing, the whole breast became excessively swollen, and a truly fungoid excrescence appeared, by which disease she was soon destroyed.

A hardness sometimes remains in the breast after these abscesses, which continues for a great length of time if something be not done to promote absorption; and as a morbid action will sometimes, and at a very distant period, arise in the swelling, it is a great object to dissipate it quickly; which will be best effected by the application of the Emplastrum Ammoniaci cum Hydrargyro, or by rubbing the part with the Iodine Ointment.

In these milk abscesses it becomes a question whether the child should suck the breast, or not. If the abscess be small, the child may be put to the diseased breast as well as the other; but if much of the mamma be involved in the disease, the child should be put to the other breast; but that which is inflamed should be drawn by the mother herself, by means of the glass tube constructed for the purpose. As the pump which is sometimes employed, bruises the breast, and gives much pain, it ought not to be used. As a general rule, it is best to continue the child at the breast so long as the mother's sufferings will admit of it.

These abscesses are sometimes the result of soreness in the nipples, which appears in three forms:—first, in simple excoriation; secondly, in deep cracks at the junction of the nipple with the areola; and, thirdly, in deeper ulceration of the nipple itself, by which a part of it is removed. The suffering from these sores is often sufficiently great to prevent the frequent application of the child to that bosom, which leads to a great accumulation of milk, and to a degree of distention which occasions inflammation. To prevent this, the breast should be drawn; but the sooner the child can be restored to it, the better. The best application to the sore nipple is a solution of borax in water, in the proportion of a drachm of borax, three ounces and a half of water, and half an ounce of spirit of wine. Some use solutions of alum, some the sulphate of zinc, and some the supernatant liquor of a mixture of the liquor calcis with the submuriate of mercury. Also to prevent the nipples from becoming sore, to which many women are extremely subject, it is right to wash them some time before the lying-in with strong brine, which hardness the cuticle, and renders it less prone to ulceration and inflammation.

When the nipple is deeply ulcerated, if the child continue to suck, it must be through the intervention of a shield prepared with the cow's teat.

When women marry young, the nipple is often very small; the child is unable to suck it, and the attempt to do so, produces excessive pain. The nurse should in this case frequently suck the breast, which she is able to do with much less pain than the child, because her mouth not only envelopes the nipple, but a large portion of the breast around it.

Ointments in general do not agree as applications to these sores; but if any be employed under a shield, it should be the ointment of bismuth, or the ointment of zinc, or simple cerate.

Of Chronic Abscesses.

The abscesses which I have hitherto described, usually pass through their different stages in from three to five weeks; but under chronic inflammation, an abscess is sometimes produced, which, from the length of time it is forming, from the little pain which attends it, from the absence of redness, and heat in the part, and from the want of rigors and other constitutional symptoms, prevent the suspicion of the formation of matter, and the swelling is supposed to be a malignant tumour which requires an operation for its removal.

In proof of this, a woman was sent to me from Sussex who had a tumour in her breast, which I was requested to remove; and when she was seated before me for that purpose, I found upon examining the swelling with attention, a fluctuation in its centre surrounded by a wall of hardness, with tenderness in the centre upon pressure. I therefore put a lancet into the seat of the fluctuation, to discover the nature of the fluid, and a considerable quantity of purulent matter was discharged through the orifice.

I was also requested to see an out-patient at Guy's Hospital, who had a swelling in her breast with a fluctuation in its centre, which had existed several months, into which when a lancet was put, a large quantity of matter was discharged. Although there was no discoloration, and the swelling had existed several months, yet I thought it contained matter, from the sense of fluctuation, and from the tenderness the patient expressed upon slight pressure, which would not have been the result if a serous fluid had been collected.

In similar cases I have seen the operation for removing the swelling begun, and in its progress the knife having accidentally entered the abscess, the Surgeon by escape of the matter having been informed of his error, the operation was suspended, and a poultice being applied, the case ended favourably.

As there is some defect in the constitution, or deficiency in some of the secretions in these chronic swellings, the patient requires the Pilula Hydrargyri Submuriatis Composita at night, and the bark with soda twice or three times in the day; or the compound infusion of gentian with soda and rhubarb. Locally when in the adhesive stage, the Emplastrum Ammoniaci cum Hydrargyro should be applied, or a solution of Muriate of Ammonia with rectified spirit of wine, both of which are used upon the principle of exciting external irritation, and of promoting absorption.

When it is in the suppurative stage, the abscess should be opened, and the part be poulticed. The constitutional treatment is to consist of a generous diet, and of tonic medicines. When they ulcerate, and sinuses form, and are difficult to heal, as they are wont to be, stimulating injections must be employed, lotions of a similar kind be applied, and the general health be improved.

I have seen in a chronic abscess in the breast, the glands in the axilla enlarged from simple irritation only, and which decreased after the disease of the breast was relieved.

Of the Lacteal or Lactiferous Swelling.

A swelling is sometimes formed in the breast after a lying-in, which I have called the lacteal or lactiferous, because it arises from a large collection of milk in one of the lactiferous tubes.

Its cause is a chronic inflammation of one of the lactiferous tubes near the nipple, by which its aperture becomes closed, and the tube obliterated to the extent of an inch or more.

The patient applies to the Surgeon some time after delivery with a swelling in the breast; unpreceded by the symptoms of abscess, it distinctly fluctuates, and she complains exceedingly of a sense of distention in the part; and when the child is put to the breast to relieve it, the pain and distention are increased by the draught of milk which enters the breast so soon as the child begins to suck. The swelling is confined to one portion of the breast, from the nipple to the circumference of the organ, and it gives a distinct sense of fluctuation. The cutaneous veins are very large, but the part is otherwise undiscoloured.

If a lancet be passed into the swelling, several ounces of milk are discharged; and the milk being suffered to rest for a few hours, forms a cream upon its surface. If a slight puncture only be made, the milk be discharged, and the opening suffered to immediately close, the accumulation recommences, and in a short time the same appearances and sufferings are renewed.

When the distention of the swelling is excessive, it sometimes ulcerates, and discharges the milk which it has contained, by a small aperture at a little distance from the nipple; and the opening so produced often continues through the whole period of suckling, the milk being lost, from the aperture not being received into the child's mouth; and this opening is difficult to heal, until by weaning the child, and by purges, the secretion of milk be entirely checked.

The treatment which this case requires is as follows:—If the mother be prevailed upon to wean her child, as the secretion of milk will soon cease in this obstructed part as in other parts of the breast, a simple puncture will suffice to relieve the distended tube of the milk which it contains.

But if the child still continue at the breast, the opening may be made larger, and the milk be suffered to escape at the artificial aperture whilst the child is sucking; thus imitating the natural relief which the ulcerative process sometimes produces, until the secretion of milk ceases, from the weaning of the child, and from purges to the mother.

In general the surgeon is consulted in this disease in a few weeks after the birth of the child; but in the following case I did not see it until twelve months after delivery.

Mrs. Reddle, at 38, has a swelling in her right breast, which appeared one month after the birth of her last child; it has now existed twelve months. I opened it with a lancet, and discharged six ounces of white curd mixed with a little yellow serum. The skin was undiscoloured, and her general health good. She had an abscess in the breast in her former pregnancy; she had milk in her breast after delivery; and the child is thirteen months old. The present swelling began in her last confinement, and it gradually increased until it became the size of an orange, with occasional trifling pain.

Feeling an obscure fluctuation, I discharged a saucer full of milk, like curd or clouted cream: the discharge continued for three days, and then ceased. She attributed the obstruction to a blow.

This disease resembles in its nature the Ranula, excepting in the fluid secreted. The one is an obstruction of the submaxillary duct, and accumulation of saliva. The other is an obstructed lactiferous tube, which is followed by an immense collection of milk, from its escape being prevented at the nipple, owing to the obliteration of the duct at that part.

CHAPTER III.

ON THE HYDATID DISEASE OF THE BREAST.

THE term Hydatid might be applied to every watery tumour, and it may therefore here with propriety be employed. But it will be seen in the sequel, that there are four species of these swellings in the breast, three of which are unmalignant, but one is of a malignant nature: and I shall first endeavour to give a description of those which do not possess any malignant tendency.

The first species of this disease exists in the form of simple bags, which contain a serous fluid. I should call them cellulous Hydatids; and the symptoms which they produce are as follow:—

The breast gradually swells, and in the beginning is entirely free from pain or tenderness; it becomes hard, and no fluctuation can then be discovered in it; it continues slowly growing for months, and even for years, sometimes acquiring very considerable magnitude, the largest I have seen having weighed nine pounds; but in other cases, although the bosom was quite filled with these bags, yet it never exceeded twice the size of the other breast.

At first the swelling feels entirely solid, so that it bears a great resemblance to a simple chronic enlargement of the breast; but after a great length of time, a fluctuation can at one part be discovered in it, and then the breast begins to increase more quickly; and in several parts similar fluctuations can be detected.

The cutaneous veins become varicose; but although the breast is immensely enlarged it still continues almost entirely free from pain: but to this there are exceptions, for some persons feel an unusual heat, and some, as the breast increases, suffer pain in the part and in the shoulder.

The tumour is extremely moveable upon the pectoral muscle; is very pendulous; and in some cases, the whole of the mammary gland, in others only a small portion of it, becomes involved in the disease.

At length one of the fluctuating portions of the breast slowly inflames, ulcerates, and discharges a large quantity of serum, or of a fluid having its general character, but of a consistence somewhat more glairy; and the sac being emptied, and the external opening closed, if the fluid be entirely discharged, it is a long time before it reaccumulates; and sometimes the sides of the sac adhere, and the cyst ceases to secrete. In other instances I have known the swelling break, and discharge a mucilaginous fluid mixed with serum; and several of the cells in succession, and at distant periods, pass through the ulcerative process, and form sinuses, which are very difficult to heal.

Excepting during the process of ulceration, the general health remains entirely undisturbed, and the person suffers so little, either locally or constitutionally, that her friends do not discover her malady; and nothing would lead her to consent to an operation for its removal, but the anxiety of mind, and the apprehension which the idea of a cancer produces, and the great inconvenience and distress which the weight of a large swelling occasions.

Although the whole breast should be involved in the disease, and even although the swelling ulcerates, discharges largely, and puts on a formidable appearance, and even becomes of the enormous size which will be seen in Plate XXIX., yet the glands in the axilla remain entirely free from disease; or if one be slightly enlarged, it is from simple irritation only, and it disappears when the complaint in the breast is removed.

When the swelling, and the breast in which it is situated, are examined, it is found, upon a careful dissection, that the interstices of the glandular structure itself, and the tendinous and cellular tissue connecting it, are in a great measure filled with fibrous matter, poured out by a peculiar species of chronic inflammation; but in some of the interstices a bag is formed, into which a serous or glairy, or sometimes a mucous fluid is secreted, according to the degree of inflammation attending it; and this fluid, from its viscidity, and from the solid effusion which surrounds it, as well as from the cyst being a perfect bag, cannot escape into the surrounding tissues; but by its quantity, its pressure, and by the gradual yielding of the bag, it becomes of very considerable size; and vast numbers of these cysts are found to occupy each part of the breast, producing and supporting a continued but slow irritation, and occasioning an effusion of fibrous matter, by which the breast forms an immense tumour, consisting of solid and fluid matter. Within these bags of fluid, Hydatids, hanging by small stalks, but some, which from their appearance I supposed to be simple cells before I opened them, instead of being entirely hollow, had a cellular tissue within them, in which a fluid was collected, which, although it produced the appearance of cells or Hydatids on the outside, within assumed the character of anasarcous swellings.

The breast, when not greatly enlarged, is almost entirely filled with cellulous Hydatids; some are produced in clusters, but the greater number are completely distinct from each other; and in those cases in which the breast is but slightly increased, the constitution is but little irritable, and only a slight adhesive inflammation accompanies it.

The size of these cells varies from the head of a pin to that of a musket-ball, of which an example will be seen in Plate XXVIII.; but in the second, some of these bags are emptied, and are seen of a much larger size.

The cysts, in which the fluid is contained is highly vascular; and so much blood circulates in these tumours, that the veins become greatly dilated, and much blood is often lost during their removal; and there is a disposition in the vessels to bleed after the extirpation of the tumour.

Although in the greater number of cases the whole breast becomes involved in the disease, yet I have several times seen it affect it in one part only; and the removal of portions of the breast has been sufficient to prevent a return of the complaint, as will be seen in Mrs. Hewlett's case, hereafter detailed.

This disease, in its first stage, resembles simple chronic inflammation; but it may be distinguished from it by the absence of tenderness upon pressure; and the perfect health in which the patient remains, stamps it to be an entirely local disease.

In its second stage, when it fluctuates, it is discriminated by the Surgeon observing several distinct seats of the fluctuation, and by the absence of tenderness; but the best criterion is the puncture of the bag, when the evacuation of a clear serum, instead of a purulent fluid, at once teaches the Surgeon the true nature of the disease.

From a scirrhous tubercle it may be distinguished by the absence of those occasional acute and darting pains which accompany that malignant affection, by the preservation of health, and by the excessive hardness, which are concomitants of scirrhus.

However, I must observe, that I have seen a case in which a true scirrhous tubercle had Hydatids connected with it, and although the swelling was carefully removed, it returned; but in this case the usual pain of scirrhus accompanied the disease.

With respect to its diagnosis from the fungous tubercle, I must defer that subject to the second part of this Work.

In the treatment of Hydatid disease, no local applications are beneficial, and the constitution requires no attention, because the general health does not suffer from the complaint.

If only one bag is discovered, and that is of considerable size, it sometimes, if punctured, does not again fill, as will be seen in several of the cases.

But when the enlargement is excessive—when a multitude of bags are produced—when the weight of the swelling becomes several pounds—when the breast is very pendulous, and drags upon the surrounding parts, and shakes upon every motion—when there is great apprehension, on the part of the patient, of some malignant disease, then the Surgeon will be wise in removing it.

The operation itself is a simple piece of dissection, in which it is the best plan to secure each divided vessel in immediate succession, to prevent, any great loss of blood; but it must be confessed that this is not absolutely necessary, as the operation does not require much time in its performance, and the vessels can be compressed by an assistant, whilst the Surgeon is removing the tumour; or, if he prefer it, each vessel may be secured in a ligature, as the operation proceeds.

When the tumour requires removal for this disease, it is necessary to take away all the hardened and swollen parts of the breast, for they have cysts, or cells, formed in them; and if any cyst be suffered to remain, it will still continue to grow and the remaining part of the breast to form an Hydatid tumour.

The great solace to the patient in this disease is, that as it does not contaminate other structures, there is no danger of its extending by absorption, of its producing any complaint beyond the breast, or of its affecting other parts of the body; nor have I seen it seated in both breasts at the same time.

CASE I.

A young woman was sent into Guy's Hospital many years ago by Mr. Saumarez and Mr. Dixon, Surgeons, at Newington, who had a tumour in her breast about two inches and a half in diameter. The tumour was hard, but her general health perfectly good, and I ordered her a plaster, and did no more ; and as the swelling underwent little change, she quitted the Hospital.

Many months after, she again applied for admission, the swelling having greatly increased, and I then ordered her into the operating theatre, to remove it; but examining it with great attention, I felt a fluctuation ; and turning to the students, said—I shall put a lancet into this swelling, to ascertain the nature of its contents;—which I immediately did, and serum only was discharged. I then introduced a small piece of lint into the orifice; brought on an adhesive inflammation ; the sides of the cyst adhered and the patient did well, having no return of the complaint.

CASE II.

Miss T., a young lady from Ireland, applied to me for a tumour in her right breast. In its centre there was a distinct fluctuation, surrounded by a wall of hardness. I requested her to permit me to put a lancet into the fluctuating part of this swelling, to which she readily consented; and upon my doing so, a quantity of perfectly clear serum (indeed a fluid somewhat less coloured than serum usually is) gushed from the opening. As soon as this fluid had escaped, I applied adhesive plaster, and the wound healed without further application. I have since several times heard from this lady, and learned that the solid tumour remained for a length of time, and that afterwards she had pain and swelling in her other breast; but by taking alterative medicine, by bathing in the sea, by the application of soothing plasters upon the part, the swelling disappeared, and the uneasiness ceased, and she is now perfectly recovered, without any further operation.

CASE III.

Mrs. Styles, ætat 28 years, had a tumour in her left breast which had existed three years, and was sometimes painful from changes of temperature, and sometimes from the approach of menstruation; but the pain was inconsiderable.

It began in a swelling, which was as large as a filbert when first observed, and which was hard and moveable; but it gradually became larger, until it was about two inches in diameter.

Her bowels and the menstrual functions were regular, but she was rather inclined to costiveness; her general health was good. My nephew, Mr. Bransby Cooper, removed the swelling in my presence, and when he cut into the tumour, a bladder of water was opened.

The cyst in which the water was contained, appeared very vascular; the solid tumour, as well as the cyst, were removed, and the wound appeared to be healed in a fortnight; but an abscess afterwards formed, and discharged for six weeks, and then closed.

The tumour was therefore of the nature of a simple cyst, formed in the cellular membrane of the breast, containing a quantity of serous secretion, and surrounded by a solid effusion of fibrine.

CASE IV.

Mrs. Adams, of Charlotte Street, Blackfriars, consulted Dr. Blegborough and myself for an indolent fluctuating tumour in her breast, which had existed three months. It was devoid of pain, the skin was undiscoloured, and it moved freely with the breast. I put a lancet into it, and discharged two ounces of clear serum, and the swelling proved to be quite free from any malignant tendency.

CASE V.

Mrs. B——, ætat 38, a patient of Mr. Haine's, of Hampstead, in the Spring of 1822, discovered a tumour in her breast about the size of a filbert; she had a sense of coldness, with some uneasiness in the part, and occasional tingling down the arm and fingers.

The swelling at first gave the sensation of its being entirely solid.

It was first perceived after her being exposed to a current of air from an open window.

It continued to increase for a year and a half.

Leeches, with mercurial and soap plasters, were applied without effect.

In July, 1823, finding a fluctuation in the centre of the tumour, I opened it, and a discharge of limpid fluid followed, which after a short period collected again.

A seton was then inserted, and the sac after that time came away nearly whole.

She has never had any return of the tumour; but in damp weather feels now and then uneasiness in that breast.

CASE VI.

Mrs. Hicks, ætat 45, had a tumour in her breast after her lying-in. It was opened by means of a seton, by Mr. Blegborough, and discharged a mucilaginous fluid. In the year 1800 I was consulted by her, when the whole breast was involved in the disease.

She had in it several tumours: some felt like peas, others as large as a marble, some of them had ulcerated, and discharged a mucilaginous fluid, and then healed.

The swelling was sometimes slightly painful, but it was not the severe darting and burning pain which accompanies the scirrhous tubercle. May 5, 1800, I removed the breast, and upon its dissection found a multitude of cells containing a serous lairy fluid.—See Plate XXVIII.

One cyst was larger than the rest, and the membrane which formed it, was highly vascular. I saw her in 1804, and she had then no return of the disease, but was quite healthy: she had a gland enlarged in each axilla at the time of the operation, which disappeared after it, and never returned.

CASE VII.

The wife of Dr. W——,ætat 45, twenty-six years ago fell in getting into a carriage, and received a blow upon the breast, which immediately became black and uneasy: she applied leeches to it, but a small lump remained. Three years ago the swelling began to increase, and from a rounded form became oblong; it was very moveable, free from pain, and its increase was so gradual, that little alteration was produced in twelve months. At this time the veins began to enlarge, and the skin to be discoloured; yet still it was free from pain. At the end of two years she applied to me, and I ordered leeches, which lessened the veins, but did not diminish the swelling, for it continued to increase, and several blue spots appeared on it; but it preserved a globular form and a smooth and even surface: spirituous lotions were applied to it, to check its growth by evaporation.

Two months before the operation, the tumour suddenly increased, and was then supposed to weigh about five pounds:—she was free from pain during the whole progress of the disease; her spirits were good, her activity undiminished, and her constitution remained unaffected, until the last two months, when she said she felt nervous; and head-aches which she had always occasionally had, increased in the progress of the disease. The original lump was for a time distinct in the tumour, but at length blended itself with the general mass. In June, 1818, in the presence of Mr. Cline, I removed this tumour, by making two flaps of the integuments, and I tied the arteries as I proceeded. Little constitutional irritation followed, and in six weeks Mrs. W. was well, and has ever since continued so.

CASE VIII.

June, 1818, Lady Hewitt, ætat 60, tall, and of a strong constitution, dates the origin of the swelling in her breast from a blow she received, November, 1815, in her axilla, by falling against a chair, although she had previously felt some evanescent pains in her right bosom. Nine weeks after the blow she felt uneasiness in the right breast, which extended into the axilla. In the beginning of 1816 she discovered a swelling in her right breast, which was about the size of a nutmeg, situated below the nipple. In May, 1816, it had acquired the size of a melon, and she consulted Dr. Sharpe, of Trapstone, who ordered her what medicines he thought most appropriate to her situation, and sent her to Harrowgate. She applied leeches every day for two months, and afterwards every other day till September. She then determined to try the influence of pressure, which she continued several months by adhesive plaisters, and afterwards by an instrument contrived for the purpose, which was worn during four months, but without any advantage, as the swelling still continued to increase. She therefore determined to leave the case to nature; and she did so till November, 1817, when the swelling began to undergo a change; it increased quickly, and became soft at its upper part, appearing inclined to suppurate: fomentations and poultices were applied, calomel and opium given, but matter did not form. This treatment was continued until the May following, when she discontinued all the means. She then made up her mind to submit to an operation, which I performed on the 10th day of June, 1818, in the presence of Mr. Cline and Mr. Lowdell, and my nephew, Mr. Bransby Cooper.

The swelling was of great size, weighing nine pounds. It was in part solid ; in some parts evidently contained a fluid ; and upon the surface of the cyst part there was a slight blue tint. The swelling was moveable, and reached to the upper part of the abdomen. Lady H.'s general health was good.

The first steps of the operation consisted in making a puncture into the tumour at its most prominent part, and discharging a quantity of serum from it ; by which it was at once clear the disease was of the Hydatid kind, and the magnitude of the swelling was lessened.

An incision was then made across the tumour, a little above its middle, and the flap of the integuments being raised, the upper part of the swelling was detached from the pectoral muscle, and with the handle of the knife the swelling was further separated ; and a flap of skin being left below to meet that at the upper part, the operation was then concluded. Its removal was borne with great fortitude. Two arteries of considerable size required to be secured. The integuments were brought together by a single suture, and by adhesive plaister. On the 16th of June the wound was first dressed, and on the 30th Lady H. was quite well.

CASE IX.

Mrs. Hewlett, residing in Paradise Row, Stockwell, ætat 34, I was requested to visit by Mr. Callaway, on account of a tumour in the left breast.

This was in April, in the year 1822 ; but four years before, she had discovered the tumour in the breast.

In consequence of hearing of another female who had a swelling in her bosom, she was induced to examine her own, and then found a swelling about the size of a filbert upon the upper part of her breast which felt extremely hard. She immediately sought the advice of Mr. Scott, of Bromley, who applied plasters, and gave her some pills : and ten months afterwards she consulted Dr. Elliotson, at Clapham, who advised leeches and medicine.

At a considerable interval, the tumour having increased, she applied to me ; but after five months' trial of means which I do not recollect, she consulted Mr. Callaway and Mr. Bransby Cooper, who advised an operation.

From first discovering it, to the period of the operation, it gradually grew larger. At first it was free from pain; but as it became large, a stinging sensation was occasionally felt in it.

It was never tender to the touch; it felt very hard even to the time of its removal. Her general health was never affected by it, excepting that the fear of cancer sometimes prevented her sleeping, and filled her mind with apprehensions.

She had no children, and never had been pregnant.

The operation was performed in April, 1822, in the presence of Mr. Callaway, and in ten days she was quite recovered.

Ever since that time she has remained free from tumour or pain in the breast; and now, the 18th of November, 1828, she continues perfectly well.

Upon inspection of the tumour, numerous little bags were found, surrounded by fibrous matter. (See Plate.)

Only a part of the breast was in this case removed.

CASE X.

Sarah Harris, ætat 30, a single woman, about three months ago, quite by accident, discovered a small swelling in her right breast, about the size of a large marble, situated just under the nipple, deeply seated, but perfectly moveable. She was not led to examine it from any pain, as it gave her none, not even upon considerable pressure. There was no discoloration of the skin, nor any circumstance that gave her the least inconvenience; yet as the tumour continued to increase, she was recommended to have it removed, and was admitted into Guy's Hospital for that purpose.

During the fortnight she was in the Hospital before the operation, the swelling increased rapidly, acquiring the size of an egg; but it was still very moveable, and entirely devoid of pain.

An incision being made through the integuments, a double tenaculum was passed into the swelling, and it was raised from its bed; in doing which, about half an ounce of fluid escaped, of a clear colourless nature.

The tumour being removed, the parts were brought together by adhesive plaster.

The disease consisted of several small cysts, containing a fluid like that which escaped during the operation; and these cysts were united by a thickened and condensed cellular membrane.

She had no constitutional symptoms from the operation, and the wound healed in a great degree by the adhesive process.

CASE XI.

Ann Harwell, ætat 49, was admitted to Guy's Hospital on the 11th of December, 1810, for an Hydatid disease of the left breast, which began about ten years ago. She was a married woman, had seven children, and has had two miscarriages.

When the last child was put to the breast, she accidentally discovered a tumour, as large as a filbert, immediately under the areola, on the outer side of the nipple, which was tender to the touch, moveable, and the skin over it unattached.

As it projected beyond the nipple, it prevented the child from sucking that breast.

The six children she previously had, she suckled with both breasts.

But almost immediately after she began to suckle with the left breast, pus, mixed with blood, was discharged at the nipple, and continued to do so until within two months of her admission.

From the commencement of the disease, the whole substance of the breast was painful; this was succeeded by an itching and a general heat in the bosom.

She described a sensation as if something were alive and crawling in the breast, which she only felt occasionally.

In May she discovered a considerable number of tumours in the substance of the breast, just beneath the integuments, not painful but very moveable, and of various sizes. Neither these nor the original tumours by the side of the nipple, ever, according to her own account, had any soft or fluctuating feel, but on the contrary were firm and hard, as if solid.

Upon removing the breast, it was found to have numerous cysts in its interior (see Plate,) filled with a serous fluid; their sizes very various, some in clusters, but the greater number were single cysts.

In this case there was more pain than is usual in Hydatid tumours, which I attribute to the changes which the breast underwent in its diseased state, from gestation and suckling: as it appears also, from her narrative, that matter had been discharged at the nipple.

CASE XII.

In the following case cellulous Hydatids were united with a scirrhous tubercle, and the lady fell a victim to the disease.

Miss S———, of Canterbury, ætat 29, healthy in appearance and feelings, but of a thin and spare habit, first observed, twelve months ago, a small swelling in her left breast, about the size of a filbert, and her attention was attracted to it by a sense of aching and pressure in the part.

Whenever she had a slight cold, she had a thrilling pain, accompanied with a darting sensation in the part, with a sense of soreness at the nipple.

During the last Summer the swelling increased, accompanied with great tenderness on pressure, and a thrilling pain; and it was more severe as her menstrual period approached. A month ago she observed the tumour to be flat upon its surface, and it felt hard, and the skin did not move easily over it.

November 20, 1822, she came to London, to undergo an operation.

The tumour was very hard, and impressed my mind with the idea of its being a scirrhous tubercle; yet her age, her health, and the fulness of the breasts, still induced a hope that it might not be malignant.

It was obvious, however, that no medicine would absorb or dissolve so large a tumour, and I therefore removed it.

The operation was performed on Saturday, the 23d, and the tumour was deeply buried in the breast. On the Tuesday following she had a rigor, which was succeeded by erisipelas from which she recovered with difficulty. Upon dissection of the tumour at its upper part it had the appearance of a scirrhous tubercle; at its lower were found several cellulous Hydatids. (See Plate.)

I wrote to her sister to learn the sequel of the case, and her reply was as follows:—

Dear Sir,

In answer to your note which I received this morning, I take the earliest opportunity of informing you that my dear sister had a return of the disease in less than twelve months, and her sufferings were severe, the disease spreading in a distressing manner. August, 1826, was the termination of her sufferings.

I am, your's most sincerely, M. A. S.

P. S.—Mr. Rowe can inform you of the circumstances.

I called upon my friend Mr. Rowe, of Burton Crescent, and learned from him that Miss S. had been under his care in 1826, and that she died of a deeply ulcerated cancer.

The Second Species of Hydatid Disease in the breast is of a very curious nature; and without the advantage of the Plate here affixed, taken from a tumour in the breast of Mrs. King, of Charing cross, it would be utterly impossible to make it understood. The breast was in this case, enlarged, and in the greater part hardened by the effusion of fibrine (coagulable lymph) in lobes into the cellular tissue; but in several parts it contained bags of serum, and formed fluctuating cysts of various sizes. In each of these cells there hung a cluster of swellings, like polypi, supported by a small stalk; and the little pendulous projections appeared to float in the fluid which had been produced around them in the different cysts.

Many Hydatids were found in a detached state, both in the fluid within the bags, and in the solid effusion in the breast: and taking the whole tumour, vast numbers of them had been formed in it.

Their size varied, but the largest did not much exceed that of a barley-corn, the figure of which they assumed.

In general they were of an oval form, or I ought to say oviform, as they were larger at one end than the other.

When opened they were found to be composed of numerous lamellæ, like the crystalline humor of the eye, or like the layers in the onion, which could be readily peeled from each other.

When removed from the breast, they had a pearly appearance, and the laminated character of pearl internally.

The cyst in which they were contained was a perfect bag, and it was composed internally of a membrane which was highly vascular, like other secreting surfaces; and the solid part surrounding the cyst had a greater number of vessels near the bag than at a remote distance from it; but the whole of the diseased structure was endowed with great vascularity, as will be seen in the Plate.

Upon examining Plate XXXI., seven of these bags will be seen with clusters of pendulous tumours growing in them, connected by the stalks, which are delineated in Plate XXX., and which contains sections from the same breast. Single Hydatids will be seen in the diseased solid structure, as well as cells containing a number of these bodies; and in one the cell is emptied, to show its vascularity.

It is doubtful if these structures are not of the nature of globular Hydatids (which is the next I shall describe,) and which have perished from the pressure of the solid matter with which they are surrounded; or whether they are productions, or secretions of the arteries of the part: but the determination of this point must be left to future observation and diagnosis.

Sections of Hydatids are seen, and the several single Hydatids, and the extreme vascularity of the fibrine with which they are surrounded, is well exhibited in the Plate.

In its external character this disease resembles the first which I have described; and the abscence of tenderness being the same in both, it will be thus distinguished from the simple chronic disease of the breast; but in the present state of our knowledge, it cannot be discriminated from the former Hydatid disease but by dissection.

From the scirrhous tubercle it is known by the hardness, by the occasional severe pain, and by the broken health which usually attends that disease; for although in the case from which I have given the description of this complaint, the tumour weighed 13lbs. upon its removal; yet the general health was good, the absorbent glands in the axilla were unaffected, and there was no local disease in any part of the body.

It may be also observed, that scirrhous tumours very rarely acquire so great a magnitude as the Hydatid swelling here produced.

Many years elapsed before the disease required removal, from its magnitude and inconvenience. In Mrs. King's case it had existed fourteen years at the time of the operation. Extirpation is the only mode of relief; for no constitutional remedy can be ever found to check the progress of the disease, and no local application can be attended with advantage. A puncture into the cyst could only afford temporary relief; but its removal by operation is free from danger at the moment, and the patient's mind may be divested of all apprehensions for the future.

Mrs. King, of Charing Cross, ætat 58, had an enormous enlargement of her left breast, which she first discovered fourteen years ago, and then supposed it arose from a blow. When she first observed it, its size was that of a marble; it felt hard, and was unattended with pain.

It appeared to be buried in the substance of the breast, and was not very moveable in the glandular structure. It increased gradually until two years ago, by which time it had acquired the size of a mellon. At that period it seemed to increase suddenly, and to grow faster than before: but it was still unattended with pain, and her general health did not appear to suffer.

Last Christmas it again suddenly increased; but was still devoid of any painful sensations excepting that sometimes when she had a cold, she felt a slight uneasiness in the part.

On the 30th of September, 1822, I first saw her, and the tumour then measured thirty-five inches in circumference: in the greater part it was solid, but in other parts it was soft and fluctuating, and one bag evidently contained a large quantity of fluid.

The solid portion of the tumour was placed at its upper part; the fluid occupied the lower part of the swelling. Her general health was good, but she suffered much from its weight drawing down the skin and pectoral muscle, and putting the nerves exceedingly upon the stretch.

On the 1st of October I removed the tumour in the presence of Mr. Key, of Guy's Hospital, and Mr. Laviss, a surgeon in Westminster.

The large vessels, divided in the operation, were immediately secured, or compressed by an assistant as soon as divided, so as to prevent any loss of blood in the operation.

The wound when dressed on the seventh day, appeared healthy. The irritative fever consequent upon the operation was very slight, and she recovered without any untoward circumstances.

The Third Species of Hydatid which is found in the breast, is the animal or globular, and which consists of a bag containing a fluid, which has no vascular connexion with the surrounding parts; and it produces within its interior a multitude of bags similar to itself.

They are often met with in great numbers in the liver, and have been frequently seen in the lower part of the abdomen, between the bladder and rectum, where they have been the cause of retention of urine.

The omentum also sometimes forms a nidus for them, of which my friend Dr. Farre has a beautiful specimen.

In some species of ovarian enlargement they are also found.

A specimen of diseased lung was met with by Sir L. M'Lean, of Sudbury, in which its interior was entirely occupied by these productions; and they have been found hanging in the inner side of the pericardium.

In the human brain they sometimes, although rarely, exist; but in that of other animals they are frequently found.

Tumours also form in the cellular membrane, which, when opened, discharge a multitude of these bags, which are enclosed in a cyst formed by the adhesive process.

They sometimes produce suppuration and ulceration, and are thus discharged.

Upon dissection of the Hydatid, the following appearances present themselves.

The Hydatid is contained in a cyst, formed in the breast by the adhesive process; for wherever it is deposited, it excites irritation, and becomes surrounded and encased by an effusion of fibrine which is highly vascular: and its internal and secreting surface is directly applied to that of the Hydatid, and a slight moisture exists between them, they having no vascular connexion.

In the breast I have only seen them exist singly, but in other parts of the body great numbers are found.

It is a semi-diaphanous bag filled by a clear water, and it is uniformly smooth on its external surface.

It has no opening or inlet, so that it must derive its nourishment by absorption from its external surface. It is composed of two coats; the external is of considerable density, and if any opaque body be placed behind it, it has the shining appearance of mother of pearl, and reflects the rays of light from its surface.

It possesses a considerable share of elasticity, and rolls itself up when it is broken.

This external layer is lined by a very delicate internal membrane, which appears to be its uterus; for from its interior a multitude of small Hydatids grow, which at first adhere to the membrane, but afterwards become detached, from its falling into the fluid which the Hydatid contains.

If, therefore, the fluid contents of the Hydatid be collected in a glass, an immense number of small Hydatids will be discovered floating in them.

Each of these small bags becomes in its turn a parent Hydatid, producing young upon its internal surface, in a similar manner to the parent cyst.

I am induced to believe them to be distinct animals; first, because they have an existence and growth of their own, having no vascular connexion with the part in which they are found, but being only encased and surrounded by a vascular and secreting cyst.

Secondly, because they have the power of producing upon their interior surface their own species.

Thirdly, that in the brain of sheep a similar bag is found, which, for several hours after the sheep has been killed, if it be put into warm water, has a distinct and very considerable vermicular motion: and, fourthly, because on the surface of the abdominal viscera, and sometimes in their interior, an Hydatid is found with a mouth and neck added to it; and consequently receives its food through the mouth, like other animals.

The globular Hydatid, therefore, may be considered, as to its mode of nourishment, the link in the creation between the animal and vegetable, as it receives its nutriment by absorption as the vegetable does; but the tænia hydetigina, as it is called, which has a mouth, is a perfect animal, with respect to the manner of its nutrition.

The Hydatid is supposed to be deposited in the structure in which it grows, carried there by the blood. Into whatever part it is thrown, it excites irritation, and becomes enclosed by an adhesive process, and which forms the cyst in which it is enveloped; but their origin is obscure, and the opinions respecting their deposition hypothetical.

The parent Hydatid is supported by a secretion from the internal surface of the cyst in which it is found; but the small Hydatids in it are probably nourished by the fluid which the parent Hydatid contains, so soon as they drop from, and cease to be connected with, the parent cyst.

When one of these Hydatids is produced in the breast, an inflammation is excited by it, and a wall of fibrine surrounds it; it feels hard, and from the small size of the Hydatid a fluctuation cannot be discovered; but as the Hydatid grows, although the quantity of solid matter increases, yet as the fluid in the Hydatid becomes more abundant, a fluctuation in the centre of the tumour may be ultimately perceived.

Sometimes, when the Hydatid has considerably enlarged, it produces a suppurative inflammation; and when the matter is discharged, either by the lancet or by ulceration, the Hydatid escapes at the opening; and there is in the collection of preparations at St. Thomas's Hospital, an Hydatid which was thus discharged by ulceration from an abscess in the breast.

The proper treatment of these Hydatid tumours is to make an incision into them, and to discharge the bag, after which a simple poultice will be sufficient to heal the wound; or if they be punctured, and the fluid be discharged, and it then reaccumulates, a seton may be passed into it, and the sac will slough.

But when the fluctuation escapes observation, and the tumour is believed to be of a scirrhous nature, the Surgeon removes it, and discovers the Hydatid bag contained within; and he can then confidently assure the patient that she is perfectly free from any future danger.

The distinguishing marks of this disease are its central fluctuation, its solid circumference, and the abscence of tenderness upon pressure.

The disease is neither dangerous prior to the operation, nor is it followed by any ill consequences.

For the following case I am indebted to Mr. Bayfield, Surgeon; and the Plate which I have given, after having dissected the swelling with care, is an excellent specimen of this disease.

Mrs. Sarah Cornish, ætat 44, was afflicted with a swelling in her left breast, which when she first observed it, was of the size of a filbert. It gradually increased in size for eleven months, but was entirely free from pain; and her general health remained good, and menstruation perfectly regular.

From the time of the operation, for its removal, which was performed several years ago, to the present period, the breast has remained free from pain or disease. (See Plate XXXII.)

Mrs. B., a patient of Mr. Haines, of Hampstead, whose case I have already related (see Case 5th) under the first species of Hydatid, probably had a globular Hydatid; because, when a seton was made in it, the cyst died and sloughed, instead of adhering, as it would have done, had it been a cellulous Hydatid.

CHAPTER IV.

On the Chronic Mammary Tumour.

This disease generally attacks young persons from the age of seventeen to thirty years, although I have known it occur after that period, but very rarely.

The constitution is often, although not always, perfectly healthy in those who are subject to this disease; nor does it usually in its turn affect the constitution, either in its progress or in its termination.

It is, I believe, generally the result of the sympathetic influence of the uterus, the excitement of the one organ leading to an increased determination and action in the other, and thus a new growth is produced; and it occurs chiefly in single women, or in the married who have had no children.

The symptoms which accompany this swelling are, that it grows from the surface of the breast rather than from its interior, and it therefore generally appears to be very superficial, excepting if it spring from the posterior surface of the breast, when it is deep-seated, and its peculiar features are less easily discriminated.

It is an extremely moveable swelling, being chiefly attached by a portion of tendinous aponeurosis to the glandular structure of the breast, rather than buried within the gland; and therefore when moved, it glides over the surface of the breast.

It begins without pain, and is therefore accidentally observed in the patient's ablutions; and it often continues for many years without exciting pain, or producing inconvenience; but in some cases it does become painful; the uneasy sensation extends to the shoulder, and the patient describes it to be of an aching or rheumatic kind.

Generally it is not tender to the touch; but I have known it occasionally so, more especially before the patient is unwell at her monthly periods.

Its growth is extremely slow, for I have removed one which had existed for five years, and which was not larger than a walnut; and I have seen another which had been growing seven years, and was but little larger than the former.

They rarely acquire any considerable magnitude, usually weighing from one to four ounces; but one which was removed by Mr. Bond of Brighton, weighed one pound and a half, and was only two years in acquiring that unusual size. There was a case in Guy's Hospital, and I believe it to have been of the same nature, which weighed several pounds, and which had ulcerated at its most prominent part, producing granulations which discharged purulent matter; but such cases are extremely rare, although tumours of smaller size, and of this description, are very frequent.

They are entirely free from malignancy, having nothing in common with cancer or fungus in their character: they therefore exist for many years almost in a stationary state, and then disappear, the patient observing them to gradually diminish.

I have known a gland enlarged in the axilla during the continuance of this tumour; but it is the result of simple irritation, is a rare occurrence, and does not proceed to the production of any formidable complaint.

Upon a nice manipular examination of this swelling, it is found to be lobulated—that is, composed of a number of lobes connected together, but leaving depressions between them; and whatever size it may obtain, it still preserves this conglomerate character: the swelling might therefore very properly receive the name of the lobulated mammary tumour.

Upon a careful examination of this disease by dissection, it is found to be contained in a bag formed of a similar fibro tendinous structure to that which envelopes, as well as occupies the interstices of the glandular part of the breast; and in proportion to the magnitude of the tumour does this envelope become more and more distinct. It grows from the glandular structure of the breast, and remains connected with it by a thin process of a similar structure, which is sufficiently loose and moveable to allow of a very free motion of the tumour upon the breast.

When first laid bare, it appears to be composed of large lobes, like those of the breast; but when more completely unravelled, it is found to be composed of smaller and smaller lobes, similar in form, but differing in magnitude; and after a short maceration in water, the lobes are easily separated.

The impression made upon the mind during the dissection of the tumour is, that nature has formed an additional portion of breast, composed of similar lobes, but perhaps differing in structure in the abscence of lactiferous tubes. When first opened, they appear red in the circumference, but whiter in the interior.

The general discriminating marks of this disease are as follow:

First, the youth of the patient: there are, however, some exceptions to this rule; but as the scirrhous tubercle is rarely seen under thirty years of age, so does this disease seldom happen after thirty.

Secondly, the absence of pain; but this also is not constantly observed, although it is generally slight, and often the swelling exists many years without it.

Thirdly, from the malignant diseases of the breast it is distinguished by the general health in this complaint remaining unaffected.

Fourthly, the slow progress of the swelling, and the number of years it will exist in almost a stationary state.

Fifthly, in its superficial situation upon the surface of the breast; for it is placed rather on the gland than in it.

Sixthly, from its extreme mobility.

Seventhly, above all, it is known from its lobulated feel; being distinctly composed of numerous lobes conglomerated into one mass, with a broken or divided surface.

The cause of this disease is, as I have stated it to be, sympathetic with the uterus, and it arises from a great determination of blood to the part at certain times; but patients frequently ascribe it to a blow which they recollect to have received, or to the continued pressure of stays; and these circumstances of irritation may become the immediate exciting causes of the tumour, but the tendency to the disease is founded in uterine excitement.

In the treatment of this complaint, it is right to learn if all the secretions be perfectly performed—if the liver secrete its proper quantity of bile—if the bowels be costive; but, above all, if the menstrual secretion be regularly performed, as regards its time, its quantity, its colour, and its duration.

If the digestive functions are imperfectly performed, the Pil. Hyd. Sub. Comp. at night, and the Infus. Calumbæ cum Infus. Rhei. et Soda Carbon. twice in the day, will be the best medicine; but if the uterine secretion be defective, the Pil. Hydrargyri. gr. ij. Extr. Colocynthidis Compositi, gr. iij. Ft. Pilula, given every fourth or fifth night, with different preparations of Steel, to be taken two or three times per diem, will be the more appropriate constitutional remedies.

As to local applications, one of the best is the Emp. Amm. cum Hydrargyro, if the diseased part be completely indolent; or the Iodine Ointment may be applied by friction upon the swelling, to excite the action of the absorbent vessels.

But if there be heat or pain in the swelling, evaporating lotions, or simple poultices, are most productive of relief.

It must be confessed, however, that these swellings are much out of the medical man's power to relieve, either by constitutional or local means; for as they are growths of long continuance, so will a great length of time be required to produce their absorption; and when they disappear, they seem to do so very gradually, from the cessation of that uterine excitement by which they have been produced, or by the part being called upon for its natural secretion of milk.

But when the patient consults the Surgeon, she is very apprehensive of a cancerous or malignant disposition in the tumour; and he has the power of relieving her mind by the following declarations, which time will verify.

First, that the disease is decidedly not malignant; and therefore if it do not yield to treatment, it is not dangerous to life.

Secondly, that it does not absolutely require an operation; for it will continue for years, and then gradually disappear.

Thirdly, if the patient be anxious to have the malady removed, from an apprehension of its becoming malignant, and if she determine to have it done, the operation is of the simplest kind; and it is not followed by any serious symptom, immediately or remotely; nor is the disease liable to recur.

Single women who have this species of tumour, inquire of the Surgeon if they may marry; and my reply to this query is, that the swelling, so far from forbidding marriage, seldom fails to disappear under the first pregnancy, and the suckling which succeeds it. But it is right that the future husband be informed of the complaint, and then he will be anxious that an opinion should be had on the subject. I knew a lady who had one of these swellings, and who was engaged to be married, and she candidly told her future husband of her misfortune. A Surgeon was consulted, who said—"Marriage will be your best cure; the tumour will not resist pregnancy, and the process of nursing the child at your bosom:" and so it happened, for the tumour disappeared, not in the pregnancy, but in the suckling.

I shall subjoin the following cases of this disease, from notes which I made at the time of my being consulted; and I have a great number of them; but from their similarity, and the few circumstances attending them, the relation of a few of them will suffice.

CASE I.

Miss M——, aged 27, had a small tumour in her breast, which was seated very superficially, was very moveable, and was lobulated upon its surface. She had a similar tumour removed five years ago by Mr. Cline. Each of the tumours was devoid of pain; but it produced great anxiety of mind, from the apprehension of its becoming cancerous, and she therefore solicited its removal. Mr. Pennington held the tumour between his fingers, and I divided the skin over it, drew it forth with the double tenaculum, and easily removed it with a small portion of the breast. Upon examination of the swelling, it appeared lobulated like the breast itself, to the surface of which it was attached by a tendinous aponeurosis, and by a small portion of the breast.

CASE II.

Mrs. G——, a lady in the city, had a lobulated mammary tumour, which began two years before I removed it, which was fourteen years ago. She had children, but was unable to suckle in the breast in which this tumour began. She remains well up to this time, and has had two children since. She was induced to have the tumour removed, because it produced a sense of contraction in the arm, and the tumour itself was sometimes painful.

CASE III.

Mrs. A—— has had a swelling of this kind in her breast for two years, and it remains stationary. Her sister had formerly a similar swelling in her breast, which gradually lessened by her taking the Pil. Hyd. Sub. Comp., and by wearing the Emplastrum Ammoniaci cum Hydrargyro.

CASE IV.

Mrs. G——, of Lynn, applied to me for a swelling, the size of a walnut, in her breast; it was situated close to the nipple, was very superficial, and very moveable; it felt lobulated, or composed of portions conglomerated together. I removed it, and found it to be formed of lobes divisible into smaller.

CASE V.

Miss. B—— had a lobulated tumour in her breast. I ordered her Cascarilla, Rhubarb, and Soda: she got quite well.

CASE VI.

Mrs. E——, of St. Paul's Church Yard, had a moveable, superficial, and lobulated tumour of the breast. When she first consulted me, she had an intention of marrying, but doubted the propriety of doing so, on account of this disease. She therefore, through her mother, mentioned it to the gentleman who was to be her future husband, and he brought her for my advice. I told him I had not witnessed these swellings continue after pregnancy, and that the disease was not of a malignant nature. She married, and the swelling disappeared in the suckling of her first child: her age was twenty-two.

CASE VII.

The following case I received from Mr. Bond, Surgeon, of Brighton.

Dear Sir,

I deferred acknowledging the receipt of your letter until I could give a more decided answer to your questions. The lady at the time of the operation was 42 years of age. The tumour had existed only two years from its first appearance until it was removed. Through its progress she seldom felt pain, unless it was much handled or pressed. It was hard and unequal. Sir Charles Blicke thought it of a malignant nature, and advised its removal. The left breast was quite sound and the glands in the axilla were free from disease. The operation proved highly successful, the parts healing by the first intention; and although it is ten years since the operation, the lady has been, and is now, in perfect health. The tumour, when removed, weighed one pound and a half. The patient was married; but although healthy, never had any children.

Believe me, your's truly,

A. Bond.

Brighton, Feb. 19, 1823.

CASE VIII.

Elizabeth Miller, aged 33, has a lobulated tumour in her right breast: it is of seven years' duration, and began in a swelling not larger than a pea, and is now the size of a walnut. She has been married sixteen years, and has had one child. The swelling feels distinctly lobulated, and the interstices between the lobes may be easily traced. For five years she had no pain in it, nor did she suffer any inconvenience from it; but lately it has been tender to the touch, and she has had pain in it which extends to the shoulder, and was worse before she was unwell. She is weak in her general health. Her monthly periods are regular, but she is subject to costiveness and headachs. She has been under the care of Mr. Callaway, who has tried various means for the dispersion of the tumour.

CASE IX.

Miss Gardner, aged 34, had a chronic mammary tumour in the right breast. In April 1828 she first observed a moveable swelling, devoid of pain, seated at the upper part of the breast. It gradually increased, and similar tumours grew out of the external portions of the breast towards the arm; but they were small, and not very distinct.

She has always had a scanty menstruation, and has a slight fluor albus.

She has also suffered much anxiety and disappointment.

Nothing which she has tried has been useful.

Leeches appeared rather to increase it than to have any beneficial effect.

The tumour was removed by operation on December 4, 1828.

Upon dissection it was found enclosed in a cyst of condensed cellular membrane; and the swelling was composed of a substance which resembled the breast itself, and was connected by a stalk to the mammary gland.

December 15—The wound is healed.

CASE X.

Miss Golden, from whom I removed a chronic mammary tumour in 1814, had an enlarged ovarium appear a few months afterwards on the right side. She consulted me for a disease in her arm in the Summer of 1828, and I found that the disease in the ovarium had disappeared, and that the complaint in her breast had not returned.

Although these tumours are not in their commencement malignant, and they continue for many years free from the disposition to become so, yet if they remain until the period of the cessation of menstruation, they sometimes assume a new and malignant action.

CHAPTER V.

Of the Cartilaginous and Ossific Tumour.

In chronic and specific inflammations of parts of the breast, a gelatine is sometimes effused, which resembles that which supplies the place of bones in the fœtus, and of parts of the bones in infants. This gelatine becomes vascular from the surrounding parts. It resembles cartilage in its yellow whiteness, in its compactness, and its elasticity, and still more in its becoming the nidus of bone; for as the blood-vessels and absorbents enter it, the latter remove portions of it; whilst the former deposit in the interstices produced by the absorbents, the more solid material of bone, *viz.* the phosphate of lime; and when the tumours composed of this structure are steeped in an acid, the phosphate of lime is removed, but the cartilaginous or gelatinous basis remains. This will be illustrated in the following case:—

Mary Farmer, aged 32 years, applied to me for a swelling in her breast, which she had observed for fourteen years.

The pain in it was very severe; the skin which covered it felt very warm when compared with the surrounding parts; and it required the constant application of evaporating lotions to moderate its warmth. The tumour was excessivly hard, very painful before menstruation, but greatly relieved after it.

Various applications were tried, *viz.* fomentations, poultices, and stimulating plasters, but they neither disposed it to absorption nor to suppuration; and as all the means employed to disperse it were quite unavailing, she was anxious for its removal.

The glands in the axilla being free from disease, as the complaint had existed for so long a period, and her general health seemed to be perfectly good, I recommended the operation, as affording the only hope of cure

Upon examination of the swelling after its removal, the larger portion of it had the appearance of that cartilage which supplies the place of bone in the young subject: the remaining part was ossific.—See Plate.

CHAPTER VI.

Of the Adipose Tumour.

I have on two occasions been required to perform operations for the removal of adipose tumours in this organ; and in each case the swelling had acquired a very considerable magnitude.

In the first case it began at the posterior part of the breast, and grew between the gland and the surface of the pectoral muscle. In the second all those lobes of fat which are interspersed between the different portions of the mammary gland, and which serve naturally to augment the size of the bosom, and to increase its prominence, became enlarged, and formed a swelling which, prior to the incision being made, seemed to involve the whole of the glandular structure of the breast; but when the operation was performed, the different lobes of adeps which formed the tumour, could be drawn away from the gland itself.

The following cases are those to which I have alluded.

CASE I.

Mrs. Smith, of Great Yarmouth, Norfolk, was admitted into Guy's Hospital in August, 1805, for an enormous tumour in the left breast: its circumference was thirty-one inches, and its length ten inches and a half. It was removed August the 29th, by making, first a semicircular incision at the anterior and upper part of the tumour, and then drawing down the swelling; an incision was made along its upper part until the pectoralis muscle was exposed, from which the tumour was afterwards dissected from the upper to the lower part, its own weight drawing the cellular membrane to a great extent, so as to render its detachment easy. As the different vessels which supplied it were cut through, the fingers of an assistant were applied upon them, and very little blood was lost in the operation; but in order to complete it, a very large portion of integument, the whole of the breast, and the tumour which was situated behind it, were removed. Several sutures were used to approximate the edges of the skin, which were also brought together by means of adhesive plaster; and the patient soon recovered.

The tumour, which is preserved in the collection at St. Thomas's Hospital, weighed 14 lbs. 10 ounces.

CASE II.

A woman of the name of Martin, was admittted into Guy's Hospital for a tumour in her breast, which was of great size, and felt as if it were composed of an increase of the different lobes which composed the glandular structure of the breast. But upon making an incision for its removal, it was found that all the different lobes of fat which enter into the composition of the breast, had become enlarged, and that the glandular structure itself was free from disease.

The different branches of which the swelling was composed, were drawn out from between the different portions of the gland, so as to leave large cells, in which the tumour had been contained. An extensive simple incision was sufficient to expose the surface of the swelling; and then by drawing it towards me, I elongated the cellular connexion which it had with the breast, and easily drew out the tumour, with very little dissection.

I have lately had a letter from this person, in consequence of some inquiry I made as to her present state, and her reply is, "that there never has been any return of the disease, and that the breast is entirely free from pain."

CHAPTER VII.

On the large and pendulous Breast.

The glandular structure of the breast sometimes grows to an enormous size, and becomes extremely pendulous, so as to reach to the fore part of the abdomen; but this is to be understood as not to be the effect of relaxation, but to be an absolute growth of the secreting lobes, which can be distinctly felt to be enlarged and hardened, and are sometimes accompanied with a considerable degree of tenderness.

A girl, whose age, the last time she was under my care, was 23, had frequently asked my advice for this kind of increase of each bosom. Her general appearance was healthy, and she seemed rather disposed to corpulency; but her constitution was defective, in her menstruation being irregular, in its colour being pale, and in its quantity being much less than natural.

But the most remarkable case of this kind which I have witnessed, was sent to Dr. Babington and myself from Pembrokeshire, and the young lady brought me the following letter:—

Haverfordwest, Nov. 5, 1821.

Sir,

I am induced to request your advice in the case of Miss——, who about three years ago was first affected with an enlargement of the left mamma, which continued increasing; and the right breast then began also to enlarge, until they attained their present dimensions. She is now fifteen years of age, and of good general health: the catamenia appeared about twelve months ago. I was requested to see her last winter, in company with Mr. Gregory, of Milford, and she has taken various emenagoge medicines and gentle laxatives; and she was enjoined regular exercise and sea-bathing. The catamenia returned at three or four regular intervals, at which time the mammæ considerably decreased in size; but since May last, the periods have been very distant, and the discharge is very small in quantity.

The mammæ are now of extraordinary dimensions. The circumference of the left is twenty-three inches and a half, that of the right is twenty-two inches, and they are pendant like a pear, as the neck is comparatively narrow. I cannot perceive any tumour, either in the breast or in the axilla. The skin feels and appears to be natural. Her appetite is good, and the bowels are kept regular by occasional doses of neutral salts. She suffers no pain whatever in either mamma, but she does not appear so lively as girls of her age, but indeed, on the contrary, is heavy and dull. In other respects there is nothing peculiar in this young lady's case.

I am, SIR, your obedient servant,

W. D. JONES.

The local treatment of this case consists in the application of a suspensory bandage from the back of the neck, under each breast, to produce artificial support; and the principle which is to be observed in the constitutional treatment of this malady, is to increase and to support the menstrual secretion; and for this purpose the exhibition of different forms of Steel united with Aloes, will be found the most efficacious medicine.

The Ferrum Ammoniatum—the Mistura Ferri Composita—the Carbonate of Iron, will be the forms of Steel which, united with Aloes, will be most beneficial; and if the biliary secretions be defective, the Pil. Hyd. Sub. Comp., or the Hyd. cum Creta, will be the best medicines.

Women who have led a life of celibacy to the age of thirty or thirty-five years, and whose menstrual secretion has become extremely defective, and who are the subjects of a severe fluor albus, are liable to have a change produced in their breasts:—they become enlarged, but not pendulous; and upon careful manipular examination, each lobe of the gland can be distinctly felt enlarged and hardened, moving freely upon each other: both breasts are affected, but generally one more than the other, accompanied with occasional pain, more especially just prior to the period of menstruation, which discharge is very slight, pale in colour, and of short continuance. In cold weather, if the breast be at all exposed, the pain is augmented; and in these cases cold has a great influence in lessening the menstrual secretion, already exceedingly diminished.

An absorbent gland is sometimes enlarged in each axilla; but this arises from simple irritation, and is not to excite any apprehension of malignancy.

The breast, after having been some time enlarged, begins to waste; and in a few years it is in a great degree absorbed.

This complaint consists of a change in the secreting portion of the breast, by which it is converted into a much more solid structure than natural, and in which its secreting power appears to be in a great degree destroyed. The breast is to the feel composed of a great number of moveable, very solid, but connected portions.

The treatment of this case consists in restoring, if possible, the menstrual secretion by the means already alluded to, and by the use of the warm hip-bath; and locally in applying leeches when there is pain, and desiring the patient to wear the Emplastrum Ammoniaci cum Hydrargyro.

CHAPTER VIII.

On the Scrofulous Swelling of the Breast.

In young women, who have enlargement of the cervical absorbent glands, I have sometimes, though rarely, seen tumours of a scrofulous nature form in their bosoms, confined in most cases to a single tumour in one breast; but in one case, two existed in one breast, and one in the other.

They are entirely unattended with pain, are distinctly circumscribed, are very smooth on their surfaces, and scarcely tender to pressure.

They are very indolent, and vary with the state of the constitution, diminishing as it improves, and increasing as the general health is deteriorating.

They can only be distinguished from the simple chronic inflammation of the breast by the absence of tenderness, and by the existence of other diseases of a similar kind in the absorbent glands of other parts of the body.

They produce no dangerous effects, and do not degenerate into malignancy.

They do not require an operation ; and indeed it would not be justifiable to remove them by the knife.

But I have seen them removed, from an error in judgment respecting their nature ; and when cut into after their extirpation, they are found to be composed of a loose and curdly fibrine, very unequally organized.—See Plate.

In some parts they possess vascularity, but in others are incapable of supporting vessels; in some parts, therefore, they are streaked with blood—in others appear of a yellowish white, approaching to the colour of suppuration, although still remaining solid.

The treatment in this case consists in improving the constitution by a warm and dry atmosphere—by an equally regulated temperature—by tepid sea-bathing—by gentle and regular exercise—by animal food of the most digestible kind—by milk—and by a farinaceous diet—a diet which shall nourish without exciting feverish heat, or calling much upon the powers of digestion.

The best medicines are Carbonate of Iron and Rhubarb; the Hyd. cum Creta with Rhubarb; a grain of blue Pill, and two or three grains of Quinine; Infusion of Columbæ with Rhubarb and Soda; for I conclude it will be admitted by every one who deserves the title of a Surgeon, that we possess no specific remedy for this disease, but that we are required to assist the digestive powers, make better blood, and convey it to the system by an increased vigour of the constitution.

Local treatment avails but little: a stimulating plaster or a lotion to the tumour, when the health is improved, may excite the absorbents to remove it.

CHAPTER IX.

Of the Irritable Tumour of the Breast.

The breast is liable to become irritable without any distinct or perceptible swelling, as well as to form an irritable tumour, composed of a structure unlike that of the gland itself, and which therefore appears to be of a specific growth.

Both states of disease, in the greatest number of examples, occur in young persons from the age of sixteen to thirty years: I have never witnessed it prior to the commencement of puberty, but I have sometimes known it to occur at a later period of life than that which I have mentioned.

When the complaint affects the glandular structure of the breast, there is scarcely any perceptible swelling, but one or more of its lobes becomes exquisitely tender to the touch; and if it be handled, the pain sometimes continues for several hours. The uneasy sensation is not confined to the breast alone, but it extends to the shoulder and axilla, to the inner side of the elbow, and to the fingers; it also affects that side of the body even to the hip; the patients cannot sleep on that side, and the pain is sometimes so severe as to prevent even their resting on the diseased side; and the weight of the breast in bed in some instances occasions intolerable pain.

Patients also state that heat and cold frequently succeed each other in the breast; and it would seem the pain resembles that in the Tic-douloureux, darting like electricity through the part, and through the neighbouring nerves. When the pain is most severe, the stomach sympathizes, and vomiting is produced. The suffering is very much increased prior to menstruation; is somewhat relieved during the period, and decreased after its cessation. There is no external mark of inflammation, as the skin remains undiscoloured.

In some cases only a small portion of one breast is affected; in others the whole, and not unfrequently both of the breasts.

This painful state remains for months, and even for years, with little intermission; but it has no malignant tendency: and an operation where there is no distinct tumour, must be entirely out of contemplation.

Besides this irritable and painful state of a whole, or part of the breast, a tumour sometimes is found distinctly circumscribed —highly sensitive to the touch—acutely painful at intervals, more especially prior to menstruation—very moveable—often not larger than a pea, seldom exceeding the size of a marble: generally one only exists, but in other cases there are several similar swellings.

Although they continue for years, they vary but little in size. I have never seen them suppurate: they sometimes spontaneously cease to be painful, and sometimes disappear without any obvious cause.

Upon dissection, they are found to be composed of a solid and semi-transparent substance, with fibres interwoven in it, but without any regular distribution; and I have not been able to trace any large filament of a nerve into them. They seem to be productions of the cellular membrane of the part, rather than of the glandular structure; and they are therefore met with in the cellular membrane of other parts of the body, accompanied with similar painful sensations; of which in the following pages I have given an example.

The diagnosis of this disease is unattended with difficulty; for the pain with which it is accompanied—its tenderness to the slightest touch, or to pressure of any kind—the suffering which succeeds examination—distinguish it from the Hydatid, the chronic mammary tumour, and the scirrhous and fungous tubercle.

If it be liable to be confounded with either of these, it is the chronic mammary tumour, which sometimes becomes very irritable and sensitive under changes of the constitution.

This disease is met with in persons of an irritable and nervous temperament, in whom there is excessive excitability of the system, accompanied with diminished power.

The menstrual action is generally very deficient; but in some cases I have known it morbidly abundant, and have very seldom seen an example in which it was in all respects regular or healthy.

The fluor albus is also a frequent concomitant of this complaint.

The immediate or exciting cause is generally believed by the patient to be a blow, or pressure from some part of the dress.

The treatment of this disease consists in lessening the irritability of the system, in lulling the local suffering, and restoring the defective or diminished menstruation.

The best local remedy is to be found in the application of a plaster, of equal parts of Soap Cerate and Extract of Belladonna, or a poultice with Solution of Belladonna and Bread.

Oil-silk worn upon the breast, or hare-skin, or some other fur, by the perspiration which it excites, aids in soothing and tranquillizing the part. When the pain is excessively severe, leeches may be also applied; but if too frequently used, they produce debility, and add to the irritability of the system.

As constitutional remedies, the Submuriate of Mercury with Opium and Conium should be given for a time, with an occasional aperient; and then the medicine which I have prescribed with most advantage in lessening the irritability of the part, is as follows:—

R. Extracti Conii,
Extracti Papaveris, āā gr. ij.
Extracti Stramonii,
ē Seminibus, gr. ss.
M. ft. Pilula.

The above pill may be given twice or three times during the day; but half a grain of the Stramonium is sometimes too strong a dose, when half that quantity will suffice.

To restore the uterine secretion, the Carbonas Ferri, the Ferrum Ammoniatum, or the Mistura Ferri Composit, may e either of them, given, combined with Aloes. A hip-bath of sea-water, or an artificial salt-water bath, may be used from 100 to 105 Gr.

No operation is really required for this disease; but some patients are anxious for the removal of the tumour, from an apprehension of its being, or of its becoming of a malignant nature.

The cases illustrative of this disease so much resemble each other, that it would be useless to detail them at length; and all therefore I shall do, is to quote from my note-book, memoranda which I have made of a few of the numerous examples which I have had an opportunity of observing.

Mrs. ——, aged 40, has three children. She has no swelling in her breasts, but they feel cold, then become excessively hot. She has sometimes very violent pain in them during the day and night, which extends to the arms, is exceedingly increased by exercise, and which she describes to be of a burning kind. Her menstruation is much less than natural.

I ordered her Plummer's Pill, and Soda with Infusion of Cascarilla; but I do not know the result.

Miss ——, aged 20, has a tumour in the breast, which is extremely tender to the touch, and painful even to the elbow, and the pain is exceedingly increased before menstruation. She attributes the swelling to a blow. She received great benefit from the application of the Ceratum Saponis cum Opio, and from taking the Pilula Hydrargyri cum Extracto Cinchonæ.

A girl, aged 25, has pain just under the bosom, which extends to the shoulder, arm, and even to the elbow and hand; it ascends to the neck, and descends to the hip. She has a light complexion, is very florid, has great pain in her loins, but her menstruation is quite regular, as regards colour, quantity, and time. Her bowels are costive; her breasts occasionally swell; and she has great pain in the bosom just prior to menstruation. Cupping, leeches, and purging have been tried without effect. I ordered Hydrargyrus cum Creta with Soda, and the Soap Cerate with Opium.

Miss ——, aged 20, has an exquisitely sensitive tumour in the breast: the pain extends from it to the axilla, shoulder, and arm. She is extremely irritable and nervous. She is not regular in her menstruation; and prior to it, the pain is exceedingly increased. Her bowels are quite regular. She is unable to divine the cause of this tumour.

Miss J——, aged 18, has pain in the left breast, neck, shoulder, and arm to the wrist; the pain is settled in the part, but is occasionally increased, and then shoots through the breast; the motion of her arm increases it, and she is unable to do any needle-work. She cannot sleep upon that side. The complaint began in a swelling of the size of a pea, three years ago and grew to that of a filbert. It frequently burns, and becomes red, and is larger and harder prior to menstruation. She has observed nothing peculiar in her bowels or menstruation. Her breast has been greatly relieved by taking the Pilula Hydrargyri at night, and the Ferrum Ammoniatum by day. Previously to her taking these medicines, she perspired greatly, and the perspirations have ceased. She was costive, but her bowels are now regular: the Ceratum Saponis was applied.

Miss L——, has a small moveable tumour in the left breast, and another not quite so large in the axilla, and neither the one nor the other exceeds the size of a small marble. Her age is

37. The tumours have existed two years ; they are very tender to the touch, and often exquisitely painful. Mr. Abernethy had seen her, and ordered her Calomel at night, with a purge in the morning and a poultice at night, and a very warm covering to the part in the day.

Mrs.——, aged 49, has an irritable breast without any tumour.

The disease commenced immediately after she had received a great alarm from some accident in a steamboat, which produced a severe illness.

The pain she feels in the breast is pricking, as if, as she says, from a pin or fork.

If it has been examined by the finger, or pressed, it extends through the whole breast and to the shoulder, and then it aches like the pain of rheumatism.

There is no distinct tumour but there is much fulness, and exquisite tenderness.

Miss W——, aged 39, received a blow upon her breast by stooping against a stick, and which produced a tumour there.

It feels as if a pea were deeply buried in the breast ; it is most exquisitely tender to the touch, and she has pain to the shoulder and to the ends of the fingers.

It also affects the inner side of the chest on the diseased side.

It is extremely augmented by anxiety of mind, and it is increased prior to menstruation.

She has been advised friction, which greatly added to her suffering.

In the Plate, I have given a view of an irritable tumour taken from the leg of a lady, which I introduce here, because it well illustrates the appearance which these tumours assume ; and the symptoms attending them are in a great degree similar to those of the same complaint in the breast.

Miss B——, a patient of Mr. Brock, of Guernsey, had twice felt a severe pain in her knee in walking at a considerable interval. Six weeks after the last attack, she discovered a little tumour, about the size of a pea, below the knee, which was extremely painful on the slightest touch : this I removed nine years ago. Twelve months afterwards she discovered, a few inches lower down in the limb, another swelling, which gave the same impression to the finger as the former, but it was more visible, as it projected the skin more ; and it produced, as she expressed it, a scraping and pricking pain, as if numerous lancets were darted into the part, and as if all kinds of pain were there combined. It fortunately lasted only ten minutes at each attack; for if it had continued longer, it would have been intolerable.

The second tumour I removed eight years ago; and I had the pleasure of seeing her in October last, at which time she had not had any return of the disease.

CHAPTER X.

On Ecchymosis of the Breast.

Allied to the irritability of the breast, is a morbid change which occasionally happens, of a bruised appearance upon this organ, which occurs at each menstruation, and is accompanied with exquisite sensibility, pain, and tenderness.

The symptoms of this complaint are as follow :—It occurs in girls who are in most instances under twenty-two years of age. It is preceded by severe pain in the breast and arm. The extravasation of blood begins a few days before menstruation, and it appears principally in a large spot, as if a severe blow had been inflicted. Smaller and less vivid spots may also be observed in other parts of the breast: it is sometimes a concomitant of an unusually large bosom. The part is exquisitely tender to the touch, and the pain with which it is accompanied, passes down along the inner side of the arm to the ends of the fingers. It disappears a week after menstruation, in some cases; but in others, when it is more severe, it continues until the next time the patient is unwell. It looks like the ecchymosis which often succeeds the application of leeches; or like the extravasation of blood under the skin, which occurs in the arm after bleeding, when the opening in the skin has been smaller than that in the vein.

It is a curious occurrence, strikingly showing the strong sympathy which subsists between the uterus and breast; for it is evidently the effect of the great determination of blood to the bosom just prior to the period of menstruation; and it indicates excessive irritability of the constitution, as well as the great delicacy and debility of the blood-vessels, which are unable to support this sudden determination which such sympathy produces.

This complaint is entirely unattended with danger; but being accompanied with diminished, irregular, and sometimes profuse uterine secretion, and by considerable debility and irritability of the constitution, two objects must be kept in view in its treatment:—the one is, by different forms of Steel medicines, to increase the quantity, and render regular the menstrual discharge; and the other, to augment the strength of the system, by the Infusion of Roses with Sulphate of Quinine.

As to local treatment, the best application is the Liquor Ammoniæ Acetatis, with Spirits of Wine, in the proportion of five ounces of the former, and one of the latter.

CASE I.

Miss G——, of Daventry, aged 17, has a bruised appearance of her breast; and the ecchymosis is like that which leeches, had they been applied, would have produced just under the skin.

This extravasation of blood, to which she has been repeatedly liable, begins about a week before, and disappears a week after menstruation. Before the blood is effused, she suffers severe pain in the bosom and arm: her menstruation is not regular; but she is unwell in that respect at distant and uncertain intervals, and then profusely.

When she consulted me, she had one large extravasation, and several smaller.

I ordered the Sulphate of Iron with Rhubarb; but I do not know the result.

CASE II.

Miss Gold, aged 21, who has very large breasts, has had the appearance of a bruise in the right bosom, and for two years has suffered great pain in it, which extends along the inner side of the arm to the ends of the fingers. She has also exquisite tenderness in it when it is slightly touched. She is corpulent and phlegmatic; she is subject to nausea, and her appetite is extremely defective. Her bowels are costive, and her menstruation is irregular. The right breast is fuller than the other, and at one part rises into a slight swelling.

CASE III.

Mrs. ——, of Crewkerne, has her left breast enlarged :—there is a general fulness in it, and uneasiness from its weight; small knots can be felt from different parts of it; there is great tenderness to the touch, which is increased by exposure to cold, and the pain is augmented prior to menstruation.

The breast has occasionally the black and blue appearance of contusion. Her menstruation is not regular in point of time, and its quantity is greater than is proper or natural.

CASE IV.

Mrs. Long, aged 21, who has been subject to indigestion, bilious attacks, and inflammation of the lungs, has had two children, and with the first had milk in the breast, but was too ill to suckle. In her second pregnancy she was subject to faintings, and had an inflammation on the lungs, for which she was frequently bled: the child was born alive, but died in three months.

Her left breast secreted milk, but the right did not produce any. Blood was discharged from the nipple for three or four days; then stopped; and after a time the bleeding was renewed, and that repeatedly: the most she discharged at any one time, was a tea-cup full. The milk in the left breast was also tinged with blood.

She was delivered in June 1821, and in October of the same year felt a tumour in the breast. In June 1822 the tumour continues, and is exquisitely sensitive.

Plate XXVIII.

Contains three views of cellulous Hydatids in the breast.

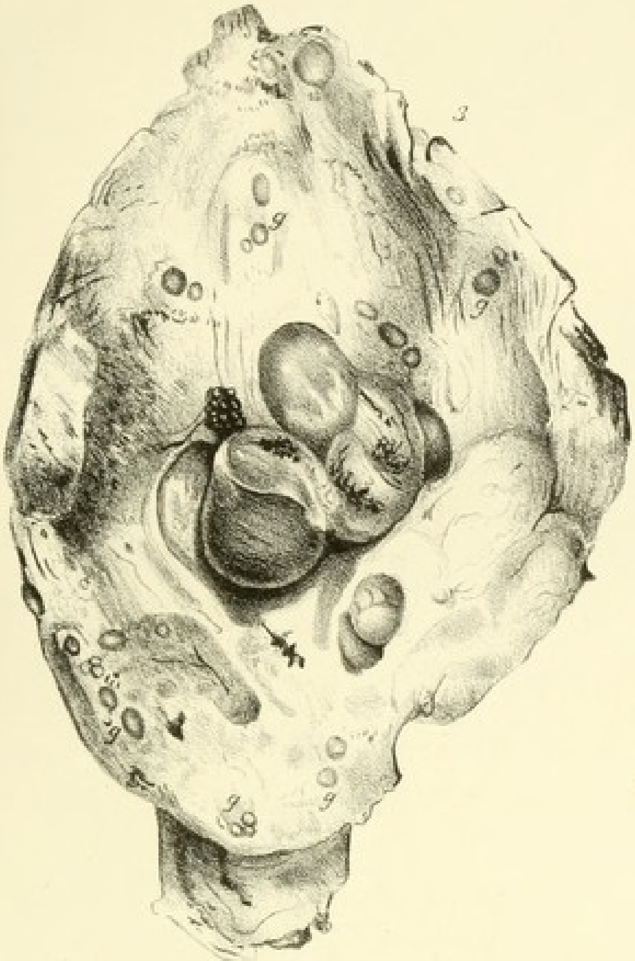
Fig. 1.—In the centre of this Figure one of these Hydatids is seen cut open, to show the vascular lining of the bag which secretes the serous fluid which it contains; whilst around it numerous Hydatids appear of various sizes, from the head of the smallest pin to that of a large pea; each of these, when cut open, having the same appearance as that which has been opened in the centre.

Fig. 2 shows the anterior view of a breast similarly affected: at *a*, in its centre, the nipple is seen, and near the areola at *b*, two large Hydatids, marked *c*; also, near the nipple, a cluster of small Hydatids; and in other parts of the bosom, at *d d d*, several minute Hydatids' cells.

Fig. 3.—A posterior view of the breast, Fig. 2 showing four large Hydatids near the centre: also a cluster of Hydatids, and a number of these cells at *g g*, in various parts of the breast.

Pl. XXVIII.

3



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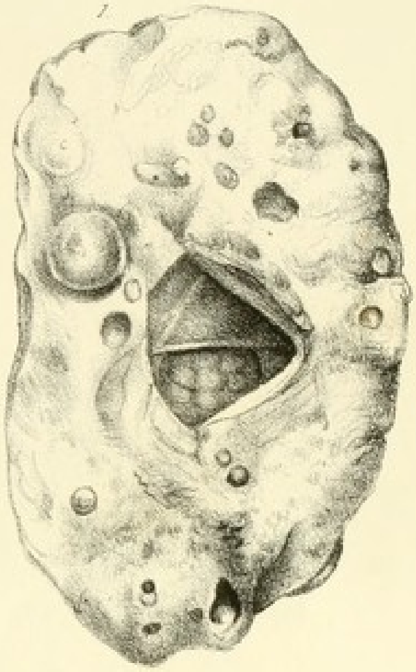

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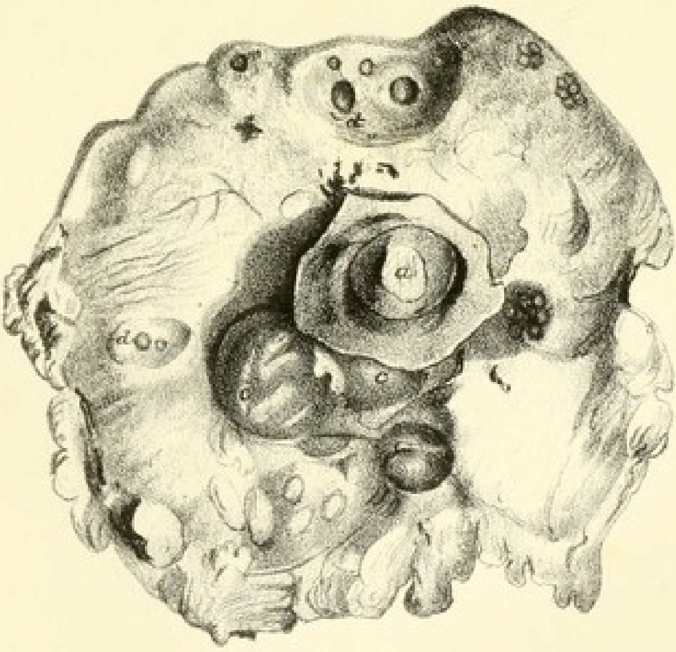


J. T. French del.

Sinclair's Lith Philad

Plate XXIX.

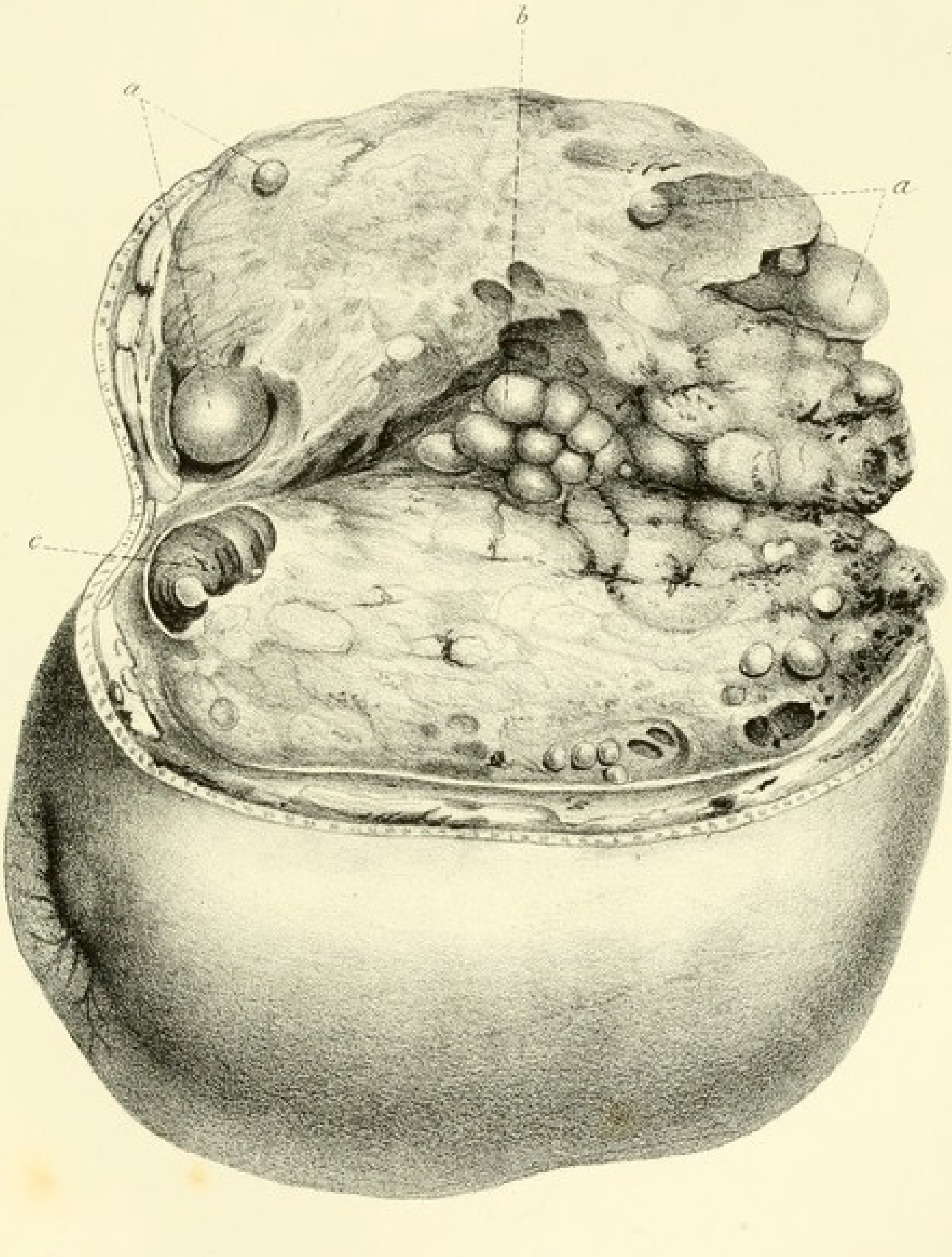
This is the breast of Lady H——, whose case I have given in the preceding Observations. A section has been made through it, and it will be seen to be composed of a solid fibrous material (coagulable lymph,) in which there are cavities containing Hydatids.

a, an Hydatid of considerable size.

b. a cluster of Hydatids in the centre of the breast.

At *c*, is a bag which contained a fluid, into which the Hydatid is seen growing; and near it is a large Hydatid, *a*, contained in a similar bag. In various parts of the breast other Hydatids may be seen growing.

Pl. XXIX.



J. T. French, del.

Sinclair's Lith. Philad.

Plate XXX.

Is a view of the breast of Mrs. King. A section has been made through the centre of this disease; and it is seen to be composed, in its greater part, of a solid fibrine, effused by chronic inflammation; but in different parts of this solid texture, bags are seen, containing clusters of Hydatids growing from stalks. On the left portion, three of these cavities are seen; on the right, four; each containing clusters of Hydatids surrounded by a serous effusion.

a, one of the large bags.

b, a cluster of Hydatid cysts not completely evolved.

c, another cluster of Hydatids connected by a stalk.

d, a large bag in the left section.

e, a cluster of Hydatids connected by two stalks.

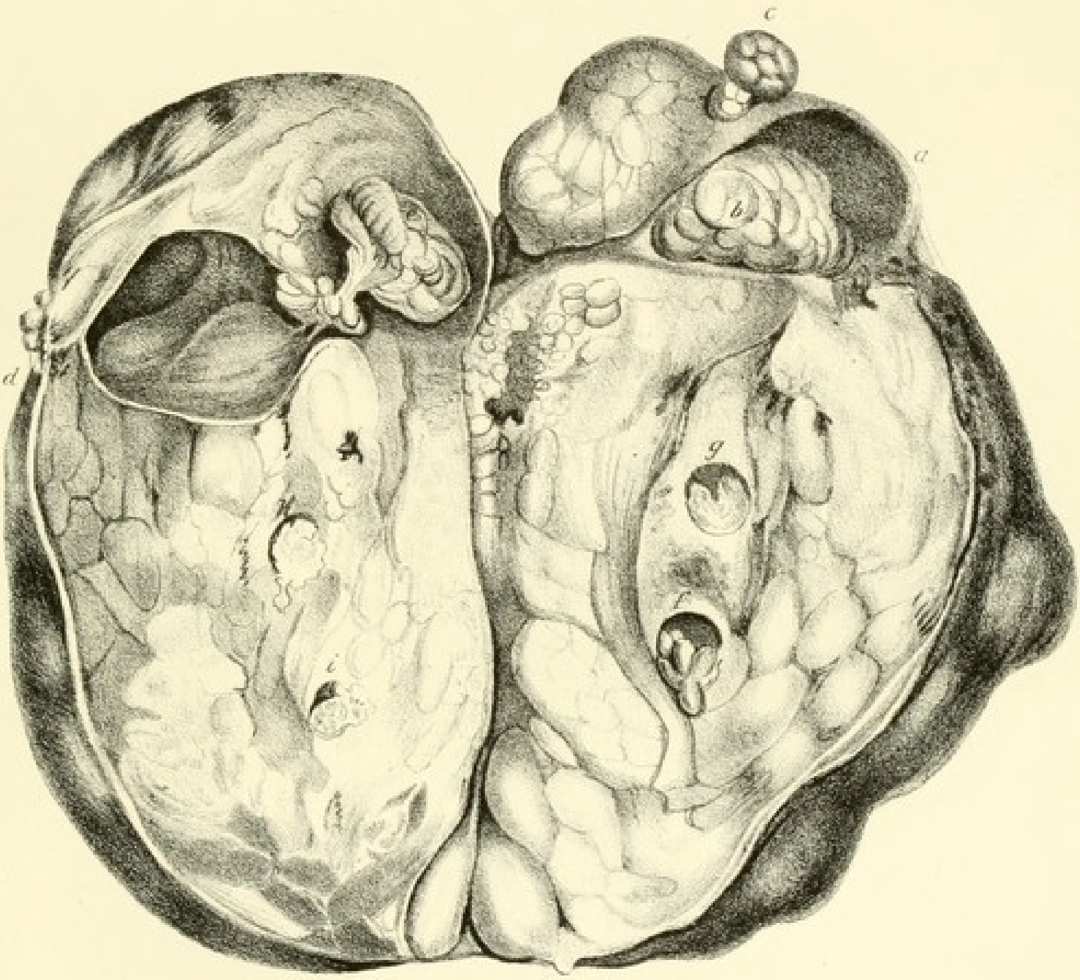
f, a small bag with a cluster of Hydatids in it.

g. a similar bag.

h, another containing Hydatids.

i, a similar bag, with Hydatids in it less evolved.

Pl. XXX.



J. T. French del.

Sinclair's Lith Philad^a

Plate XXXI.

Different sections of Mrs. King's breast :—

Fig. 1 shows the vascularity of the effused fibrine.

Fig. 2. A section of the fibrine, with numerous Hydatids contained in it.

Fig. 3. A similar section, exhibiting the great vascularity of the fibrine, which also contains numerous Hydatids.

Fig. 4. The early appearance of these Hydatids.

Fig. 5. A cluster of Hydatids, with the stalk upon which they grew, cut through.

Fig. 6 exhibits a single Hydatid, of an oval figure.

Fig. 7. A single Hydatid, of different shape.

Fig. 8. Is a pyriform Hydatid.

Fig. 9. Two similar formed Hydatids in fibrine.

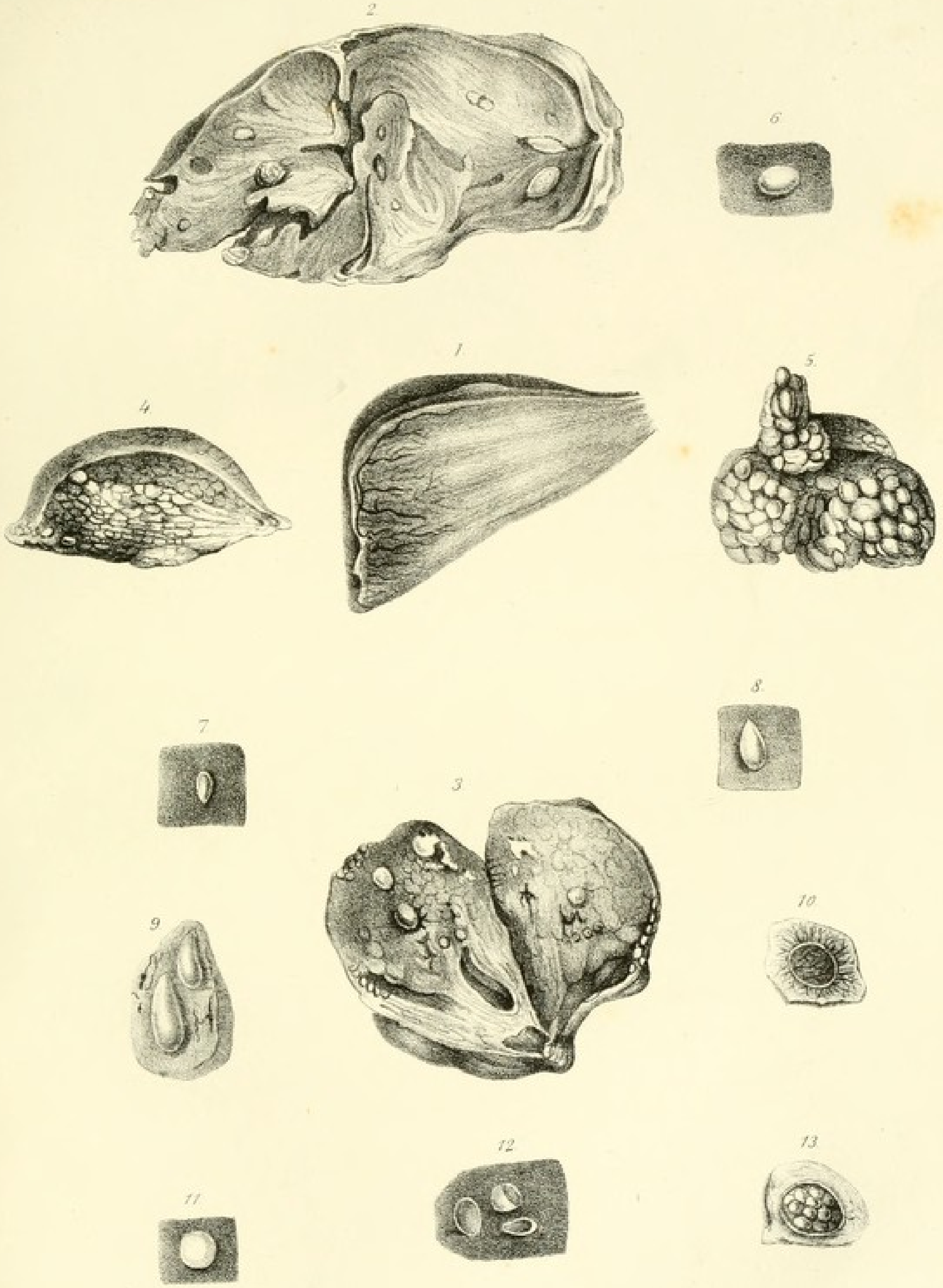
Fig. 10. A cyst, in which the Hydatids had been contained, exhibiting its great vascularity.

Fig. 11. One of these Hydatids, of a globular form.

Fig. 12. Sections of the Hydatids, to show their laminated structure.

Fig. 13. A cyst, containing numerous of these Hydatids.

Pl. XXXI



J. T. French, del.

Sinclair's Lith Philada

Plate XXXII.

Figure 1 shows Hydatids imbedded in a scirrhous structure. This portion of the breast was removed from Miss S., who died some time after of cancer.—See the last case of cellulous Hydatids.

Figure 2 shows several small Hydatids in a tumour removed from the breast.

Figure 3 exhibits an immense number of small Hydatids in a portion of the breast which I removed from Mrs. Hewlett, the largest not bigger than a pea.—See Case.

Figure 4. An Hydatid bag cut open, and another seen through it.

Figure 5. A view of the globular Hydatid removed by Mr. Bayfield (see Case.) A portion of the breast is seen, which was removed with it; close to it the cyst, formed by chronic inflammation, in which it was contained; and in the centre the Hydatid opened, and the appearance which it assumed, beautifully displayed.

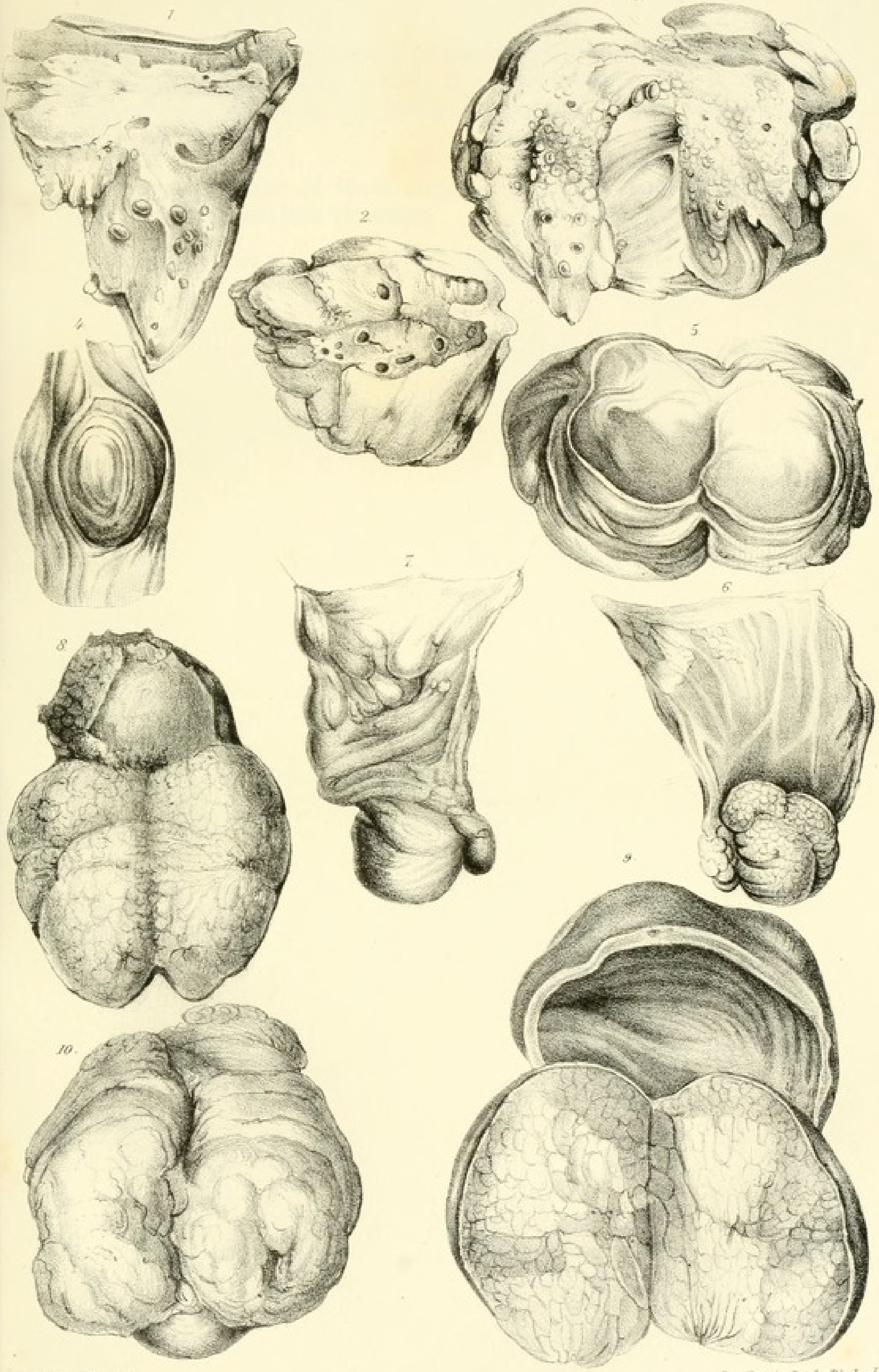
Figs. 6, 7, 8, 9, and 10 show different views of the Chronic Mammary Tumour.

Figure 6 exhibits one of these tumours cut open, and above it a portion of the breast to which it is attached.

Figure 7. Posterior view of the same, showing its growth from the glandular structure of the breast.

Figure 8. One of these tumours cut open, to show the lobes of which it is composed: above it a portion of the breast is seen, to which it adheres.

Pl. XXXII.



J. T. French. del.

Sinclair's Lith. Philad.

Figure 9. A larger tumour of the same species, separated from an aponeurotic cyst in which it is contained; and which is distinct, and dense in proportion in general to the size of the swelling.

Figure 10. One of these tumours, in part unravelled, after continued maceration in water.

Plate XXXIII.

Figure 1 shows a small Chronic Mammary Tumour growing from the breast.

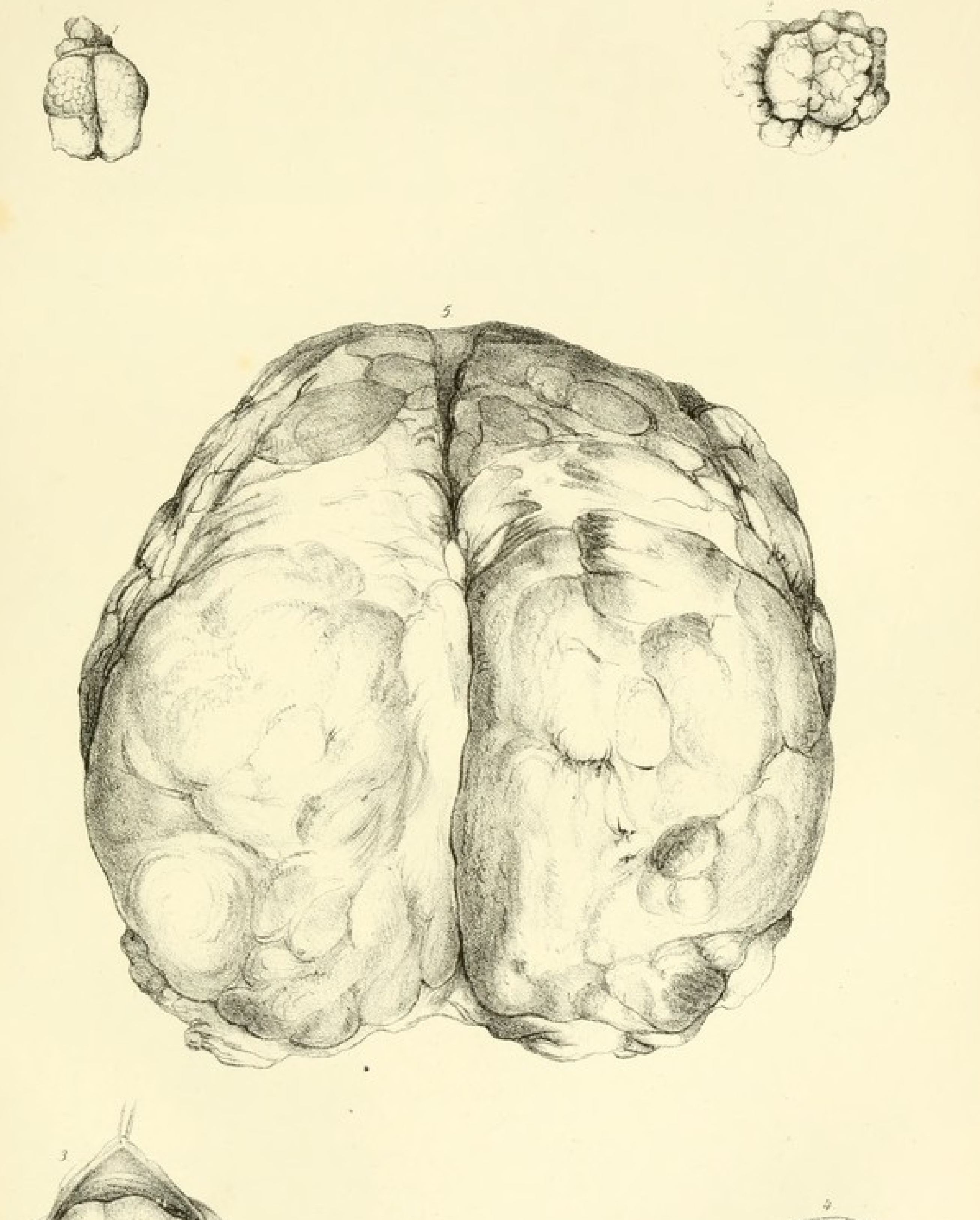
Figure 2 exhibits one of these Chronic Mammary Swellings more imbedded in the glandular substance of the breast than usual.

Figure 3. Another of these swellings cut open, to show its interior, and the cyst in which it is contained.

Figure 4. A Chronic Tumour in its cyst, very much resembling Figure 2.

Figure 5. A very large swelling of the same description, sent me by Mr. Bond, Surgeon at Brighton, which was successfully removed,—See Case.

Pl. XXXIII.



J. T. French del.   Sinclair's Lith. Philad.

Plate XXXIV.

Figure 1. An Irritable Tumour entire, its external surface compact, smooth.

Figure about exhibits the internal character of these swellings, semi-transparent, circumscribed, texture closely resembling somewhat a nervous ganglion, but differing in its fibrous arrangement.

Figure 3 seems to be a mixture of the Chronic Mammary Tumour with the Irritable.

Figures 4, 5, 6, and 7, Irritable Tumours of the size which they frequently acquire, and in which they often remain.

Figure 8. An Irritable Tumour removed from the cellular membrane beneath the skin, in Miss [illegible], of Guernsey, showing its similarity in shape of the breast.—See Case.

Figure 9 is a section of a Scrofulous Tumour of the breast, showing its yellow appearance and unequal vascularity.

Figure 10. Cartilaginous and Osseous Tumour of the breast, the skin extended over it; two large portions of cartilage in the breast below the skin; and beneath them a large piece of osseous matter is deposited.

Figure 11. A globular Hydatid.

Figure 12. One of these Hydatids cut open, in order to show the manner in which the young Hydatids grow by little stalks from the inner surface of the parent Hydatid.

Figure 13. The small Hydatids separated from the parent.

Figure 14. The loose hydatids, from the above; showing the shadow of a head, neck, and pointed appearance in that part which it adheres to a Hydatid bag below.

Figure 15. Another of these Hydatids, sketched by Mr. Clift, showing a mouth, jointed neck, and body.

Plate XXXIV.

Figure 1. An Irritable Tumour cut open, its internal surface compact, smooth.

Figure 2 best exhibits the internal character of these swellings, *viz.* semi-transparent, circumscribed, texture close, resembling somewhat a nervous ganglion, but differing in its fibrous arrangement.

Figure 3 seems to be a mixture of the Chronic Mammary Tumour with the Irritable.

Figures 4, 5, 6, and 7. Irritable Tumours of the size which they frequently acquire, and in which they often remain.

Figure 8. An Irritable Tumour removed from the cellular membrane below the knee, in Miss B——, of Guernsey, showing its similarity to those of the breast.—See Case.

Figure 9 is a section of a Scrofulous Tumour of the breast, showing its yellow appearance, and unequal vascularity.

Figure 10. Cartilaginous and Ossific Tumour of the breast, the skin extended over it; two large portions of cartilage in the breast below the skin; and beneath these a large piece of ossific matter is deposited.

Figure 11. A globular Hydatid.

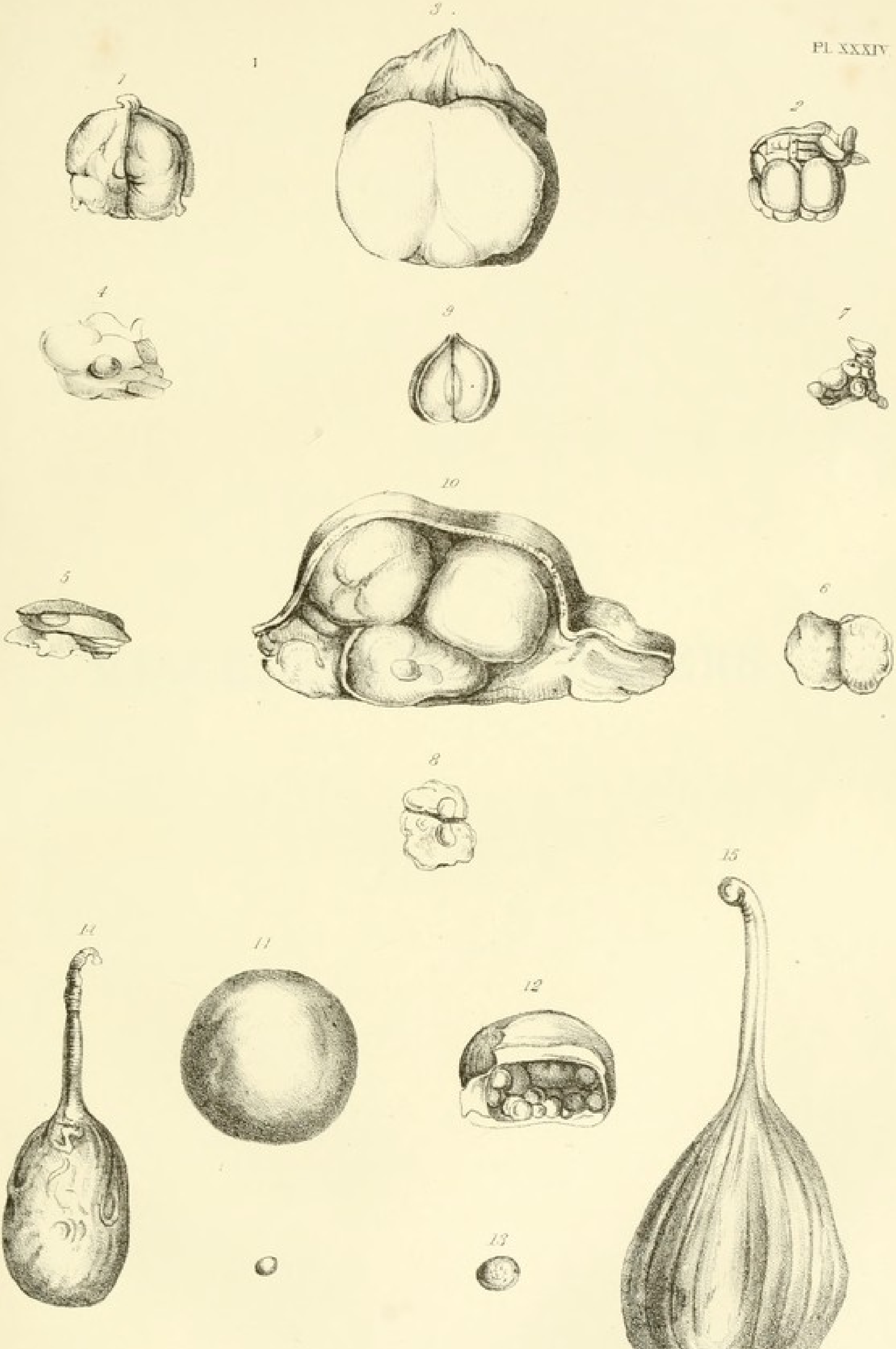
Figure 12. One of these Hydatids cut open, in order to show the manner in which the young Hydatids grow by little stalks from the inner side of the parent Hydatid.

Figure 13. Two small Hydatids separated from the parent.

Figure 14. The tenia hydatigena, from the sheep; showing the addition of a head, neck, and jointed appearance in that neck, which terminates in a Hydatid bag below.

Figure 15. Another of these Hydatids, sketched by Mr. Clift, showing its mouth, jointed neck, and body.

Pl. XXXIV.



J. T. French del.

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MISCELLANEOUS PAPERS.

[MEDICAL RECORDS AND RESEARCHES, 1798.]

Three Instances of Obstruction of the Thoracic Duct, with some Experiments, showing the Effects of tying that Vessel. By Mr. ASTLEY COOPER.

THE thoracic duct is a vessel of so much importance in the animal economy, from its being the medium by which the nutritious part of the food is conveyed into the blood, and the channel through which the greater number of the absorbents empty themselves into the veins, that it might be reasonably expected an obliteration of its canal would produce the most fatal consequences.

It will be found, however, by the following facts, that nature, with a kind regard to our preservation, has provided security against this evil, so that a considerable degree of disease may exist in the principal trunk of the absorbents without any permanent interruption to the progress of absorption.

In the beginning of the winter of 1789, being desirous of injecting the thoracic duct of a subject which I was at that time dissecting, I fixed a tube containing quicksilver into an absorbent on the loins; the vessel became quickly filled, and I saw the injection pass into the receptaculum chyli. The quicksilver, instead of proceeding along the thoracic duct now ceased to flow; but by having recourse to a higher column, whatever occasioned the resistance was overcome, the fluid passed about an inch, and further I could not force it.

Anxious to discover the cause of this failure, I immediately opened the duct, and found the following appearances.

The first impediment was occasioned by two valves placed near to the receptaculum chyli, which were much thicker than natural, and projected into the duct, so that their superior edges were pressed firmly together. An inch from these, and higher in the duct, two other valves appeared, diseased in a similar manner, only in a greater degree. These were also so much thickened as to fill the canal, and they formed a barrier, beyond which no fluid could pass.

On further examination I perceived a third disease, which seemed to have been originally seated in valves, although it had proceeded so far as to destroy their regular figure, and entirely to obliterate the tube.

Beyond this last disease, which was placed opposite the curvature of the aorta, the duct appeared in a natural state, and opened in its usual manner into the veins.

The morbid changes here observed seemed to have been of a scrophulous kind; the valves were hollow, and contained a substance between their laminæ, having the same curd-like appearance with that commonly found in scrophulous abscesses.

There were other appearances in the body which served to confirm this idea. The absorbent glands of the neck were enlarged, and many of them imperfectly suppurated; and the person appeared to have died of phthisis pulmonalis, the lungs being loaded with ulcerated tubercles.

As the absorbents were found every where empty, their contents must have passed into the veins, either by collateral branches entering the duct above the diseased part, or by other terminations than the two which are commonly found. However, the body had been too much dissected to admit of any accurate examination into these circumstances, and I was obliged to depend on some future opportunity to determine in what manner the obstruction had been prevented from producing fatal consequences.

In the spring of 1790, Mr. Waterworth, now a surgeon in the Isle of Wight, who was at that time attending the lectures at St. Thomas's and Guy's hospitals, requested me to assist him in making a preparation of the thoracic duct and the large vessels which accompany it. Common coarse injection being thrown into the duct upon the loins, it passed about an inch, and then suddenly stopped. A greater force being applied, the injection entered a cluster of vessels placed under the left crus of the diaphragm: and there the wax escaped from a divided absorbent.

When quicksilver was forced into this divided vessel, it entered a large absorbent, which passed half way up the chest on the left side of the aorta, crossed the spine behind that vessel, and then terminated in the thoractic duct, which became readily filled with the injection from the part diseased to that at which it opens into the vein.

Upon farther examination I found the wax had been stopped in the duct by a small fungus, placed about an inch and a half from its lower extremity; and that about two inches higher another fungus, larger than the former, had rendered the tube impervious.

Between these parts the vessels was open, and free from disease; but wherever absorbents entered the duct, the valves at their terminations were thickened and opaque.

The obstruction extended no farther than opposite to the fifth vertebra of the back, so that about half the duct was still capable of performing its natural functions.

The appearance of the disease proved that this complaint, as well as the former, had been of a scrophulous nature; considerable thickening, and some ulceration, being attended with a comparatively slight inflammation. The mesenteric glands were enlarged, and the peritoneum was studded with small tubercles, which I have since seen in several instances in very scrophulous subjects.

This obstruction was prevented from proving fatal by anastamosing absorbents, having performed the functions of the thoracic duct. These vessels, which were situated on the left side of the spine, by entering the duct above the disease, and having communication with the lacteals, and other absorbents of the loins, conveyed the chyle and lymph into the blood. The fluids were therefore only diverted into different channels, there was no permanent interruption to the progress of absorption, and no material inconvenience arising from the obstruction.

CASE.

John Hammett, a labouring man aged twenty-two years, was admitted into St. Thomas's hospital in the month of January, 1795. The account which he gave was, that about five months before he had been attacked with a pain in the testis of the right side, which soon after swelled, and had continued to the present time, gradually enlarging; and that seven weeks previous to his admission he had observed a tumour in his abdomen, on the same side of the navel. The testis, at the time he became an hospital patient, was of considerable size, but preserved its natural figure, being flattened on its sides, and round on its fore part; its substance felt pulpy, yet not sufficiently soft to give the sensation of fluctuation; the spermatic cord was somewhat enlarged. The tumour in the abdomen, though small when he first observed it, was, at least, four inches in diameter; and although it was not in the beginning attended with uneasiness, it now occasioned very considerable pain. His general health, however, had not suffered, for he seemed equal to any labour, and his countenance exhibited no marks of disease.

27th. He has been in the hospital a fortnight, and complains of great pain in the abdomen, extending in a line from the testis to the tumour. He has lost the healthy and florid aspect which he had at the time of his admission, and so sudden a debility has succeeded, that he finds great difficulty in raising himself from his bed. His pulse is quick and feeble, the skin hot; he has a continual thirst, a great degree of restlessness, his appetite fails him, and his bowels are disordered.

In addition to these symptoms, he complains of a disagreeable sensation of distension in the upper part of the abdomen, after taking a small quantity of food, which continues for several hours.

30th. The pain in his testis destroys his rest, and he has had no stool for several days, excepting what has been produced by medicine.

Feb. 4. He frequently vomits, the tumour and testis are at intervals easy, at other times acutely painful; the pain extends from the former to the latter, along the spermatic cord, and thence down the inner side of the thigh.

18th. The pain in the diseased parts is very acute, but much less so when he is warm in bed, than when exposed to cold.

21st. He complains of more pain than before; vomits frequently, and is very costive.

22d. The diarrhœa is returned, which has removed the sickness, and lessened the pain; however, he is very hot, and has no moisture upon the skin.

28th. He is easier, the swellings remain stationary, but his stools are frequent, black, and ill formed.

March 2d. All the unfavourable symptoms are increased, the diarrhœa continues unabated, and he vomits frequently, milk being the only substance his stomach is able to retain.

12th. He has had no sleep, takes but little food, and is extremely emaciated.

14th. He died this morning.

EXAMINATION.

On making an incision into the enlarged testis, a pulpy mass appeared, composed of broken coagulable lymph, and of a blood-coloured serum.

The absorbents of the spermatic cord were very considerably enlarged, their coats thickened, and small tumours appeared at irregular distances, arising from a diseased and enlarged state of their valves. These vessels were entirely impervious, and contained matter similar to that found in the testis, which adhered firmly to their internal surfaces.

The small glands on the loins, which receive the absorbents of the testis and cord, by their enlargement and union, formed a tumour on the lumbar vertebræ, weighing nine pounds and a half.

As these glands are placed close to the spine at the loins, and behind the duodenum and pancreas, when they became enlarged, they forced each of those parts from their natural situation, and carried them to the anterior part of the abdomen, where they were compressed between the parietes and tumour.

On opening the tumour, it exhibited a similar appearance to the testis; and there could be no doubt of the disease being of the same nature.

The appearance of the thoracic duct was much altered: its coats were thickened and opaque, and it was rounder than usual, bearing more resemblance to a nerve than to the principal trunk of the absorbent system.

The receptaculum chyli was filled with matter of the same kind with that found in the tumour, in the absorbents of the spermatic cord, and in the body of the testis. It adhered with firmness to the inner coat of the vessel, which was thickened, opaque, and irregular.

The thoracic duct had undergone a similar change, for in its cavity a substance was contained, resembling that in the other diseased parts, by which the tube was rendered impervious. Opposite to the curvature of the aorta the vessel was lost in a swelling as large as a moderate sized walnut, differing in no respect, excepting in bulk, from the swelling in the abdomen. Above this tumour the duct appeared in a healthy state, and terminated, as usual, in the veins.

This disease in the testis was, I believe, truly cancerous. The great pain with which it was accompanied, and the rapid progress it made by absorption, are proofs of the truth of this opinion. And as the appearance of the duct was the same, I believe that this part also was affected by cancer.

Although the obliteration extended farther than in either of the former instances, for two-thirds of the duct were obliterated, yet neither the lacteals, nor other absorbents, were distended with their fluids; nor did any circumstance appear which could lead to a belief that absorption had been impeded.

To ascertain the course of the chyle, I inserted a tube, filled with quicksilver, into a large absorbent on the loins. The mercury passed as far as the receptaculum chyli, and then stopped; but, by increasing the column of injection, it ran through several vessels behind the aorta into a large trunk, which passed the whole length of the chest on the left side of the spine. Through this vessel the injection flowed to the first dorsal vertebra, and there entered the thoracic duct, which being above the part at which the vessel was diseased, there was no farther interruption to its passage into the jugular vein.

From the side of this trunk several small vessels arose, and having passed behind the aorta, entered the undiseased part of the duct, near to the tumour.

In this case, then, as well as the former, the obstruction was prevented from producing fatal consequences by the anastamosing vessels on the left side of the spine having performed the office of the thoracic duct.

Such collateral absorbents may be found in many subjects, in which the thoracic duct is undiseased. Let that vessel be tied at a small distance from the receptacle, and quicksilver forced into the absorbents of the loins, and it will often pass by collateral branches to the left side, and into a trunk formed by the union of these vessels, with others coming from the intercostal spaces; and thus, by a circuitous course, the quicksilver will enter the duct above the ligature. It is only when the thoracic duct is obstructed that these absorbents acquire any considerable size; for, as its functions are then performed by these collateral vessels, they become so considerably enlarged as to be enabled to convey a quantity of fluid equal to that which passes through the duct in its healthy state.*

These vessels, therefore, possess the same power with the arteries and veins, of adapting themselves to different circumstances. As the canal of an artery may be obliterated, yet the circulation continues by means of collateral branches; and many veins be destroyed, yet the blood returns by others to the heart; so the absorbents may be obstructed to a considerable extent, yet absorption will not be interrupted.

* It is but justice to remark, that Mr. Cline, in his anatomical lectures, when speaking of a case of obstructed thoracic duct described by Dr. Cheston, used to point out the probability of these vessels forming the new absorbent channels.

The absorbents also possess a power of dilitation and contraction, according to the quantity of fluid they are required to convey; a circumstance which the enlargement of the absorbents on the left side of the spine, in these diseases, sufficiently establishes.

As the thoracic duct is small, when compared with the size of the numerous branches, collectively taken, which pour their contents into it, its contents must be flowing in a constant stream; and any considerable interruption to its function would soon destroy life. It is probably on this account that nature has provided, through the chest, those collateral branches, which prevented death in the preceding instances.

At the lower part of the neck also, near its termination, the duct is generally divided into two or three trunks, which again become united into one. It has been generally supposed that this structure was for the convenience of receiving branches from the neck and arms, but that it may also serve as a provision against disease, is probable from what happened to me in tying the thoracic duct of a dog: having included only one of those divisions, the two others carried the chyle into the blood, and the animal recovered.

This provision is necessary in the neck where the glands are frequently enlarged, and the duct often exposed to pressure.

Although, from the foregoing observations, it appears that an obliteration of a great part of the thoracic duct may happen without any dangerous symptoms succeeding, yet I was still desirous of knowing if the obstruction would not have proved fatal, had it been placed near the termination of the duct in the veins.

In order to ascertain this, and to see what other effects might follow the experiment, I resolved to attempt to make a ligature on the duct in a dog near to its entrance into the veins. Knowing the difficulty of the experiment, and that it had been tried by others without success, its course in the dead animal was carefully examined before it was attempted to be tied in the living.

The thoracic duct in the dog enters the posterior part of the left jugular vein, where that vein joins with the left subclavian; just previous to its termination it divides into three vessels, which again unite into one near the coat of the vein. The experiment was made in the following manner. An opening through the skin exposed the jugular vein, which was traced near to the first rib, where the subclavian joins it; by an incision under the jugular vein, the duct was opened, and a quantity of chyle escaped : a needle with a ligature was passed under the orifice, and the duct secured. It is right to enclose some of the surrounding parts with the mouth of the vessel, otherwise the three divisions of the duct will not be included. The difficulty of the experiment arises from the distance at which the vessel lies from the skin, the vicinity of the large arteries and nerves of the neck, and from its close connexion with the pleura, a wound in which, if not healed by the first intention, will produce a general inflammation of that side of the chest.

I have also performed the experiment by making two ligatures on the jugular vein, and after dividing the vein between them, and having drawn the inferior portion of it over the first rib, the duct was easily discovered, and without much difficulty included in a ligature.

EXPERIMENT I.

June 29th, 1795. I tied the extremity of the thoracic duct. Having observed it distended with chyle before the ligature was passed, it was opened by means of a lancet, and about twenty drops of chyle were discharged. When tied below this orifice, it became much swelled, owing to the interruption the absorbed fluids met with in their course.

30th. The dog appeared lively, and lapped milk heartily, but almost immediately after became dull, and showed no inclination to move.

July 1st. Nine o'clock in the morning the animal was unable to move, refused food, and seemed to be dying. At eleven o'clock he died, forty-eight hours after the duct had been tied.

DISSECTION.

On opening the abdomen, the following remarkable appearances presented themselves. Many of the visera were obscured by an effusion of chyle. The cellular membrane, connecting the laminæ of the mesentery was loaded with that fluid, and the anterior surface of the pancreas was entirely concealed by it. The surface of the kidneys was covered, and the space situated between the aorta and vena cava filled with it, as far as the upper part of the sacrum ; a small quantity was also extravasated into the cavity of the peritoneum. The lacteals were all empty.

These appearances were owing to the rupture of the receptaculum chyli, which in the dog is very large. When it burst, the chyle escaped into the cellular membrane, and through the peritoneum, and occasioned the appearances we have described.

When the chest was opened and the lungs were raised, I saw the thoracic duct distended with chyle, and at least double its natural size.

The ligature which had been placed on its extremity, had produced no ulceration of its coats.

Although the lacteals were empty, some of the other absorbents were very much distended; those particularly of the stomach, and concave surface of the liver.

The absorbent vessels of the hinder extremities, and organs of generation, were distended, but not in an equal degree with those of the left fore-leg, and left side of the neck; one of the latter was larger than a crow's quill.

EXPERIMENT II.

July 2d. I FIRST divided, then tied, the thoracic duct of a dog; its course was peculiar, as it passed over the jugular vein, instead of behind it. When opened, about a drachm of chyle escaped. The animal refused food all that day.

3d. Could not be made to eat, seemed dull, and very unwilling to move.

4th. Lapped a great deal of milk.

5th. Refused food and appeared extremely weak.

6th. Died during the night.

EXAMINATION.

CHYLE and lymph had been extravasated in so large a quantity as to have entirely concealed the aorta and vena cava. The receptaculum chyli had burst, and it was from this part the fluids had escaped.

The thoracic duct was much distended with chyle, the valves having prevented its escape by regurgitation.

EXPERIMENT III.

July 15, 1795. I DIVIDED the thoracic duct of a dog, and did not afterwards include it in a ligature, but healed the wound by the first intention.

16th. The animal appears lively, and takes food.

17th. Is less lively, and will eat but little.

18th. Seems very weak, and refuses food. He was bled this day; the appearance of the blood was natural, but the loss of only a small quantity made him faint.

19th. Found dead.

Upon dissection, under the wounded skin of the neck, a pouch was found containing a considerable quantity of chyle.

The death of this animal was certainly hastened by the loss of blood, for although the quantity removed was small, the division of the duct prevented that loss from being repaired.

These experiments, which were several times repeated, prove that when the extremity of the thoracic duct is suddenly obstructed, absorption is no longer continued, and the consequences are fatal to the animal. I met, however, with one exception to this. The duct being tied, as in the former experiments, although the dog, for several days, appeared duller, and less inclined to eat than before; yet he gradually recovered. It was found, upon inspection, that a vessel given off from the thoracic duct opposite to the division of the trachea into the bronchiæ, had passed into the absorbent trunk placed on the right side of the neck.

The quantity of chyle extravasated varied according to the state of the stomach and intestines; if these were distended with food, the cellular membrane was found loaded with chyle, but very little appeared if the animal was empty at the time of the experiment.

The contractile powers of the absorbents are proved by these experiments to be very strong, for it appears that their action is sufficient to occasion a rupture of their coats. It is true that the receptaculum chyli, which was the part broken, is thinner, and less capable of resistance than the thoracic duct; yet it is able to bear the pressure of a column of quicksilver, more than two feet in height; the force, therefore, exerted by the absorbents, must be acknowledged greater than that of such a column of mercury; more especially when it is remembered that living parts will resist a force which will readily tear them when dead.

It is not necessary to tie the duct, to produce this effect; if an animal is fed with milk, and after half an hour the extremity of the duct is exposed, and compressed for only a few minutes, upon subsequent examination the receptaculum will be found ruptured.

The time at which death ensued differed in different animals; those which were fed just previous to the experiment died sooner than those whose stomachs were at that time empty. Young dogs lived longer than the old, and the lean much longer than the fat; for these last can support but very slight injuries. None survived the tenth day, nor did any of them die under forty-eight hours, unless there was some untoward circumstance in the experiment. I am inclined, however, to believe that dogs which are very young will live a longer time.

That it is the interruption to absorption, and not simply the wound, which is the cause of death, is proved by the instances in which I did not succeed in tying the duct: the animals then recovered, though the wound was equally large as in those in which the experiment was successful.

Other terminations of the absorbents in veins have been supposed to exist beside those at the lower part of the neck on the right and left side. This opinion has not been founded upon accurate experiment, but only conjectured by those who first opposed the idea of this system, of vessels performing the office of absorption. Formerly the red veins were supposed to absorb; it was next thought that absorption was in part performed by these vessels, and in part by the veins; and when this idea was obliged to be relinquished, it was asserted that the absorbents terminated in the veins, in various parts of the body.

Into this mistaken opinion some good anatomists have fallen, from having found quicksilver escape from the absorbents into the different branches of the vena portarum whilst they were injecting the stomach and mesentery of the turtle. This has several times happened to myself; but I believe that the absorbents arise from the veins in certain parts of the body, and that the openings by which the quicksilver enters, are the beginnings, and not the terminations, of these vessels.

As proofs of this, we may observe that the circumstance is only seen in those animals in whom the valves of the absorbents will admit of a retrograde motion of the quicksilver, and I have never observed it, except whilst injecting contrary to the course of absorption.

The absorbent also always becomes smaller as it approaches the vein with which it communicates.

The branches of these absorbents pass into them in a direction from the vein.

And as a farther proof, I may mention that my friend Mr. Coleman, professor at the Veterinary college, has several times found blood in the thoracic duct of horses which had died without any rupture of the blood vessels, which shows a direct absorption of blood under certain circumstances.

When quicksilver is thrown into absorbent glands, it sometimes happens that the veins are filled from them, but this, upon attentive examination, is found to arise from previous extravasation. The same may be observed when the absorbents of the testes are filled from the spermatic artery or vein.

The experiments which are here related furnish a powerful argument against the idea of any other terminations of these vessels, excepting those at the lower part of the neck; for, when the thoracic duct was tied, the absorbents, instead of having emptied themselves into veins, were many of them ruptured, and those which remained whole continued fully distended with their fluid.

How far do these experiments confirm, or contradict, the opinion which some have entertained of a retrograde motion of the absorbents? Should we not have found, if this idea were true, that the fluids, instead of having ruptured the duct, when interrupted in their proper channel, would have returned into the cavities from whence they had been removed; and how did it happen that those absorbents which were not ruptured remained distended?

An opinion has of late years prevailed that hunger depends less upon an empty state of the stomach, than upon a sensation of general want of the system. The symptoms of tabes mesenterica have furnished the arguments which support this opinion, since the patient, during the progress of that disease, eats more frequently, and in larger quantities, than usual, and although the stomach is always distended, there is still a strong inclination for food.

The diseased state of the mesenteric glands, by preventing the passage of the chyle into the blood, has been supposed to occasion these symptoms.

It might be expected that the experiments here related, as they also occasioned an interruption to absorption, would furnish additional arguments in support of this opinion; but the great irritation produced by a large wound, and by the sudden destruction of so important a function, prevented any certain conclusions with regard to this circumstance.

[Philosophical Transactions for 1800.]

Observations on the Effects which take place from the Destruction of the Membrana Tympani of the Ear. By Mr. Astley Cooper. *In a letter to* Everard Home, *Esq. F.R.S.*

Dear Sir,

At the time your were engaged in the investigation of the structure and uses of the membrana tympani, you mentioned a wish to ascertain the effect a rupture of that membrane would have upon hearing. I now send you some observations on that subject, which, if you think them of sufficient importance, you will do me the honour of presenting to the Royal Society.

I am, &c.

ASTLEY COOPER.

Anatomists have endeavoured to ascertain, by experiments on quadrupeds, the loss of power which the organ of hearing would sustain by perforating the membrana tympani: dogs have been made the subject of these trials; but the results have been neither clear nor satisfactory, and they accord but little with the phenomena I am about to relate.

Mr. Cheselden had conceived the design of making the human organ itself the subject of direct experiment; and a condemned criminal was pardoned, on condition of his submitting to it; but, a popular outcry being raised, it was thought proper to relinquish the idea.

Though denied the aid of experiment, we are not without the means of obtaining knowledge upon such subjects; since the changes produced by disease, frequently furnish a clew which is equally satisfactory.

It often happens, that some parts of an organ are destroyed by disease, whilst others are left in their natural state; and hence, by the powers retained by such organ, after a partial destruction, we are enabled to judge of the functions performed by those parts, when the whole was in health.

Guided by this principle, I have made the human ear the subject of observation, and have endeavoured to ascertain the degree of loss it sustains in its powers by the want of the membrana tympani; a membrane which has been generally considered, from its situation in the meatus, and its connexion with the adjacent parts by a beautiful and delicate structure, as essentially necessary to the sense of hearing; but which, as appears by the following observations, may be lost, with little prejudice to the functions of the organ.

Mr. P——, a medical student at St. Thomas's Hospital, of the age of twenty years, applied to me, in the winter of 1797, while he was attending a course of anatomical lectures, requesting my opinion upon the nature of a complaint in his ear, which had long rendered him slightly deaf.

Upon inquiring into the nature of the symptoms which had preceded, and of those which now accompanied the disease, he informed me that he had been subject from his infancy to pains in the head, and was attacked, at the age of ten years, with an inflammation and suppuration in the left ear, which continued discharging matter for several weeks: in the space of about twelve months after the first attack, symptoms of a similar kind took place in the right ear, from which also matter issued for a considerable time. The discharge in each instance was thin, and extremely offensive to the smell; and, in the matter, bones or pieces of bones were observable The immediate consequence of these attacks was a total deafness, which continued for three months; the hearing then began to return, and, in about ten months from the last attack, was restored to the state in which it at present remains.

Having thus described the disease and its symptoms, he gave me the following satisfactory proof of each membrana tympani being imperfect. Having filled his mouth with air, he closed the nostrils, and contracted his cheeks: the air, thus compressed, was heard to rush through the meatus auditorius, with a whistling noise, and the hair hanging from the temples became agitated by the current of air which issued from the ear. To determine this with greater precision, I called for a lighted candle, which was applied in turn to each ear, and the flame was agitated in a similar manner. Struck with the novelty of these phenomena, I wished to have many witnesses of them, and therefore requested him, at the conclusion of the lecture upon the organ of hearing, to exhibit them to his fellow students, with which request he was so obliging as to comply.

It was evident from these experiments, that the membrana tympani of each ear was incomplete, and that the air issued from the mouth, by the Eustachian tube, through an opening in that membrane, and escaped by the external meatus.

To determine the degree in which the membrana tympani had been injured, I passed a probe into each ear, and found that the membrane on the left side was entirely destroyed; since the probe struck against the petrous portion of the temporal bone, at the interior part of the tympanum, not by passing through a small opening; for, after an attentive examination, the space usually occupied by the membrana tympani was found to be an aperture, without one trace of membrane remaining.

On the right side also, a probe could be passed into the cavity of the tympanum; but here, by conducting it along the sides of the meatus, some remains of the circumference of the membrane could be discovered, with a circular opening in its centre, about the fourth of an inch in diameter.

From such a destruction of this membrane, partial indeed in one ear, but complete in the other, it might be expected that a total annihilation of the powers of the organ would have followed: but the deafness was inconsiderable. This gentleman, if his attention were exerted, was capable, when in company, of hearing whatever was said in the usual tone of conversation; and it is worthy of remark, that he could hear with the left ear better than with the right, though in the left no traces of the membrana tympani could be perceived.

When attending the anatomical lectures also, he could hear, even at the most distant part of the theatre, every word that was delivered; though, to avoid the regular and constant exertion which it required, he preferred placing himself near the lecturer.

I found, however, that when a note was struck upon the piano forte, he could hear it only at two-thirds of the distance at which I could hear it myself; and he informed me, that in a voyage he had made to the East Indies, while others, when ships were hailed at sea, could catch words with accuracy, his organ of hearing received only an indistinct impression. But the most extraordinary circumstance in Mr. P——'s case is, that the ear was nicely susceptible of musical tones; *for he played well on the flute, and had frequently borne a part in a concert.* I speak this not from his own authority only, but also from that of his father, who is an excellent judge of music, and plays well on the violin; he told me, that his son, besides playing on the flute, sung with much taste, and perfectly in tune.

The slight degree of deafness of which Mr. P— complained, was always greatly increased by his catching cold: an effect which seems to have arisen from the meatus being closed by an accumulation of the natural secretion of the ear; for it frequently happened to him, after he had been some time deaf from cold, that a large piece of hardened wax, during a fit of coughing, was forced from the ear, by the air rushing from the mouth through the Eustachian tube, and his hearing was instantly restored.

From bathing likewise he suffered considerable inconvenience, unless his ears were guarded against the water, by cotton being previously forced into the meatus. When this precaution was neglected, the water, as he plunged in, by rushing into the interior parts of the ears, occasioned violent pain, and brought on a deafness, which continued until the cause was removed, that is, until the water was discharged: but he had acquired the habit of removing it, by forcing air from the mouth through the ear.

In a healthy ear, when the meatus auditorius is stopped by the finger, or is otherwise closed, a noise similar to that of a distant roaring of the sea is produced: this arises from the air in the meatus being compressed upon the membrana tympani. In the case here described, no such sensation was produced: for, in Mr. P's ear, the air meeting with no impediment, could suffer no compression; since it found a passage through the open membrane, to the mouth, by means of the Eustachian tube.

Mr. P—— was liable to the sensation commonly called the *teeth being on edge*, in the same degree as it exists in others; and it was produced by similar acute sounds, as by the filing of a saw, the rubbing of silk, &c. Its occurring in him seems to disprove the idea which has been entertained of its cause; for it has been thought, that the close connexion of the nerve called the corda tympani with the membrani tympani, exposed it to be affected by the motions of the malleus; and that, as it passes to nerves connected with the teeth, they would suffer from the vibratory state of the nerve, produced by the agitations of the membrane. But, in this case, as the membrane was entirely destroyed on that side on which the sensation was produced, some other explanation must be resorted to; and I see no reason why this effect should not be referred to that part of the auditory nerve which lines the labyrinth of the ear, which, being impressed by acute and disagreeable sounds, would convey the impression to the portio dura of the same nerve, and to the teeth with which that nerve is connected.

The external ear, though two distinct muscles are inserted into it, is capable, in its natural state, of little motion; however, when an organ becomes imperfect, every agent which can be employed to increase its powers is called into action; and, in the case here described, the external ear had acquired a distinct motion upward and backward, which was observable whenever Mr. P—— listened to any thing which he did not distinctly hear. This power over the muscles was so great, that when desired to raise the ear, or to draw it backwards, he was capable of moveing it in either direction.

This case is not the only one of this description which has come under my observation; for another gentleman, Mr. A——, applied to me under a similar complaint, (but in one ear only,) proceeding from suppuration, and producing the same effects. This gentleman has the same power of forcing air through the imperfect ear; suffers equally from bathing, if the meatus auditorious be unprotected; and feels, even from exposure to a stream of cold air, very considerable pain. The only difference I could observe was that in Mr. A's case, the defect of hearing in the diseased organ was somewhat greater than in the former; for though, when his sound ear was closed, he could hear what was said in a common tone of voice, yet he could not distinguish the notes of a piano forte at the same distance: a difference which might have in part arisen from the confused noise which is always produced by closing the sound ear; or because, as he heard well on one side, the imperfect ear had remained unemployed, and consequently had been enfeebled by disuse.

From these observations it seems evidently to follow, that the loss of the membrana tympani in both ears, far from producing total deafness, occasions only a slight diminution of the powers of hearing.

Anatomists who have destroyed this membrane in dogs, have asserted, that at first the effect on the sense of hearing was trivial; but that, after the lapse of a few months, a total deafness ensued. Baron HALLER also has said, that if the membrane of the tympanum be broken, the person becomes at first hard of hearing, and afterwards perfectly deaf. But, in these instances, the destruction must have extended farther than the membrana tympani; and the labyrinth must have suffered from the removal of the stapes, and from the consequent discharge of water contained in the cavities of the internal ear; for it has been very constantly observed, that when all the small bones of the ear have been discharged, a total deafness has ensued.

It is probable that in instances in which the membrana tympani is destroyed, the functions of this membrane have been carried on by the membranes of the fenestra ovalis and fenestra rotunda: for, as they are placed over the water of the labyrinth, they will, when agitated by the impressions of sound, convey their vibrations to that fluid in a similar manner, though in somewhat an inferior degree, to those which are conveyed by means of the membrana tympani and the small bones which are attached to it; and thus, in the organ of hearing, each part is admirably adapted, not only to the purpose for which it is designed, but also as a provision against accident or disease; so that, whenever any particular part is destroyed, another is substituted for it, and the organ, from this deprivation, suffers but little injury in its functions.

It seems that the principal use of the membrana tympani is, to modify the impressions of sound, and to proportion them to the powers and expectation of the organ. Mr. P—— had lost this power for a considerable period after the destruction of the membrane; but in process of time, as the external ear acquired the additional motions I have described, sounds were rendered stronger or weaker by them. When, therefore, he was addressed in a whisper, the ear was seen immediately to move; but when the tone of voice was louder, it then remained altogether motionless.

[Philosophical Transactions for 1801.]

Farther Observations on the Effects which take place from the Destruction of the Membrana Tympani of the Ear; with an Account of an Operation for the Removal of a particular Species of Deafness. By Mr. Astley Cooper.

In the Paper which I had last year the honour of presenting to the Royal Society, I endeavoured to point out the effects which are produced upon the organ of hearing, by a partial loss or entire destruction, of the membrana tympani.

From the facts therein detailed it appears, that an aperture in the membrana tympani does not diminish the power of the ear, and that even a complete destruction of the membrane is not followed by a total deprivation of the sense of hearing; a supposition which medical men have adopted, and common opinion has generally sanctioned.

Convinced of the importance of the subject, and desirous, as far as my other avocations would allow, of pursuing my inquiries. I have, since the publication of that Paper, examined more than twenty cases of a similar defect in the membrana tympani; and these instances have uniformly tended to confirm me in my former opinion, as to the use of the membrane, and the effects which follow from its loss.

Injury may arise to the membrana tympani, or its destruction take place, from various causes, of which the most common is, a suppuration in the meatus auditorius. In persons of a delicate constitution and irritable habit, the wax secreted in the ear is liable to be hardened; this, by filling the meatus auditorius, gradually occasions deafness, and then excites inflammation and suppuration. In this case, if no mode of relief be resorted to, not only will the membrane, lining the meatus, but also the membrana tympani itself be destroyed, the small bones of the tympanum discharged, and sometimes considerable exfoliations produced.

The membrana tympani is also not unfrequently injured by means of external violence. In Plate XXXVI. Fig. 4, a view is given of the membrane lacerated in different directions, by a blow upon the side of the head; an effect which probably was occasioned by the air in the meatus having been driven with violence upon the membrane.

The membrana tympani is also sometimes broken by attempts to remove extraneous bodies, which have been thrust into the meatus auditorius. Children, in their thoughtless pranks, often introduce small stones, pieces of slate-pencil, and even pins into their ears; in extracting which, I have known considerable lacerations made in the membrana tympani. Fig. 5, shows the membrane broken perpendicularly, in an attempt to remove a pin, which had been accidentally dropped into the meatus.

The membrana tympani may be easily seen in some persons, by directing the rays of the sun, or a condensed light from a common lamp, into the ear; but this is not the case in all; for the meatus differs considerably in different persons, both in its depth and diameter.

If the ear is clear from wax, the membrane has a bright tendinous appearance; and an aperture in it appears as a dark spot, which, by the silvery surface of the membrane surrounding it, is rendered distinctly perceptible. If there be an aperture, air also, upon blowing the nose with violence, will be forced with a whistling noise through the ear. The smoke of tobacco may be driven from the mouth through the ear; or water may be injected from the ear into the throat.*

The effect produced upon the sense of hearing, by this defective state of the membrana tympani, varies according to circumstances. If there be a small aperture only, leaving the malleus with its natural attachment, no difference in the power of the organ is perceptible; the membrane vibrates, and communicates its vibrations, as before. If the whole of the membrane be destroyed, and three out of four of the small bones of the tympanum be removed, an almost total deafness ensues; but the ear, after a time, begins to recover its powers, and, in the end, regains them, with that degree of imperfection only, which, in my former Paper, I have described in the case of Mr. P——.

The following fact appears to confirm the truth of this statement. Mr. Radford, surgeon, of Newington Butts, informs me, that in the year 1779, he attended a woman who had an ulcer in the throat, by which a portion of the palate was destroyed, and the tonsils and Eustachian tube so much injured, that in

* It was formerly supposed, that there was naturally a communication between the external ear and the throat, through the membrana tympani; an opinion which it is now almost unnecessary to say is without foundation.

the attempt to swallow, a part of the liquid ran through her ears; yet notwithstanding these ravages, she neither complained of any defect in her hearing, nor had the slightest appearance of deafness. In cases, however, where the discharge of matter which produced the destruction of the membrane continues, should a fungus arise on the periosteum of the tympanum, or exfoliation of the bones forming this cavity occur, and more especially should the stapes separate, very considerable deafness will be the consequence.

When the membrane of one ear only is destroyed, a greater degree of deafness takes place in that ear, than would happen in either, were the membrane destroyed in both. This, as I stated in my former Paper, probably arises from the disuse into which the imperfect ear falls, from its being less quick in its powers than the other ; a conjecture which seems to be verified by the following fact.

Mr. G——, a merchant in the city, lost, at an early period of life, so great a portion of the membrana tympani of the left ear, that no more of it remained than appears in Fig. 3 ; and, as he heard somewhat better with his right ear than with his left, he was little in the habit of employing the latter, and considered himself at length as almost totally deaf in it. Becoming, however, in the month of December last, deaf in the right ear, and being obliged, in consequence, to employ the other, he found that the left ear was by no means deprived of its powers ; although he could force air from his mouth through that ear, and, if he suddenly thrust his finger into the meatus, the air was heard to rush through his nostrils.

I feel a hope that the foregoing observations will tend to something more than merely to gratify curiosity, and will be productive, in the end, of lasting benefit ; for they have induced me, in one species of deafness, to try the effect of an operation, which has, in several instances, proved successful.

The deafness to which I allude, is that which arises from an obstruction of the Eustachian tube ; and the operation consists in puncturing the membrana tympani.

The tympanum of the ear is formed like a drum ; and, as a drum will produce very little sound, unless air be admitted by a hole in its side, so, in the usual state of the ear, the membrana tympani cannot perform its office, if air has not free access to the cavity of the tympanum. The air, thus essential to hearing, passes from the throat to the ear by the Eustachian tube ; so that the membrana tympani is placed between two portions of air, the one contained in the meatus, the other in the cavity of the tympanum. Accordingly, if the Eustachian tube becomes obstructed, the air confined in the tympanum being unable to yield, the membrana tympani must cease to vibrate; and thus, sound being no longer conveyed to the interior parts of the organ, a permanent deafness must ensue.

There are several causes by which a closure of the Eustachian tube may be produced.

It may arise, first, from a common cold affecting the parts contiguous to the orifices of the tube, and thereby preventing the free passage of air into the tympanum. The deafness thus produced, however, is often merely temporary. But the frequent recurrence of such attacks may produce permanent enlargement of the tonsils, which, by their pressure on the Eustachian tubes, will occasion a permanent deafness.

In February last, an instance occurred, of a person who had thus been rendered deaf since the year 1793; and I have met with another instance of deafness from a similar cause.

Secondly, The scarlet fever occasions ulcers in the throat, which, in healing, frequently close the Eustachian tubes, thereby producing lasting deafness.

As this fever occurs particularly in young persons, who are but little subject to a defective state of the nerves of the ear, the greater hope of relief may be entertained from the operation already mentioned.

Thirdly, A venereal ulcer in the fauces, by the cicatrix it produces, often occasions a closure of the Eustachian tube, causing a deafness which nothing but the operation here spoken of can relieve.

Fourthly, I have known this closure of the tube produced by an extravasation of blood in the cavity of the tympanum.

Lastly, I have seen one instance of a stricture in the tube, which, although it did not entirely obstruct the passage of the air, yet rendered it extremely difficult. To enable himself to hear, the gentleman who was the subject of this disease, was under the necessity of forcing air, from the mouth, into the cavity of the tympanum, which pushed the membrana tympani towards the meatus; then, pressing gently upon the ear, he forced out a part of the air which the tympanum contained; thus giving the membrane liberty to vibrate, and producing an immediate increase in the power of hearing.

The above mentioned are the most common causes of the closure of the Eustachian tube; and I have reason to think, from the experience I have already had, that they may all be remedied by puncturing the membrana tympani.

I was led to this operation by reflecting that, as an aperture in this membrane did not appear to injure the power of the ear, and a small opening would be sufficient to admit a free passage of air to and from the tympanum, perhaps a substitute might be thus easily found for the Eustachian tube, and the membrane by such an aperture be restored to its natural functions. Opportunities were soon afforded me of trying the effects of this operation, and of putting my idea to the test of experiment. Of the instances by which it has been verified, the following appear to me most worthy of selection and record.

Case 1. A woman about thirty-six years of age consulted me, in December last, respecting some disorder in her child. In attempting to converse with her, I found her so extremely deaf that it was with difficulty I could make her hear me. Questioning her upon the subject of her deafness, she informed me that she had been thus afflicted since the year 1763; and I found that it had arisen from the tonsil glands becoming enlarged by a cold, which she caught in the winter of that year. As she was anxious to be relieved, I immediately punctured the membrane of the left ear, being that in which the hearing was most defective. The operation was no sooner performed, than to my great joy, and of course to hers, I found that, in that ear, she could hear what I said to her, without any particular exertion on my part to speak loud. She staid with me about half an hour; and when she left me, was capable of hearing every thing that was said in the ordinary tone of conversation.

Case 2. Ann Daley was admitted under my care, in Guy's Hospital, on the 21st of January, 1801. She was so deaf that, unless words were spoken close to her ear, it was impossible to make her hear them. She had been thus far deprived of hearing for the space of six weeks; and the deafness had been occasioned by some ulcers which had existed in the fauces. On the 25th of January, four days after her admission into the hospital, I punctured the membrana tympani of the left ear; having previously taken care (the better to ascertain the effects of the operation) to hold a watch to the ear of the patient, the beating of which she could not distinguish, unless it was pressed against her head. After the operation, I instantly repeated that experiment, and found that, with the ear I had punctured, she could distinctly hear the watch, though it was held at the distance of several feet; whereas, with the opposite ear, she was still unable to hear it beat, unless as before, it was pressed against her head. Mr. Stocker, apothecary to the hospital, witnessed the effects of this operation.

On the 28th of the same month, I performed the same operation on her right ear, in the presence of several medical gentlemen, who satisfied themselves as to the cause and degree of her deafness; the ear upon which I first operated having been purposely closed. As soon as the puncture was made, the trial with the watch was again resorted to; and she could hear it beat at the same distance as with the other ear; and could hear us speak, in the common tone of voice, as distinctly as we could hear one another.

To ascert in with certainty whether she really heard the beating of the watch, I placed it at a considerable distance from her, and asked her if she still heard it. To which she answered, "Yes, perfectly." I then stopped the watch, without her knowing it; and the question being repeated, she listened for a while, then said, "I must have been deceived, I do not hear it:" but the moment I set it again in motion, she called out, "I hear it now, and as well as I ever did in my life." In this state her hearing continues; the deafness having never, at any time, returned.

The cause of this deafness was obviously in the throat. The disease had not existed sufficiently long to produce any other derangement in the ear; and the good effect of the operation was therefore so immediately apparent, that it could not be doubted by the most sceptical observer.

Case 3. Mr. Round, of Colchester, consulted Dr. Baillie respecting his son, Mr. John Round, aged 17, who had laboured, from his birth, under such a degree of deafness as would have incapacitated him from engaging in business. Dr. Baillie, having satisfied himself that there was no nervous defect in the ear, referred him to me. I found that this gentleman had been born with an imperfect state of the fauces, which rendered him incapable of blowing his nose; that the Eustachian tubes had no openings into the throat, and, therefore that he was unable to force air from the mouth into the ear. The auditory nerves, however, were perfect; for he could distinctly hear the beating of a watch, if placed between the teeth, or against the side of the head: and he never had perceived any buzzing noise in his ears. I therefore advised him to submit to the operation of perforating the membrana tympani; to which he cheerfully consented. The moment this was done, a new world was opened to him; and the confusion produced by the number of sounds which immediately struck his ear, made him sink upon a chair, almost in a fainting state. From this state he recovered in about two minutes; and, finding that his hearing was completely restored upon the one side, he wished the operation to be performed upon the other; which was immediately done, with the same happy result, and without his experiencing the same confused sensation as before.

Near two months after the operation, I had the pleasure to receive an assurance from him, that he had suffered no relapse, nor any inconvenience from the opening which I had made, and that his hearing continued perfect.

CASE 4. Mr. BRANDON, of Upper Clapton, sent a person to me in January last, who had received a blow upon his head, which had occasioned symptoms of concussion of the brain, and was attended with a discharge of blood from each ear. From the effects which the blow had occasioned on the brain, he speedily recovered; but the deafness which had immediately followed from the accident, continued. I cleared the meatus from the blood it contained, without any relief being derived to the patient; and, suspecting that a quantity of blood was lodged in the tympanum, and the vibration of the membrane thus prevented, I some days after punctured the membrana tympani. Upon withdrawing the instrument, some dark-coloured blood appeared on its point; and, whenever I examined his ear afterwards, there was the same appearance of blood mixed with the wax of the ear, which continued to discharge for about ten days after the operation, during which period the hearing was gradually restored. I have formerly known instances of permanent deafness from this cause; and I think it not improbable that the blood thus effused has become organized, and continued to fill the cavity of the tympanum.

The operation to remedy the species of deafness here described, consists in passing into the ear a canula, of the size of a common probe, in which a trocar is concealed; the canula is to rest upon the membrana tympani, and the trocar is then to be thrust through the membrane.

The trocar should be so adjusted as not to pass more than $\frac{1}{8}$ of an inch beyond the canula, to prevent its reaching the opposite side of the cavity of the tympanum. Should it however touch the periosteum of the tympanum, it can be productive of no serious harm. The aperture should be made in the anterior and inferior part of the membrane, under the manubrium of the malleus, which must not be injured in the operation; and it is therefore necessary that the operator be acquainted with its exact situation.

Though the membrana tympani be vascular, the vessels are so small that they bleed but little; and, therefore, if much blood is discharged, the operation cannot have been properly performed.

In an ear otherwise healthy, the operation is attended with so slight a degree of pain, that when it has been performed in one ear, the patient expresses no unwillingness to submitting to it in the other. The sensation which it occ sions is momentary; and no subsequent inconvenience of any kind arises.*

As this operation will not afford relief in any cases of deafness, except such as arise from a closed Eustachian tube, I am anxious that it should be performed in those only which are clearly of that description. The criteria by which I judge whether the tube is closed or open are the following.

First, If the person in whom it is suspected to be closed, should feel, in blowing the nose violently, a swelling in the ear, from the membrane being at the time forced outward, the tube is open; for, when closed, no such sensation is produced.

Secondly, The Eustachian tube may be closed, yet the beating of a watch may be heard, if it be placed between the teeth, or pressed against the side of the head; and, if it cannot be heard when it rests upon the teeth, this operation cannot relieve, as the power of the auditory nerves must have been destroyed.

Thirdly, It is right to inquire if the deafness was immediately preceded by any complaint in the throat.

Lastly, In a closed Eustachian tube there is no noise in the head, like that which is hereafter described as accompanying nervous deafness.

The causes of deafness are extremely numerous; and many of those which effect only the meatus auditorius, the membrana tympani, the cavity of the tympanum, and the Eustachian tube, admit of relief from surgical assistance.

But there is one species of deafness in which, as it depends, like the guta serena of the eye, upon an affection of the nerve, it would be as absurd to expect relief could be derived from any operation upon the membrana tympani, as it would to suppose that a person diseased in the optic nerve could be restored to sight by extracting the cataract. This species of deafness occurs more frequently than any other, happening generally in old persons; but sometimes also in the delicate and irritable, in the earliest stages of life; I have known it produced by anxiety and distress of mind. Its approach is generally gradual: the person hears better at one time than at another; a cloudy day,

* If the ear has been previously irritated by stimulating applications to the meatus, the operation will then be painful; it is therefore proper to wait until the inflammation has subsided.

a warm room, agitated spirits, or the operation of fear, produce a considerable diminution in the powers of the organ. In the open air, the hearing is better than in a confined situation; in a noisy, than in a quiet society; in a coach when it is in motion, than when it is still. A pulsation is often felt in the ear; a noise resembling sometimes the roaring of the sea, and at others the ringing of distant bells is heard.

This deafness generally begins in a diminished secretion of the wax of the ear, which the patient attributes to some unusual exposure of the head to cold; and this continues so long as the disease remains. In the commencement of this complaint, it may be cured by the application of such stimulants as are capable of exciting a discharge from the ceruminous glands; which stimulants ought to be introduced into the meatus, for that purpose. If these are used so as to irritate, without exciting a discharge, they are rather prejudicial than otherwise. But, if the organ has been long neglected, and the disease has been suffered to make considerable progress, I believe that no hope of cure can be rationally entertained.*

There is another cause of deafness, to which I fear no art of the surgeon can apply a remedy; this is, an alteration of the contents of the labyrinth. The interior part of the ear, called the labyrinth is naturally filled with water, upon which the auditory nerve is expanded; and it is by the undulations of this fluid, that impressions are made upon the nerve, and conveyed to the brain.

If a solid substance be generated in this part of the ear, instead of the fluid, the powers of hearing will be destroyed, or at least very considerably impaired. From the following dissection, this would appear to be at least one cause of deafness in those who are born with this infirmity, and who are also dumb, unless assisted by particular instructions.

Mr. Cline, being requested by Dr. Walshman, of Kennington, to examine the head of a young man who had died of a fever, and who had been born deaf, and was consequently dumb, found, upon dissecting the organs of hearing, all the parts perfectly formed, and as usual in a healthy ear, except the vestibule, cochlea, and semicircular canals; these were filled with a substance of the consistence of cheese, instead of the

* I have, in several cases of this kind, made trial of the operation of opening the membrana tympani, without finding that it afforded any other relief than that of diminishing the noise in the head, which always accompanies it.

fluid which they usually contain. From a defect like this, deafness could not fail to arise; for, as the substance occupying the place of the watery fluid could not be made to undulate by the motions of the membrane of the fenestra ovalis and rotunda, all impressions upon the auditory nerve were completely prevented.

I have thought it right to describe the foregoing instances of deafness, because they are liable to be confounded with that which arises from a closed Eustachian tube. Others might perhaps have been added; but various professional engagements have prevented me from devoting so much time to this subject as I am confident it merits. I have, however, the pleasure to reflect, that several individuals have been restored to society, who were before almost incapacitated from its enjoyments. I hope others will be induced, by this success, to second my feeble efforts, and to direct their attention to a subject which appears to be of the highest importance, and to have been too much neglected by medical men; for a knowledge of the structure of the ear is by no means general in the profession, and still less are its diseases understood. A prejudice has prevailed, that the ear is too delicate an organ to be operated upon, or, as it is commonly expressed, *tampered with;* and thousands have thus remained deaf for the rest of their lives, who might have been restored to hearing, had proper assistance been *early* applied. But this prejudice it is hoped, will now be done away; since it appears, that the part which has been thought most essential to hearing, viz. the membrana tympani, may be injured by disease, or may be broken by violence, without a deprivation of the sense of hearing, and that, even when this membrane is entirely destroyed, another is found to perform its functions; so that the powers of the organ have still been, in a considerable degree, preserved.

Let it also be recollected, as a farther encouragement, that in the operation I have mentioned, little pain is felt, no dangerous consequences follow, and even if it is sometimes performed unsuccessfully, the patient is left with the same capacity as before, of receiving relief from other remedies.

Plate XXXVI.

Fig. 1. Shows the external ear, the meatus auditorius, membrana tympani, and Eustachian tube.
A, The meatus.
B, The membranum tympani.
C, The cavity of the tympanum.
D, The Eustachian tube.

Fig. 2. Shows the perforating instrument, as it is introduced in the operation.

Fig. 3. The membrana tympani of Mr. G——, of which only that part which appears of a lighter colour remains.

Fig. 4. The membrane lacerated by a blow.

Fig. 5. The membrane lacerated in an attempt to extract a pin.

Fig. 6. Shows the membrana tympani of a medical man of this city, having a fungus projecting through it: in this ear he is considerably deaf.

Fig. 7. The other membrane of the same gentleman.

Fig. 8. One of the membranes of Mr. P——, whose case I described in my former paper.

Fig. 9. A membrana tympani in its natural state, showing the attachment of the manubrium of the malleus.

Fig. 10. The appearance of the membrane, after having been punctured.

Pl. XXXVI.

Fig. 1

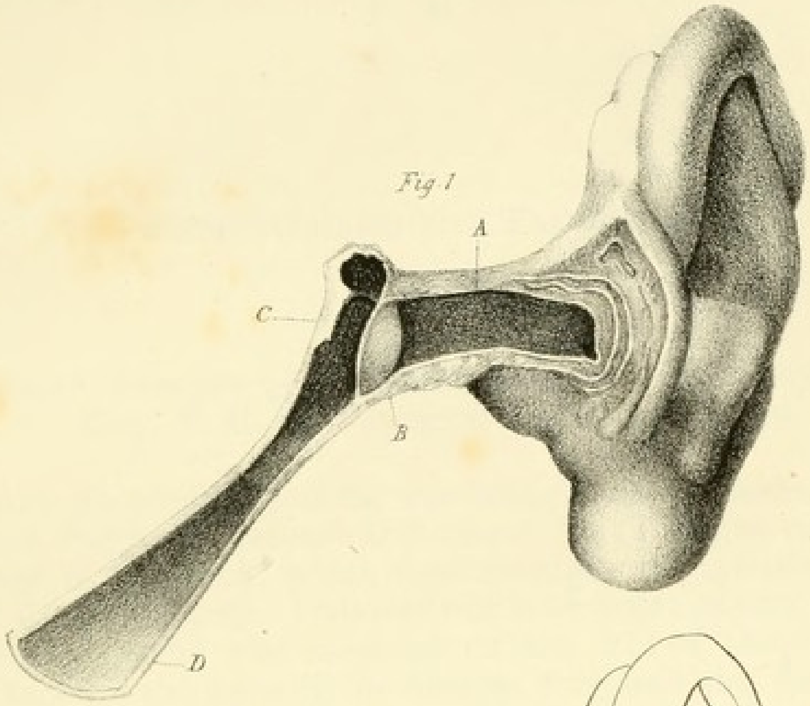


Fig. 2

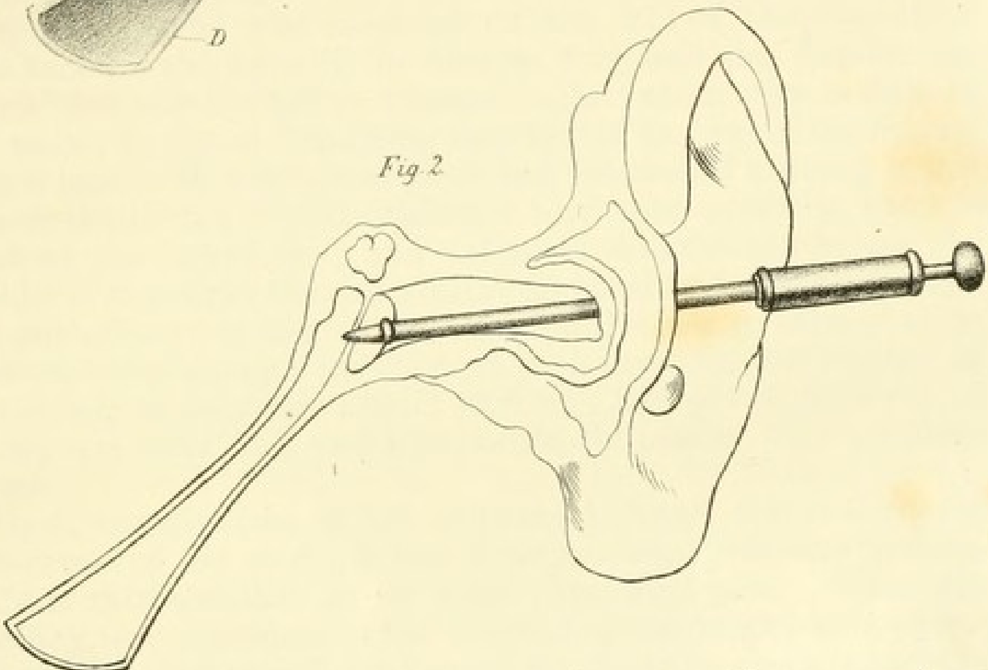


Fig. 3. 4 5 6 7 8

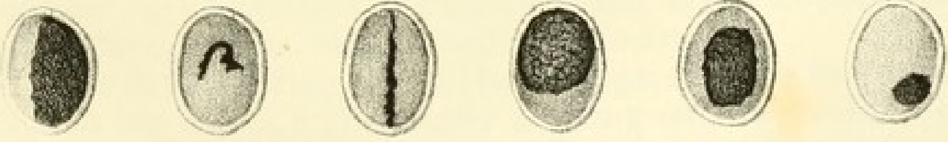
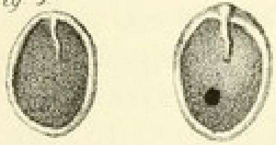


Fig. 9 10



J. T. French del.

Sinclair's Lith. Philad.

[Medico-Chirurgical Transactions.]

A Case of Aneurism of the Carotid Artery. By Astley Cooper, Esq., F. R. S. Surgeon to Guy's Hospital.

Mary Edwards, aged 44, was brought to my house by Mr. Robert Pugh, of Gracechurch-street, that I might examine a tumour in the neck, which was obviously an Aneurism of the right Carotid Artery. I advised her to become a patient in Guy's Hospital, and she was admitted on the 23d of October, 1805. The account she gave of the disease was, that the tumour appeared five months before, situated rather above the middle of the neck; its size at first being only that of the end of the finger; that it beat with very great force, and occasioned a strong pulsation in the brain; that it gradually increased upwards, until it reached the lower jaw, and extended downwards below the middle of the neck; that for a fortnight previous to her admission, the pulsation in it and in the brain had been so strong as to prevent her sleeping; that the scalp on that side was tender, so as scarcely to bear the touch; that she had great difficulty in taking any solid food, and was constantly teased with a violent cough.

Upon examination of the swelling I found that it occupied two-thirds of the neck; it had a very strong pulsatory motion, and the skin was thin at its most prominent part. When the swelling was examined at the hospital, great doubts were entertained if there was sufficient space between the clavicle and the tumour for the application of a ligature, and as her husband objected to the operation, she quitted the hospital.

In a few days, hearing that all her symptoms were increased, I called at her house, and strongly pointing out the probability of a fatal termination of the disease, I gained her consent and that of her relations to an operation.

On Friday, Nov. 1st, 1805, the operation was performed, in the presence of Mr. Pearce, Surgeon, and Mr. Owen, Apothecary to the Universal Dispensary, Ratcliffe Highway, of Mr. Travers, Surgeon, and that of five other Medical Gentlemen.

The tumour at this time reached from near the chin beyond the angle of the jaw, and extended downward to within $2\frac{1}{2}$ inches of the clavicle. I made an incision two inches long, on the inner edge of the sterno-mastoid muscle, from the lower part of the tumour to the clavicle, which laid bare the omo-and sterno-hyoideus muscles, which being drawn aside toward the trachea, exposed the jugular vein. The motion of this vein produced the only difficulty in the operation, as under the different states of breathing it sometimes presented itself to the knife, tense, and distended, and then as suddenly collapsed. Passing my finger into the wound to confine that vein, I made an incision upon the carotid artery, and having laid it bare, I separated it from the par vagum, and introduced a curved aneurismal needle under it, taking care to exclude the recurrent nerve on the one hand, and the par vagum on the other. The two threads were then tied about half an inch asunder, being the greatest distance to which they could be separated; I thought it proper not to run the risk of a hemorrhage by dividing the artery, as I was fearful the ligatures would be thrown off by the force of the heart, and the distance was too small to allow of any means being used to prevent it. As soon as the threads were tied, all pulsation in the tumour ceased, and the operation being concluded, and the wound superficially dressed, she rose from the chair in which she sat during the operation, and was immediately seized with a fit of coughing, which I thought would have terminated her existence. This seemed to arise from an accumulation of mucus in the trachea, which she could not expel; it continued about half an hour when she became more tranquil.

Saturday, Nov. 2.—Mr. Owen, who had sat up with her reported that she had slept six hours during the night, but was now and then disturbed by her cough. The pulsation in the tumour has not returned; that in the brain has ceased, and there is no appearance of diminution of nervous energy in any part of the body.

Sunday, Nov. 3.—Last night as she had some pain in her head, leeches were applied. To-day the pain in her head is gone; her cough is less troublesome; her stools and urine are natural; pulse 96.

Monday, Nov. 4.—Slept six hours last night; her spirits are good; pulse 100.

Tuesday, Nov. 5.—In the afternoon, I found her, as may be supposed contrary to my orders, sitting before the fire with three other persons, drinking tea which she swallowed with great difficulty; she had no pain in her head; her pulse 96, and the only circumstance of which she complains, is that her cough is troublesome.

Wednesday, Nov. 6.—In a violent fit of coughing last night, a slight discharge of venous blood took place from the wound. Mr. Hopkie, of Ratcliff-Highway, was called to her; but the bleeding ceased with the cough, and a piece of lint was laid lightly on the wound; in the afternoon her cough was less troublesome; her pulse only 92.

Thursday, Nov. 7.—My colleague, Mr. Forster, accompanied me to see her and to make a drawing of the tumour, which he thought was reduced one-third. She slept eight hours last night; her pulse 94.

Friday, Nov. 8.—Evening; I was sent for by Mr. Owen and Mr. Roberts, who alternately sat up with her, on account of their observing, that her left arm and leg were paralytic. I found them benumbed, and she moved them with great difficulty; but as her pulse was weak, and she laboured under considerable constitutional irritation, I thought the powers of these parts would be restored as her health improved. She had passed a very restless night, complaining that her bones were sore, and that her teeth felt as if softened. Her head is free from pain.

Saturday, Nov. 9.—Her cough is less troublesome; her pulse is 90; her spirits good; she talks with cheerfulness, and moves her arm with more facility than yesterday. She slept eight hours last night; she said she must have something to eat; but upon attempting to swallow solids she was incapable of doing so. She has no pain either in the head or tumour, but says, when she coughs she feels a pricking pain in the wound.

Sunday, Nov. 10.—I did not see her.

Monday, Nov. 11.—She had passed a good night; her left arm she now moves with more facility, but I thought with not quite so much ease as the other. She is in good spirits, and has some appetite, but cannot swallow solids. Her chief sustenance is arrow root, to which, as she had been very much accustomed to take spirits, a little wine is added.—Her cough is sometimes very violent; her pulse is only 84; the ligatures are projecting farther from the wound, than at any time since the operation.

Tuesday, Nov. 12.—My colleague, Mr. Lucas, accompanied me to see the woman, this day. We found her in good spirits, and the pulse only 82, her cough less troublesome, and she was able to sit up and use her arm with so much facility that it required that the attention should be particularly directed to the part, to discover any difference in the powers of the two arms.

When the dressings were removed, the ligatures were drawn from the wound, including the intervening portion of artery. The edges of the wound were then brought together by adhesive plaster.

Wednesday, Nov. 13.—Her cough is less troublesome; she swallows liquids with more ease. The only complaint she makes is of a pain in the back, of which she was relieved by a dose of magnesia vitriolata.

Thursday, Nov. 14.—She slept eight hours last night, and her state is in every respect improved; she swallows with less difficulty; the tumour is reducing in size, and is entirely unattended with pain. As I now considered her out of danger I did not visit her on Friday or Saturday; but Mr. Jones, one of my house-pupils, visited her and found the wound nearly closed.

Sunday, Nov. 17.—I was much disappointed to find her labouring under a high degree of constitutional irritation; the tumour was also increased and very sore upon pressure; the wound was as large as immediately after the operation, and discharged a sanious serum; she complained of a great difficulty in swallowing, and of a most distressing cough after the fits of which she hooped violently; her pulse 96; and her left arm again weaker than the other.

Monday, Nov. 18.—She had passed a restless night; complains of pain in her head, and the size of the tumour has increased; there is great soreness upon the neck, when it is pressed; the pulse is quick, and the tongue is furred.

Tuesday, Nov. 19.—Her pulse is very quick; she had no sleep last night, although she took forty drops of tincture of opium; the tumour is still more increased, and the skin over it of a brownish red colour.

Wednesday, Nov. 20.—She had slept three hours last night; her pulse is 108, and small; she is unable to swallow even her saliva, which constantly dribbles from her mouth, and every attempt at deglutition, produces a violent cough.

Evening.—Her pulse 120; she is in a profuse sweat; and still unable to swallow.

Thursday, Nov. 21.—She died.

DISSECTION.

The aneurismal sac was found inflamed, and around the clot of blood which it contained, there was a considerable quantity of pus.

The inflammation extended on the outside of the sac along the par vagum, nearly to the basis of the skull.

The glottis was almost closed, and the internal surface of the trachea was inflamed, coagulating lymph adhering to its mucous membrane.

The sudden increase which the parts had undergone from inflammation, added to the size of the tumour previous to the operation, had occasioned so much pressure upon the pharynx, that it would not easily admit a bougie of the size of a goose quill.

The nerves, sustained no injury, the ligature having passed between the recurrent and the artery on the one hand, and the par vagum on the other.

The cause of her death then, was the inflammation of the aneurismal sac and the parts adjacent, by which the size of the tumour became increased so as to press on the pharynx and prevent deglutition, and upon the larynx, so as to excite violent fits of coughing, and ultimately to impede respiration.

A similar event, however, may be in future prevented, by performing the operation when the tumour is small, and pressure has not been made by it upon important parts, or if it is of considerable size, as in this case, by opening the tumour and discharging the coagulum, as soon as inflammation appears.

As I could not obtain permission to open the head, the cause of the paralysis remains unknown. It did not immediately succeed the operation, but was observed first on the eighth day after it. It came on whilst she laboured under great constitutional irritation, lessened as it decreased, and returned when the irritation became greater; but as it appeared that the irritation which she suffered was owing to the operation being too long deferred, it will not prevent my performing it in any case in which the disease is somewhat less advanced.

It appears that no objection can be made to this operation on account of any unusual danger of bleeding at the time the ligatures separate, since, although they were discharged from the wound on the twelfth day, and they were certainly separated from the artery on the eleventh, the ulcerated extremity of the vessel had been closed by the adhesive process and by a clot of blood which adhered strongly to its coats. Hence we may conclude, therefore, that the carotid artery may be, in this respect, as safely tied as any other artery in the body.

[Guy's Hospital Reports, Vol. I.]

Case of Femoral Aneurism for which, the External Iliac Artery was tied by Sir A. Cooper, Bt. *with an Account of the Preparation of the Limb, dissected at the expiration of eighteen years.*

William Cowles, aged 39, in the spring of the year 1808, walked the distance of five miles with a heavy burden, which fatigued and strained him, and caused an uneasiness in the right groin. On examining the part of the thigh where he felt pain, he discovered, a fortnight afterwards, a hard tumour about the size of a hazel-nut, which throbbed violently under the finger. As the pain was inconsiderable, he disregarded it for six weeks, during which time the swelling had increased to the size of a large marble. He observed, that, whenever he drank more than usual, the throbbing was much stronger, and the pain from tension much greater. He continued to work at his business as a gardener, but suffered great inconvenience in the act of stooping. In about three months the swelling had become as large as a walnut, beating with increased force; and in six weeks more it had acquired the size of a pullet's egg. He now left off work, in consequence of the great pain which he suffered. The swelling continued to increase in size; and the suffering became so intense, that he came to town, for the purpose of obtaining advice. In the course of his journey on the outside of the coach, he fell asleep while lying on his abdomen, and the pressure on the swelling in his thigh produced some discolouration on its surface.

At this time he came to Guy's Hospital, walking occasionally from Brompton, where he resided on his arrival in town. On examination, the tumour was found to be situated close below Poupart's ligament, and, by its pressure, to raise it considerably; the artery was dilated to the size of a small pint-bowl, and the skin covering it had become extremely thin, tense, and irregular on the surface. The more prominent parts of the swelling had become changed in colour, presenting several hues of purple. From the advanced state of the tumour, it was evident that no time was to be lost in performing the operation of securing the vessel, and the patient was admitted into the hospital. The thigh and leg were of their natural temperature, and exhibited no deviation from their healthy state.

The operation was performed on the day of his admission, 22d of June, 1808. The first incision commenced an inch and a half from the superior spinous process of the ilium, and extended obliquely inwards, towards Poupart's ligament. The tendon of the external oblique muscle, being laid bare, was divided so as to expose the free edges of the internal oblique and transversalis muscles. These were turned up by the finger, with the peritoneum; so that the external iliac artery could be felt distinctly pulsating at the bottom of the wound. The handle of the scalpel was then employed, to separate the artery from the surrounding parts. This became the most difficult part of the operation, on account of the depth of the vessel, and the difficulty of bringing it into view. The division of the lower fibres of the transversalis and internal oblique muscles facilitated this part of the operation; and the artery was then exposed to view, detached from the surrounding structures. An aneurismal needle, armed with a double ligature, was passed under the vessel; and the two ligatures applied so as to include about three-quarters of an inch of the artery between them. The upper ligature was first tightened; and one end carried by means of a needle, through the artery and secured to the other end by a knot. The lower ligature having been tightened, the artery was divided midway between the two. The coats of the vessel appeared quite healthy. The external wound was closed with straps of plaster, supported by a fold of linen and a T bandage.

Towards the conclusion of the operation, the temperature of the limb sensibly diminished, but soon regained nearly its former height. The patient was laid in bed, on his left side, with a pillow between his knees to support the right limb; and his leg was covered with a thick stocking and a double fold of flannel. On being questioned, he did not complain of any numbness in the lower part of the limb, nor sense of coldness. In the evening, his pulse was 85: he was free from complaint, and expressed himself as being comfortable. The dark colour of the tumour had somewhat diminished, since the operation.

June 23. He had passed a restless night; and complained of soreness at the lower part of the abdomen, just above the wound: his pulse was excited: the temperature of the limb natural. In the evening, a dose of sulphate of soda and senna was prescribed, to act on his bowels; and a clyster was ordered, in case the bowels should not be moved before twelve o'clock.

On the following day—He had been relieved by a free evacuation of his bowels on the preceding evening, and he had passed a comfortable night. His pulse, however, rose considerably towards the evening.

On the succeeding day his pulse rose to 108; and he complained much of having passed a restless night, and of great commotion of his bowels, without any evacuation: he was ordered a purgative dose of senna. In the evening a small discharge of pus began to ooze from the wound, and there appeared to be great constitutional disturbance.

June 26. He had been delirious during the early part of the night; and required an attendant constantly, to prevent his getting out of bed: his bowels were relieved towards the morning, and he fell into a quiet sleep. He awoke relieved, expressed himself altogether free from pain. The wound had discharged a large quantity of pus, which was probably the cause of the relief he had experienced: the granulations looked healthy. The straps of plaster were loosened, and in part removed, to allow the escape of matter. The tumour was reduced in size; but remained very soft, as if its contents consisted nearly of fluid blood. The suppurative stage being established, and his pulse being inclined to fall, supporting diet, was allowed.

On the 30th, the aneurismal sac, which had gradually become softer, opened, and began in the night to discharge a quantity of dark-coloured blood; which, on pressure, oozed out freely, leaving the sac flaccid, and nearly empty. He complained of pain and rheumatic sensations about his limbs and other parts of his body. His respiration was quick, and his pulse jerking, but not exceeding 108 in a minute. Discharge from the wound, thin and less copious. A sponge, with vinegar and water, was ordered to be applied over the sac.

On the following day more grumous blood came away from the sac, mixed with some coagulated fibrin. He seemed anxious and restless, and his skin indicated fever. Some opium at bed-time was ordered.

From this time to the 8th of July his symptoms remained much the same. His appetite increasing, he was allowed meat and bread, of which he partook freely: the sac continued to discharge an ichorous and offensive fluid. On this day, when the sore was dressed, the inner surface of the sac came away in a mass, as if it had sloughed; and exposed a rather healthy granulating surface at the bottom of the wound. Common poultice was applied, to encourage healthy suppuration and granulations. The wound of the operation continued to discharge, but appeared healthy; and the sac, or rather its remains, gradually diminished in volume, and improved in appearance.

On the 8th of July, the upper ligature came away; and was followed by the other ligature on the following day, without any hæmorrhage. From this time a pint of porter was added to his diet, and his health and strength began to improve; the sac continued to granulate, and to contract in size; and the incision looked healthy, and inclined to close.

In the second week of July he left the hospital, under the impression that a better air would restore his strength.

In a week after he left the hospital, the sac had entirely closed, as had also the wound, and he was able to take exercise: but he began to complain of feverish sensations, especially at night, attended with pain in the limb, which shot across the abdomen from the wound. In a week after the wound had closed, the scab was accidentally struck off, and a small quantity of matter oozed from the opening. The sore again closed; and his fever, which had slightly remitted, returned with more violence than before, accompanied by the pain in the limb, and across the belly.

This state continued till the 25th. On this day he walked a quarter of a mile. A profuse discharge of pus took place from the incision, and also from the opening of the sac, and continued throughout the night.

The discharge from both openings by degrees diminished; and by the 1st of September had entirely ceased, the wounds being both healed. On the afternoon of the same day, they re-opened, and about four ounces of matter again were evacuated through both openings. This discharge was attended with a severe diarrhœa, which lasted seven days; and was checked by grain doses of ferri sulphas with pulvis opii, given him at bed-time. The diarrhœa left him with some degree of fever and a white tongue, which were relieved by mild rhubarb purgatives.

He continued in the same state with an occasional return of the purging, and a continuance of discharge from both openings, till the 23d of the same month; when a fresh abscess formed at the seat of the operation, and emptied itself at the outer extremity of the incision. About half a pint of matter made its escape.

From this period he suffered no relapse, with the exception of occasional pains in his limb, on which he continued to walk during the discharge of the abscess. The wounds gradually healed, under a free allowance of wine and water, with two pints of porter a day.

This patient went to reside in a distant part of the country, and continued to enjoy a good state of health for some years*. In the autumn of the year 1826, eighteen years and a half after the operation, he died: and an opportunity of examining the limb offering itself it was injected from the common iliac artery, and the anastomosing vessel carefully exposed by dissection. The preparation from which it is made is in the museum of the school. The following account, drawn up by Mr. Cock, will render the route of the circulation intelligible.

Description of the Preparation.

In order that the course of circulation through the limb might be examined and preserved, an injecting pipe was introduced into the aorta, just above its bifurcation. The left common iliac artery was tied, and the arteries of the right side were filled with wax. The vessels were then traced from the bifurcation of the aorta, as far as the knee-joint: the limb, including the os innominatum, the sacrum, and the lower portion of the spine, was removed from the body, and the leg was separated just above the condyles of the femur. The preparation which we shall endeavour to describe and explain, consequently comprises the right common iliac artery, the internal iliac and its branches, the external iliac on which the operation was performed, and the whole course of the femoral.

In describing the result of this dissection, we shall speak, 1st, Of the condition of the iliac trunk above the point where the ligature was applied. 2dly, Of the appearances presented by the vessel immediately below the ligature; together with the situation and remains of the aneurismal tumour, and the

* A brief account of this case was published in the Fourth Volume of the Medico-Chirurgical Transactions, in the year 1813; the patient being at that time alive and perfectly well.

femoral artery as restored by the influx of blood from anastomosing branches both above and below the sac. 3dly, The manner in which the restoration of the femoral trunk had been effected by collateral circulation.

Condition of the External Iliac Artery.

The external iliac artery was pervious, to the extent of rather more than an inch from the bifurcation of the common iliac; but had become somewhat diminished in size, and altered in shape. No branches were given off from this portion of the vessel, which, when filled with injection, presented a conical form, tapering downwards to a mere point, and terminating in a rounded cord, which constituted the remaining part, or the obliterated portion of the artery, and was continued down to the spot where the operation had been performed. The ligature had probably been applied just above the origin of the circumflex and epigastric branches, although no evidence remained to indicate the precise spot. Just above Poupart's ligament, the iliac trunk became suddenly restored (apparently by the influx of blood from the branches mentioned above,) and assumed about half its natural size. The obliterated vessel presented the appearance of a continuous unbroken cord, from the cessation of the iliac above, to its restoration below.

Condition of the Iliac and Femoral Artery, below the ligature

It has already been stated, that the iliac trunk became restored just above Poupart's ligament, by the retrograde circulation established through the circumflex and epigastric branches, which received their blood from the branches of the internal iliac above. The vessel having thus regained about half its natural size, passed into the thigh, and was continued without receiving any accession from collateral vessels, until it reached the origin of the profunda. From this branch (*i. e.* the profunda) the trunk appeared to derive a large supply of blood, sufficient to restore it to the ordinary extent of calibre which the femoral possesses in a stout muscular limb; the remaining portion of the femoral artery, below the profunda, presented nothing unusual in its appearance, and bore no indication of having received any farther influx of blood through collateral branches. Just above the origin of the profunda, the femoral artery had become distorted, and irregular in shape; and was rendered somewhat obscure by its connexion with what appeared to be the remains of the aneurismal sac, adhering to the anterior surface of the vessel, and gluing it to the adjacent muscles and facia. There can be but little doubt, that the original opening of communication between the sac and the femoral trunk had existed at this spot, viz. just above the profunda branch; but it would seem equally apparent, that, as the aneurismal tumour became obliterated in the progress of the cure after the operation, the opening into the vessel also became closed, while the integrity of the arterial trunk, above and below the sac, was maintained continuous and entire.

The manner in which the restoration af the femoral trunk had been effected by the collateral circulation.

The collateral circulation had in this instance, been established by the junction of the ileo-lumbar, obturator, gluteal and ischiatic branches, from the internal iliac, with the circumflex and epigastric of the external iliac, and the profunda of the femoral. They consisted of three sets of communicating vessels, which descended, respectively, over the fore part, the internal side, and the posterior surface of the hip-joint; and may be described as forming a vascular plexus around the articulation, ramifying amongst the muscles of that region.

The anterior set consisted—1. Of a very large branch from the ileo-lumbar artery, which descended along the crista of the ilium, to terminate in the circumflexa ilii and circumflexa ilii externa. 2. Of another branch from the ileo-lumbar, which became joined by a small artery from the obturator, and divided into a number of small and exceedingly tortuous vessels. These connected themselves to the anterior crural nerve; and, descending under Poupart's ligament, terminated in the external circumflex branch of the profunda. 3. Of two other branches from the obturator, which turned over the brim of the pelvis, and formed a plexus similar to the last, which, after communicating with the epigastric, descended on the inner side of the femoral trunk, and terminated in the internal circumflex branch of the profunda.

The internal set consisted of the branches given off by the obturator after it had left the pelvis, which ramified amongst the adductor muscles on the inner side of the hip-joint, and joined most freely with the divisions of the internal circumflex form the profunda.

The posterior set of anastomosing vessels was constituted—

1. By three large branches from the gluteal; two of which crossed the dorsum of the ilium, in close contact with the bone, and anastomosed near the anterior and superior spinous process, with the ascending branches of the external circumflex; whilst the third descended in a direction more nearly vertical between the gluteus maximus and medius muscles, to join with the middle branches of the same artery, just below and behind the trochanter major. 2. by several tender and very tortuous vessels from the ischiatic, which surrounded the great nerve of that name, and thus, descending behind the thigh, communicated with the internal and external circumflex, and finally terminated by joining the perforating branches of the profunda.

In this preparation, the ileo-lumbar, obturator, gluteal and ischiatic arteries are enormously dilated. The internal pudic is also of large size; but it does not appear to furnish any direct communication with the femoral. Doubtless, however, in the dissection of the limb, many small branches were removed, which during the life of the individual, lent their tributary streams to swell the femoral trunk, and assisted in restoring to the limb that supply of blood which enabled it to maintain its muscular development, and carry on its functions with undiminished vigour.

[GUY'S HOSPITAL REPORTS, VOL. I.]

Account of the first successful Operation, performed on the Common Carotid Artery for Aneurism, in the year 1801 : *with the post-mortem examination, in* 1821. *From the notes of* Sir Astley Cooper, Bart.

H. HUMPHREYS, aged 50, who had been used to carry heavy burdens in the streets of London, perceived, about six months ago, a tumour about the size of a walnut, possessing a pulsatory motion, on the left side of the neck, just below the angle of the jaw, and extending down as low as the thyroid cartilage. It was productive of great pain on the same side of the head, and the left eye-lid appeared to contract over the globe of the eye. The pain in his head was first felt about a month after he discovered the swelling, and was attended with a sense of pulsatory motion in the brain. His speech had become, of late, somewhat affected, being less distinct than it formerly had been, and hoarse; and he also complained of some difficulty in breathing, apparently from the pressure of the swelling on the larynx. His appetite had of late become impaired. He had a sense of coldness, succeeded by heat, in his left ear; and he often bécame sick when eating, but did not vomit. Upon attempting to stoop at any time from that period, he had an insupportable feeling as if his head would burst, a giddiness, loss of sight, and almost total insensibility. The only remedy he had tried for the relief of the pain, was a blister on the head, which gave him ease for a few days. He did not discontinue his usual occupation. The internal carotid appeared to be dilated just where it comes off from the common carotid; the tumour was about the size of a pullet's egg, and very prominent about its centre.

The operation of tying the common carotid was performed on the 22d of June, in the theatre of the hospital. The pulsation of the tumour was remarkably strong on that day; when pressure was made on the artery below the tumour, the latter was emptied; and when the pressure was removed, it filled at one impulse of the heart.

The external incision was begun opposite to the middle of the thyroid cartilage, and continued down to within an inch of the sternum, along the inner side of the sterno-mastoid muscle. On raising the edge of the muscle, the omo-hyoideus could be distinctly seen crossing the carotid sheath, and the descendens noni lying upon it. On separating the sterno mastoid and omohyoideus, the internal jugular vein became immediately apparent, and dilating at each expiration, spread itself over the carotid artery: the vein being drawn aside, the par vagum came into view, as the artery was cleared from its sheath. A double ligature was then carried under the artery, by means of a blunt iron probe constructed for the purpose, and the lower ligature was tightened. The artery was then detached from the surrounding parts, to the extent of an inch upwards, and the upper ligature secured, so as to include between the two, the detached portion of the vessel. The artery was divided midway between the ligatures; and the blood contained in the vessel was found to be already coagulated. Each ligature was carried, by means of a needle, through the coats of the artery, and secured by a knot, in order to prevent the force of circulation from disturbing it.* The incision was dressed, by placing a pad of lint over it, and securing it by straps of plaster; the ligatures hanging out of the wound.

Dr. Vose, dresser in the hospital, took charge of the patient; and reported, that, immediately after the operation, he had been entirely relieved of the pain which for two months he had incessantly experienced, together with the throbbing of all the arteries in the left side of the head. This pain never returned. The pulsation did not wholly cease in the tumour, after the artery was tied, but was distinctly felt, though very slight, by Mr. Foster, Mr. George Young, and Mr. Dubois, jun., who were present at the operation. It was thought to be caused by the recurrent circulation through the internal carotid from the brain, in consequence of the free anastomosis which exists between the blood-vessels within the scull.

The patient's head was supported by a pillow; and slightly bent forwards, to relax the sterno-cleido-mastoid muscles.

3 P. M. Pulse moderate: skin cool: little pain in the wound: pulsation in the aneurism distinct; but inconsiderable, when compared with what it was before the operation.

8 P. M. Pulse natural and skin cool.

June 23. He has passed a comfortable night; and is otherwise free from complaint, with the exception of a slight cough. The tumour to-day is more tender,

* This practice was adopted, in consequence of a fatal hæmorrhage that had occurred in a case under the late Mr. Cline, occasioned by the ligature having been forced from the artery.

and still slightly throbbing: its contents feel more solid, as if the blood were coagulating.

25. The patient says he is quite easy, with the exception of a slight rattling, from an accumulation of mucus in the larynx: pulse tranquil. The tumour is diminishing in size, and gives him little or no uneasiness. No constitutional irritation.

26. Report good; the same as yesterday.

27. Has passed a very restless night: has coughed much and had pain generally over the head; his spirits are depressed, but otherwise free from disturbance.

28. His symptoms of yesterday have been relieved, by his bowels having been opened: pulse 84: free from pain: slight pulsation still to be felt in the aneurismal tumour, which is diminished in size.

29. Pulse natural: no pain: pulsation still perceptible: tumour is so much shrunk, that the skin over it is wrinkled: wound dressed for the first time, and looking healthy.

On the following day, he was very hoarse, and hardly able to speak in a tone above a whisper. This symptom was again relieved by a purgative, which freely unloaded his bowels.

On the following day the hoarseness was diminished. He continued in the same favourable condition up to the 12th.

On that day, the ligatures were observed to have projected farther from the wound, which had begun to discharge more profusely.

On the two following days, the ligatures came away, as Dr. Vose was dressing the wound. The upper ligature separated first.

On the 17th of July, the patient walked out of his ward. The tumour had hardly any pulsation, and was gradually getting smaller. The wound was cicatrizing favourably: the sac was reduced more than one half in size.

The wound was a long time in healing, owing to a small sinus remaining in the track of the ligature; and a small projecting fungus required to be touched often with caustic. He was discharged from the hospital in September.

He called on Sir Astley Cooper on the 16th of October following: the tumour could no longer be distinguished by the eye: he felt quite well, and in no respect different from what he was before the occurrence of the disease. The eye, which had been very much closed had regained nearly its former appearance. The facial and temporal arteries on the same side could hardly be felt, particularly the former: the latter beating slightly. Those on the opposite side pulsated with more than usual vigour.

This man continued to work in the employment of a large iron-master, Mr. Crawshay, in Upper Thames Street, and enjoyed good health till towards the year 1821; when he had pains in the head, which led eventually to a fatal attack of apoplexy, in the following year. In his last illness he was attended by the late Mr. Ankers, surgeon in the city; who immediately requested, and obtained permission, for Sir Astley Cooper to inspect the body.

For this purpose Sir Astley Cooper, accompanied by Mr. Key, went, after surgical lecture, late in the evening, to make the inspection.

POST-MORTEM EXAMINATION.

The aorta was opened, and an injecting-pipe introduced into the arch, for the purpose of filling the anastomosing vessels with coarse common injection; the subclavian arteries being tied externally to the scaleni. The head was then opened and examined for the purpose of discovering the seat and cause of the fatal effusion. On cutting away the hemisphere of the left side of the brain, a large semi-fluid clot was discovered, filling an apoplectic cell in the substance of the brain, just above the corpus striatum, and close to the corpus callosum; the size was that of a hen's egg. A little further examination discovered the source of hæmorrhage to be a large branch of the middle cerebral artery, the trunk of which vessel appeared more dense and white than usual, as if undergoing the change prior to ossification. The disease of which he died sufficiently attested the freedom of the circulation, as well as its force in the cerebral vessels, on the side on which the carotid had been tied. The arteries on the left side of the brain were rather larger than those on the opposite side. The anterior cerebral artery was of the same size as its fellow: the middle cerebral larger than that on the right side, which was filled with a coagulum, and did not admit the injection. The large size of the latter vessel is accounted for by the increased size of the communicating branch; which receiving its blood from the basilary, had become as large as an ordinary radial artery. The basilary appeared to be of its usual capacity, although it was evidently the channel which supplied the middle cerebral artery. The blood probably found an easier course from the basilary, through the left communicating branch, than into the right corresponding vessels, which appeared rather diminished in size. From an inspection of the base of the brain after the vessels had been injected, it immediately struck the observer, that the left side of the arterial circle of Willis was much more developed than the right, and that the left side of the brain received its full share of arterial blood. The anterior cerebral artery received its supply from its fellow by means of the transverse branch: these vessels seemed to be of their usual size. The internal carotid artery was pervious for about half an inch, and of its ordinary capacity.

The external vessels were not so well displayed. Those of the face did not receive the injection. The common carotid trunk was impervious throughout its whole extent, being reduced to a mere cord. The external carotid was injected at its commencement; and the superior thyroideal was also filled from the arteries of the opposite side: but beyond this the branches were empty, and therefore could not be satisfactorily traced.

The free communication, however, of the branches of the external carotids, in their natural state, affords an ample channel of supply, when the circulation in one is cut off. The aneurism must, as Sir Astley Cooper suspected, have been situated in the internal carotid artery.

[Medico-Chirurgical Transactions Vol. 2.]

Dissection of a Limb on which the Operation for Popliteal Aneurism had been performed. By Astley Cooper, Esq. F. R. S. Surgeon to Guy's Hospital.

Having lately had an opportunity of dissecting the limb of a man who had a popliteal aneurism for which the operation of tying the femoral artery was performed seven years ago, and having injected and dissected the limb, I thought that a short account of the appearances might not be deemed unworthy the Society's attention.

Independent of the gratification of curiosity in observing the mode by which the tributary streams supply the want of the chief channel of the blood, a knowledge of the exact course of the enlarged arteries will be useful in the after treatment of patients who have undergone the operation for aneurism, as it will teach the position least liable to compress the anastomosing vessels.

When this limb is examined it will be seen that the arteries, which form the new circulation, are not only enlarged, but that they have also become *tortuous.* This change in figure is at first the effect of an increased momentum of the blood in the anastomosing vessels which elongates them, and therefore prevents their lying in the same space as before, a circumstance that may be at all times seen on injecting arteries, that if the injection is much forced, the vessel becomes serpentine. But in the living artery this tortuous course is established by a new growth; for at the time that the vessel elongates and increases in diameter, its coats also become considerably thicker than natural; and thus it is kindly provided, that as the vessel enlarges, and the original matter of which it was formed is expanded over a larger surface, instead of the vessel becoming thinner, the increased determination of blood upon the artery occasions the deposit of additional matter in its coats, and its strength as well as its length and diameter are increased.

In enlarged veins, as well as arteries, this tortuous course may be observed. This limb will show it with respect to arteries, and with regard to veins it will be well seen in a plate published by Dr. Baillie, in the work for the improvement of medical and surgical knowledge, in which a view is given of the vena azygos, enlarged and tortuous from an obliteration of the vena cava inferior, and it may be at all times seen in varicose veins in the lower extremities.

This tortuous course of vessels will be also observed in the arteries of old persons, in whom the coats of the vessels are ossified; for in these cases, as the circulation is less assisted by the arteries of the part, the heart is called upon to make extraordinary efforts, by which the blood is sent with such momentum upon the aorta, as to increase its length and diameter, and render its course serpentine. It is in the aorta before it forms its curvature, in the abdominal aorta, and in the iliac arteries that this change is most conspicuous.

Any great increase in diameter of the anastomosing vessel is but slowly produced, for I have injected a limb several weeks after the operation for popliteal aneurism, without being able to force the injection through communicating vessels into the parts below. To enlarge the vessels much, it is necessary that the limb should have been employed in active exertion.

On account of the arteries not very readily enlarging, the limbs of those who have undergone the operation for aneurism, are for a considerable time weaker than natural. They feel the influence of cold more, are more disposed to ulcerate from slight causes, and when sores are produced, have diminished powers of restoration. On account of the languor of circulation and the diminished power of resisting the influence of low degrees of heat, it is right, after the operation for aneurism, to clothe that limb much warmer than the other; for which purpose, a piece of flannel or a fleecy stocking should be applied to prevent the sedative influence of cold.

A man who had undergone the operation for popliteal aneurism, complained in the evening of his leg being painful, and a dresser going through the ward, applied a lotion of the acetate of lead, and when the rags were removed on the following morning, the limb was found mortified.

Mr. Campbell, a patient of Mr. Curtis, surgeon in Whitechapel, underwent the operation for popliteal aneurism at a time when the weather was extremely cold. In three nights after the operation, he said his foot was benumbed, and when it was examined, it was found to be of a blue colour and quite cold. Frictions were immediately had recourse to; first with the hand only, and after a time with warm flannels, and the circulation was restored, although with considerable difficulty.

When a ligature has been applied, it is some time before the artery below becomes obliterated. Mr. Foster, surgeon of

Guy's Hospital, has a drawing in his possession of a case of popliteal aneurism, for which the femoral artery was tied in August; the man died in January following, and when the limb was injected, the femoral artery, below where the ligature had been applied, was found to have received a part of the injection by communicating vessels.

It is for this reason that the pulsation, in some aneurisms where there are free communicating vessels, will remain for a considerable time after the operation. However, in twelve or fourteen months, when the femoral artery has been tied, it becomes obliterated, above the ligature to the arteria profunda, and below it to the origin of the anterior tibial artery, and sometimes the remnant of the vessel is not only converted into a cord, but is ossified.

It is scarcely necessary to observe how improper it is to apply bandages upon limbs in which the principal artery has been tied; but I mention it because I have seen a roller used to confine dressings: on the same account it is required that attention should be paid to the position of the limb, to prevent any pressure being made by pillows, which may obstruct the course of the blood in its new channels.

Dissection of the Limb.

The femoral artery, which is necessarily obliterated by the ligature, was here converted into a cord from the origin of the arteria profunda down to the ham, the whole of the popliteal artery was also changed into a similar substance: and thus the natural channel of the blood from the groin to the lower part of the knee was entirely destroyed. The muscles, therefore which usually receive blood-vessels from the femoral artery, as the sartorius, the rectus, and the vasti, had no branches but from the arteria profunda and circumflex arteries; and the articular arteries from the popliteal, although they were still capable of receiving blood, derived it, not from the popliteal artery, but from the communicating vessels of the profunda.

The arteria profunda formed the new channel for the blood. Considerably enlarged in its diameter, although still not equal in size to the femoral artery at the groin, it took its course to the back of the thigh on the inner side of the thigh bone, and sent branches of a larger size than usual to the flexor muscles of the leg, and just midway on the back of the thigh it began to send off those arteries which became the support of the new circulation.

The first artery sent off passed down close to the back of the thigh bone, and entered the two superior articular branches of the popliteal artery, which vessels supply the upper part of the knee joint.

The second new large vessel arising from the profunda at the same part with the former, passed down by the inner side of the biceps muscle to an artery of the popliteal, which was distributed to the gastrocnemius muscle, whilst a third artery dividing into several branches, passed down with the sciatic nerve behind the knee joint, and some of its branches united themselves with the inferior articular arteries of the popliteal, with some recurrent branches of these arteries, with arteries passing to the gastrocnemii, and lastly with the origin of the anterior and posterior tibial arteries: and these new large communicating branches were readily distinguished from others by their tortuous course.

It appears, then, that it is those branches of the profunda which accompany the sciatic nerve, that are the principal supporters of the new circulation. They were five in number, besides the two deep-seated arteries which do not acccompany the nerve.

The external circumflex artery was considerably larger than usual for the supply of branches to the muscles on the fore part of the thigh, but it had no branches for the new circulation.

The obturator artery did not appear larger than usual, and although much pains were taken to trace any enlarged communicating branches between the ischiatic arteries and profunda, yet no vessel capable of receiving coarse injection could be found.

Anastomosis appears to be so free in all the arteries of the limbs and in the vessels of the head and neck, that there is no difficulty, with the precautions that I have mentioned, in the blood finding its course in new channels when the old are interrupted. If there is any exception to this statement, it is with regard to the subclavian artery. But experience is not yet sufficient to lead to a decisive judgment upon this point.

Mr. Ramsden has published an account of an operation on the subclavian artery, and the man does not appear to have died from want of anastomosis. Sir William Blizard has also lately tied this artery, and, as I understand, accomplished the operation with great ease; but the man was advanced in years, and much reduced in strength, and he died on the fourth day after it had been performed.

In other animals the blood may be diverted from its proper channels in all the external arteries of the body. The carotids, the femoral, and brachial arteries may be tied, and yet the life of the animal be preserved.

The preparations which I have now the honour of showing to the Society were made under the following circumstances.

I have long been in the habit of tying the carotid arteries in the dog in my Surgical Lectures, for the purpose of showing the falsehood of the prevailing idea that a ligature upon these arteries produces sleep or coma in the animal. In a healthy dog who had been the subject of this experiment, I made ligatures upon both the femoral arteries; and when these ligatures had separated, and the wounds had perfectly healed, I tied one brachial artery, and that wound having closed, the other brachial was cut down upon, and, as I supposed, divided and tied. The animal survived these different experiments, and lived above a year afterwards. Immediately after death it was injected, and the injection had passed so successfully in the neck and in the thighs, as to make beautiful preparations of the anastomosing vessels. But the injection failed in one of the fore extremities, so as to leave a doubt whether the brachial artery had been divided, or the radial or ulnar under a high division of the brachial artery. This, however, is certain, that the animal lived for more than twelve months with the two carotids, the two femorals, and one brachial artery obliterated.

These experiments were made not merely with a view to ascertain the extent of the anastomosing principle, but also for the purpose of learning if any change would be produced in the habits of the animal, in consequence of the blood circulating through new and numerous channels; for it has been observed by Mr. Carlisle that slow moving animals have such a circulation; but with regard to this dog he remained equally lively and active as before.

Lastly, I was anxious to ascertain when even the aorta was tied, if the blood would still find its course by anastomosis.

It is now more than two years ago, that I opened the abdomen, by an incision of about three inches in length close to its junction with the loins, and turning aside the peritoneum with my finger, I felt the aorta pulsating, and passing a blunt hook under it, easily put a ligature around it.

During the last winter, assisted by my friends, Mr. White and Mr. Dean, two of our most promising and intelligent

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pupils, I repeated the experiments, and have the honour of showing to the Society the aorta tied and divided, the animal having survived the experiment, and maintained his usual health; the ligatures coming away as other ligatures upon arteries, and a successful injection having been made of the body, the anastomosing vessels are beautifully seen. These were sufficiently large and numerous to allow of a free injection of the femoral vessels.

Some degree of weakness is produced in the hinder extremities by a ligature made upon the aorta; but it is not sufficient to prevent the animal from using them with great freedom, and would scarcely be observed by one who knew nothing of the experiment.

Previous to the animal being killed, the femoral artery and vein were laid bare; the blood in the artery was florid as usual, and passed with a motion that was pulsatory, although weaker than natural.

[MEDICO-CHIRURGICAL TRANSACTIONS, VOL. 2.]

Some Observations on Spina Bifida. By Astley Cooper, Esq., *F. R. S., Surgeon to Guy's Hospital.*

I PROBABLY should not have read to the Society the following remarks on Spina Bifida at the present time, had not I been urged to it by those on whose judgment and friendship I have been accustomed to rely. The cases which form the basis of this paper having been shown to Drs. Marcet, Yelloly, and Farre; to Mr. George Young, and to Mr. Barlow of Blackburn; they were of opinion that they not only deserved publication, but strongly urged that they ought not in justice to remain concealed, as there were, probably, many children at this time in the kingdom who labour under the disease in a state to admit of remedy, and whose lives might fall a sacrifice to withholding this communication from the public. Nor will it, I trust, be considered that I am publishing precipitately, by those who will give themselves the trouble to visit the cases which I am now about to describe, as they will find that one has been under my observations for four years, another two years and a half, and the third for the space of eighteen months; so that a considerable time has been allowed to watch the effect of the treatment which is here recommended.

CASE I.

James Applebee, Baldwin Street, Old Street, was born on the 10th May, 1807, and his mother immediately after his birth observed a round and almost transparent tumour on the loins, of the size of a large walnut.

Mr. Deering, who was her accoucheur, requested Dr. Petch to see the child with him, who informed the mother of the dangerous nature of the complaint, and of the probability of its fatal termination.

On the 22d June, 1807, the child was brought to my house, and I found that although it had spina bifida, the head was not unusually large; that the motions of its legs were perfect, and its stools and urine were discharged naturally.

I applied a roller around the child's waist, so as to compress the tumour, being induced to do so from considering it as a species of hernia, and that the deficiency of the spine might be compensated for by external pressure.

The pressure made by the roller had no unpleasant influence on its voluntary powers; its stools and urine continued to be properly discharged, but the mother thought that the child was occasionally convulsed.

At the end of a week, a piece of plaster of Paris, somewhat hollowed, and that hollow partly filled with a piece of lint, was placed upon the surface of the tumour: a strap of adhesive plaster was applied to prevent its changing its situation, and a roller was carried around the waist, to bind the plaster of Paris firmly upon the back, and to compress the tumour as much as the child could bear.

This treatment was continued until the month of October, during which time the tumour was examined about three times a week, and the mother reported that the child was occasionally convulsed.

When the child was five months old, a truss was applied, similar in form to that which I sometimes use for umbilical hernia in children, and this has been continued ever since.

At the age of fifteen months it began to make use of its limbs; it could crawl along a passage, and up two pair of stairs.

At eighteen months, by some accident, the truss slipped from the tumour, which had become of the size of a small orange, and the mother observed when it was reduced, that the child appeared in some degree dull; and this was always the case if the truss was left off for a few minutes, and then re-applied.

At fifteen months he began to talk; and at two years of age could walk alone.

He now goes to school, runs, jumps, and plays about as other children. His powers of mind do not appear to differ from those of other children. His memory is retentive, and he learns with facility. He had the measles and small-pox in the first year, and the whooping-cough at three years. His head, previously and subsequently, to the bones, closing, has preserved a proper proportion to the other parts of his body.

The tumour is kept by the truss entirely within the channel of the spine; but when the truss is removed, it soon becomes of the size of half a small orange. It is therefore necessary that the use of the truss should be continued. When the truss is removed, the finger can be readily pressed through the tumour into the channel of the spine.

CASE II.

January 21st, 1809, Mrs. Little, of No. 27, Lime-house Causeway, brought to my house her son, aged ten weeks, who was the subject of spina bifida.

The tumour was situated on the loins; it was soft, elastic, and transparent, and its size about as large as a billiard ball when cut in half; his legs were perfectly sensible, and his urine and fæces were under the power of the will.

The child was taken to a surgeon of eminence, who said that nothing could be done, and that the child would not live more than four or five months, and ordered the swelling to be washed with vinegar and water.

Having endeavoured to push the water contained in the tumour into the channel of the spine, and finding that, if the whole was returned, the pressure would be too great upon the brain, I thought it a fair opportunity of trying what would be the effect of evacuating the swelling by means of a very fine pointed instrument, and by subsequent pressure to bring it to the state of the spina bifida in Applebee's child.

I therefore immediately punctured the tumour with a needle, and drew off about two ounces of water.

On the 25th of January, finding the tumour as large as before it had been punctured, I opened it again, and in the same manner, and discharged about four ounces of fluid. The child cried when the fluid was evacuated, but not whilst it was passing off.

On January the 28th, the tumour was as large as at first. I opened it again, and discharged the fluid. A roller was applied over the tumour and around the abdomen.

February 1st, it was again pricked, and two ounces of fluid discharged.

On the 4th, three ounces of fluid were discharged.

On February 9th, the same quantity of fluid was evacuated as on the 4th; but instead of its being perfectly clear, as at first, it was now sanious, and it had been gradually becoming so in the three former operations.

On the 13th, the same quantity of fluid was taken away; a flannel roller was applied over the tumour and around the abdomen; a piece of pasteboard was placed upon the flannel roller over the tumour, and another roller over the pasteboard to confine it.

On the 17th, three ounces of fluid, of a more limpid kind, were discharged; the pasteboard was again applied.

On the 27th, the surface of the tumour inflamed; the fluid, not more than half its former quantity, was mixed with coagulable lymph, and the child suffering considerable constitutional irritation, was ordered calomel and scammony, and the rollers were discontinued.

February 26th, the tumour was not more than a quarter of its former size; it felt solid; the integuments were thickened, and it had all the appearance of having undergone the adhesive inflammation.

On the 28th it was still more reduced in size, and felt solid.

On March the 4th it was in the same state as on the 28th of February.

March the 8th, the swelling was very much lessened; the skin over it thickened and wrinkled; a roller was again had recourse to; a card was put over the tumour, and a second roller was applied.

March the 11th, the tumour was much reduced; the skin covering it was a little ulcerated. On the 15th it was flat but still a little ulcerated.

On the 27th the effused coagulable lymph was considerably reduced in quantity, and of very firm consistence.

On the 2d of May nothing more than a loose pendulous bag of skin remained, and the child appearing to be perfectly well, the bandage was soon left off.

On December the 18th, it was attacked with the small-pox, and went well through the disease.

The skin now hangs flaccid from the basis of the sacrum; its centre is drawn to the spine to which it is united, and thus the appearance of a navel is produced in the tumour by retraction of the skin.

The pricks of the needles are very obvious on each of the punctured parts of the tumour, forming slight indentations.

My friend and neighbour, Dr. Yelloly, saw the progress of the cure in this child, it being from time to time sent to his house.

CASE III.

January 1810, Hannah Jackman, aged eleven days, was brought to my house with spina bifida, having *an ulcerated* *state of the skin over it.* The woman had been delivered by Mr. Rosewarn, a pupil of Dr. Haighton's, and Dr. H. had seen the child.

Jan. 5th, the tumour was punctured with a needle, and the fluid was discharged.

Jan. 9th, the tumour was filled with coagulable lymph, as was proved by its inflamed appearance, and the firmness of its feel; the child appeared in great pain, had no stool, and suffered considerable constitutional irritation; it was ordered a dose of calomel and a glyster.

On the 10th it had evacuations both by stool and urine, and on the 11th Mr. Rosewarn reported that the tumour was less in size; that it was still solid; that the child was considerably torpid, but suckled heartily.

On the 13th the ulcer in the spina bifida was almost healed; the tumour was flaccid; convulsions which had begun on the evening of the 11th had been frequent to the 13th; the child foamed, struggled very much, and seemed very weak.

On the 16th my assistant, Mr. Lewis, saw the child, and reported that the convulsions ceased on the 15th; that the child was much reduced, and that it was costive; the tumour was nearly level with the surrounding skin, soft, and of a red colour; it had still a small ulcer on it. Glysters were directed to be given.

Jan. 19th, the tumour had become very small, and but a trifling ulcer remained. The child, however, was convulsed; its eyes were drawn under its upper eye-lids; it was much reduced: it had retention of urine for a day and a night, and was extremely costive; it had ceased to suck for several days, but began to take the breast again on that morning.

Jan. 23d, the child sucked heartily; the tumour appeared to contain some fluid in its centre; the ulcer upon its surface was healthy, and nearly healed.

Jan. 26th, the tumour was somewhat increased; the child sucked, was free from convulsions and, improved in strength.

February 3d, the ulcer was healed; the tumour was much reduced, and the child greatly improved in its strength.

The child was again brought to me on the 13th, at which time the adhesive inflammation appeared to be complete. On the 15th of the same month it was seized with convulsions, which continued until the 24th; its eyes became inflamed on the 13th, and continued so until its death, and it died, on the 25th of February.

Inspection on the 27th.—The bones of the cranium were very much separated at the sutures; there was no hydrocephalus externus; the brain was unusually soft; the ventricles contained about six ounces of a limpid fluid, but there were clots of coagulable matter floating in it.

In the preparation which I have now the honour to show to the Society, it will be seen that the adhesive inflammation is very complete, so that no cavity is left for the reception of the spinal fluid.

CASE IV.

—— Sterney, son of Mr. Sterney, a butcher at Peckham, was brought to me on the 10th January, 1810; it had a very large spina bifida at the basis of the sacrum.

I opened it on the 15th by the same means as I have before described, and discharged about an ounce of limpid fluid.

On the 17th I again opened it, and removed about an ounce of fluid, which was a little bloody; the child had been restless and had green stools, which is always a marked sign of irritation in children.

On the 19th the child had two convulsions; the tumour was opened; the fluid was a little sanious, and the tumour contained some solid matter; the child was much purged, and this was directed not to be repressed.

Two ounces of fluid were discharged on the 24th, and on the 26th an ounce and a half of fluid, was drawn off, and a dossil of lint was applied upon the opening from the spinal canal into the tumour; this was firmly bound down by a roller.

On the 30th of January, 1st of February, 4th, 11th, and 26th, the tumour was opened.

Two ounces of fluid were also discharged on the 27th and then a piece of sheet lead was placed upon the tumour lined with lint and covered by a roller.

On February 28, and on March 1st, and 2d, it was opened.

On the 3d, plaster of Paris was applied upon the swelling after discharging its fluid; this was confined by a roller tightly applied.

On the 4th it had convulsive twitchings of its hands, quickened respiration; it was restless, hot, and cried much; half an ounce of fluid was discharged.

5th.—Vomited frequently; the swelling was again opened.

6th.—The fluid was discharged; lint and adhesive plaster were afterward applied, and this plan was repeated on the 8th and 9th.

10th.—The tumour was not opened, because it felt so hard as to induce me to believe it had adhered.

11th.—Stools green; vomited frequently; bandage still applied, but not the adhesive plaster.

13th.—Child sick; stools green.

14th.—Two ounces of fluid discharged; plaster and roller applied.

17th.—Plaster of Paris applied wrapped in lint, and bound very tight.

19th.—Comatose, and convulsed, as it was thought, from the pressure of the bandage and plaster of Paris; these were removed and a lighter bandage applied.

22d.—The child, which on the 19th appeared to be dying, is better to-day.

24th.—Is more lively; it sucks but little, the tumour being very large and full; a truss was applied.

27th.—The truss is to be continued as the tumour is smaller.

30th.—Tumour reduced; the child has cut a tooth; the truss continued.

April 4th.—Appeared to be suffering pain and sickness from the truss, and it was removed.

9th.—Tumour pricked, and the truss re-applied.

14th.—The tumour again pricked.

18th.—Continues to wear the truss; the tumour was opened to-day; a handkerchief was doubled under the truss; the child vomited after its application.

22d.—Appeared in good health; the tumour was pricked, and again on the 26th, when there was some coagulable lymph in the fluid.

May 2d.—The swelling was pricked; also again on the 6th, and the quantity of fluid which was discharged was not diminished, continuing to amount to from two to three ounces.

The child was now sent to Messrs Sharpe and Arnauld, surgeons at Peckham, who attended the family, and who pricked the swelling at different times, and discharged the same fluid both in quantity and quality which I have described.

The adhesive process was, however, unequal to close so large an aperture as existed from the spine in this case, and I therefore abandoned the adhesive plan, and directed that the same mode of treatment should be pursued as in Applebee's case; that a truss should be applied and constantly worn upon the part, and that the palliative rather than the radical cure should be attempted.

The tumour has been gradually diminishing under this mode of treatment; the child has grown in proportion to other children, and at the age of a year and a half is a very healthy boy.

These, then, are the two modes of treatment which I have pursued for the relief of those who are afflicted with spina bifida; the one palliative only; the other radical.

The first consists in treating the case as a hernia, and applying a truss to prevent its descent; and the second in producing adhesion of the sides of the sac, so as to close the opening from the spine, and stop the disease altogether. The first is attended with no risk. The truss forms an artificial vertebra when the natural is defective, a buttress which supports the part, and prevents the increase of the disease; but in this mode of treatment the truss is required in future life, for if discontinued the tumour re-appears, and will grow, as hernia does, to great magnitude, but with more fatal consequences.

On the contrary, the adhesive mode of cure exposes the patient to much constitutional irritation, but leaves him without the apprehension of the future return of the disease. And a finer and more healthy child cannot be seen than that which was cured by this mode of treatment.

It may be also observed that this mode does not prevent the subsequent attempt at the palliative treatment, if the radical should not be successful.

But as there are many cases of spina bifida which cannot be cured, it is right that I should state what are those that will not admit of relief.

If the tumour is connected with an unnatural enlargement of the head, hydrocephalus internus is conjoined with spina bifida; and the water will accumulate in the ventricles, if the tumour in the loins is attempted either to be palliated or radically cured.

If the lower extremities are paralytic, or the fæces and urine are discharged involuntarily, there is no hope of relief.

If the tumour has burst at the time of birth, or bursts soon after, there is little hope of cure; for although the opening in the skin may be closed by lint and adhesive plaster, and union be produced so as to admit of no further discharge of water, yet hydrocephalus internus will still succeed. In a case which I saw with Mr. Young, surgeon, at Lambeth, I closed the opening, and applied a truss, but the head enlarged, and the child died after eight months with Hydrocephalus Internus.

The deficiency of the spine is sometimes so great as to lead to the production of a most extended tumour at the time of birth, and when this is the case the nerves are so far protruded from the spinal canal as to injure the structure of the spinal marrow, and to render every attempt at cure unavailing.

I should feel myself deficient in that liberality with which our profession ought ever to be marked, and usurping more than my due, if I did not state that the principle of the radical cure as proposed for Spina Bifida, is similar to that recommended by Mr. Abernethy in his work on Psoas Abscess.

The mode however which I have employed for the purpose is, I believe, the only safe one, that of puncturing the part with a needle; for every opening of a larger size will be attended with the utmost danger.

I have for many years used this plan in cases of ganglia, when I could not burst them by a blow, or excite their removal by pressure or irritation; and I have never seen it followed by inflammation or any serious consequence; and it may be used in cases of accumulations in joints and other cavities where larger openings are dangerous.

Dr. Marcet was so kind as to analyze the fluid which was taken from the Spina Bifida of Little's child, and will probably soon favour the Society with the result of his observations on this fluid, compared with that of Hydrocephalus Internus.

[MEDICO-CHIRURGICAL TRANSACTIONS, VOL. IV.]

History of a Case of Premature Puberty. Communicated by Astley Cooper, Esq., F. R. S.

CHARLOTTE MAWER, the daughter of a waterman at Lincoln, aged about four years and a half, had an appearance of the catamenia about a year and a half since, and again in the course of four or five months; but for the last two or three periods, nearly at the end of five weeks. The discharge exactly resembled that of most women, except that it was of rather a darker colour. The last period was about the fifth of this month, when the girl looked pale and seemed to have a degree of lassitude about her. The breasts are very full, and as large as most young women's of twenty years of age. She is very broad over her chest and loins. Her pelvis seems much larger than is ever observed at her age. The pubes is covered with a white-coloured hair, which began to show itself when she had the first appearance of the catamenia. She is quite a little woman in her appearance, except as to her countenance, which is childish. She is much bigger than a sister who is two years older. She plays with children of her own age, and does not seem to have any sexual feelings, or an uncommon degree of modesty. That there might be no mistake with respect to her age, the register of the parish where she was baptised was examined, which specified her being born on the 22d March, 1806.

Lincoln, November, 1810.

Since the above account of the case of Charlotte Mawer was taken, she has continued to menstruate regularly; but there is now only a space of three weeks between each period. The discharge is as copious as in most women, and it generally continues about four days; it is the colour of venous blood, and does not coagulate. She is frequently affected with leucorrhœa in the intervals; the hair has begun to grow in the axillæ; her countenance has not near so much the childish appearance; her voice is much rougher; she has a degree of modesty not formerly noticed, and does not now like to walk in the streets, because some boys have teazed her about her appearance. She is four feet and an inch high, is broader across the pelvis than the shoulders, measuring only fourteen inches and three quarters from one acromion scapulæ to the other, but seventeen inches from the anterior superior spinous process of one ilium to that of the other.

Her eldest sister, aged about seventeen years, has never menstruated, and there is very little fullness in her breasts, though she is in good health. One of her sisters, aged ten years and five months, is four feet and two inches high, and is not so broad across her pelvis as her shoulders; she measures fourteen inches and a half from one acromion scapulæ to the other, and thirteen inches from the anterior superior spinous process of one ilium to that of the other.

August 3, 1812.

[MEDICO-CHIRURGICAL TRANSACTIONS, VOL. IV.]

An Account of the Anastomosis of the Arteries at the Groin. By Astley Cooper, Esq., F. R. S., *Surgeon to Guy's Hospital.*

IN a paper which I had formerly the honour of reading to this Society, I endeavoured to describe the course of the new channels for the blood, when the femoral artery has been obliterated by the operation for popliteal aneurism. Since that period I have had an opportunity of dissecting two persons in whom the iliac artery had been tied; and as one of these had survived the operation a much longer time than the other, an opportunity was given, not only of seeing the blood-vessels, when the course of the blood is established, but also of tracing the gradual progress of the new circulation.

Hypothesis would lead to a belief that anastomosing vessels would be numerous in proportion to the time which had elapsed from the operation, but the reverse of this is the fact, for at first many vessels convey the blood originally conducted by the principal artery; but gradually the number of these channels becomes diminished, and, after a length of time, a few vessels conveniently situated for the new circulation, are becoming so much enlarged as to be capable of conveying an equal portion of blood to that which passed through the original trunk.

In examining, therefore, the two limbs, which I have the honour of showing to the Society, many more anastomosing vessels are enlarged in that which had been recently the subject of the operation, than in the limb on which the operation had been performed for more than two years, a circumstance which has not arisen from a more successful injection, as the one had been as well injected as the other.

It may be further observed, that a person who has his iliac artery tied for an aneurism of the groin, recovers the use of the limb much more quickly than when the aneurism is situated in the middle of the thigh, for in the inguinal aneurism the principal anastomosing vessels are left free from pressure, but the femoral aneurism is buried so deeply in the muscles of the thigh, that the branches of the arteria profunda are compressed and the passage of the blood to the lower part of the limb is impeded.

In about six weeks from the operation in the former case, the patient is able to make use of the limb, but in the latter the muscles of the leg and foot will be some months before they recover their powers, requiring the absorption of the aneurismal contents, and the consequent removal of the pressure upon the nerves and vessels.

This observation, however, applies principally to large aneurisms, on which account it is desirable in femoral aneurism, if not, indeed, in all others, to perform the operation in an early state of the disease.

One of these cases was that of a man of the name of Garrett Riley, who was a patient in Guy's Hospital, and had his iliac artery tied on the 14th of February, 1811; this man died ten weeks and six days after the operation, in consequence of the bursting of an aneurism at the bifurcation of the aorta; he was sitting, as I was informed, by his dresser, Mr. Barraud, in the square of the Hospital, when he suddenly fainted; he was taken into his ward, and in a few minutes afterwards expired.

Upon inspection of his body, besides the aneurism at the bifurcation which had burst, five aneurismal swellings will be seen in the limb, which I have now the honour to exhibit to the Society, one at the origin of the arteria profunda in the groin, a second in the middle of the thigh where the artery pierces the tendon of the triceps, which aneurism was of large size, and was that for which the operation was performed; a third aneurism was placed in the ham, and between the popliteal and femoral there were two smaller aneurisms.

This man was a bricklayer's labourer, and the great exertions he had made in carrying loads up ladders, was, in his mind, the cause of the disease. Upon endeavouring to ascertain the mode in which the blood took its course through the limb, it was found that the femoral, tibial and fibular arteries were still open, and that the blood was conveyed into the femoral artery by the following anastomoses:—The internal pudendal artery formed several large branches upon the side of the bulb of the penis, and these branches freely communicating with the external pudendal artery, had determined the blood into that artery, and by this channel into the femoral; the lateral sacral artery also sent a branch on the iliacus internus muscle, into the femoral artery, and the ilio lumbar artery freely communicated with the circumflex ilii, so that by these three routes, the blood found direct ingress to the femoral artery.

Numerous branches of arteries also passed from the lateral sacral to the obturator and epigastric arteries, the obturator in this case having its origin from the epigastric.

Besides these arteries a free communication existed between the arteria profunda and circumflex arteries with the branches of the internal iliac; first, the gluteal artery sent a branch under the gluteus medius muscle to the external circumflex artery; secondly, the ischiatic artery gave two sets of branches of communication, one upon the gluteus maximus muscle to the arteria profunda, and another upon the sciatic nerve to the internal circumflex artery; the internal pudendal artery also sent a branch of communication to the internal circumflex; lastly, the obturator freely communicated with the internal circumflex.

These then are the channels for the blood in an early date from the operation, but at more remote periods, as the anastomosing branches become larger, they are less numerous, and the description of their course is much more simple.

The second case was that of James Nutter, aged 37, who had the operation of tying the iliac artery performed on the 24th August, 1810, on account of a large femoral aneurism above the tendon of the triceps. This man survived the operation nearly three years, and dying in Guy's Hospital, I had an opportunity of examining his body, and of learning the condition of the parts which had been the subject of the operation. The external iliac and the femoral arteries were obliterated, excepting about an inch of the femoral artery just below Poupart's ligament, which still remained open, and continued to convey a portion of the blood, but below this part it had become simply a ligamentous chord. The internal iliac artery sent first a very large artery of communication to the epigastric and obturator artery, so that the epigastric was supplied with blood from the internal iliac: secondly, the internal iliac sent an artery of communication upon the sciatic nerve, to the internal circumflex artery. The gluteal artery, gave a large branch to the origin of the profunda: lastly, the internal pudendal artery largely anastomosed with the obturator: the obturator, therefore, sprang in this case from two new sources, viz. from the internal iliac and from the internal pudendal artery, and the obturator thus formed, sent two branches of communication to the internal circumflex artery. The arteria profunda was in this case supplied from two sources directly from the gluteal, and more indirectly from the internal circumflex by the obturator and ischiatic arteries. The external iliac artery was obliterated to the origin of the internal iliac as other arteries usually are when ligatures are made upon them to the first large anastomosing vessel.* The principal agents, then, of the new circulation are the gluteal artery with the external circumflex, the obturator artery with the internal circumflex, and the ischiatic with the arteria profunda, and the obturator artery is supplied with blood principally by the internal pudendal when the obturator arises from the epigastric artery.

CASE II.

April 30, 1813.

William Martin, aged 27, was admitted into Guy's Hospital under the care of Mr. Forster, for a fracture of the olecranon, and after having been in the hospital three weeks, he requested his dresser (Mr. Johnson) to examine a swelling in the left groin, which proved a femoral aneurism, seated at a small distance below Poupart's ligament, and the integument over it was in a mortified state, being of a dark colour, and having three vesicles upon its surface.

As it was thought that an operation was immediately necessary, and Mr. Forster was not at the hospital, I was requested to see him. The man said that the swelling had been growing nearly twelve months, and had a pulsation when he first observed it. He attributed its commencement to an attempt to raise 3½ cwt. about three weeks before he first observed it.

The mortified state in which it was he attributed to walking the distance of four miles three days before it was shown to his dresser.

The tumour was as large as an orange; the pulsation in it very strong; its most projecting part was livid, and the surrounding parts of a deep red colour.

It appeared to me that no time was to be lost, and I immediately proceeded to tie the iliac artery. It may not be improper to remark, that the incision which I make for this purpose, is different to that usually advised; for I begin it just above the abdominal ring, and carry it half an inch above Poupart's ligament, in a similunar direction to one inch upon the inner side of the anterior and superior spinous process of the ilium.

Two ligatures were applied upon the artery and the vessel divided between them.

* I have been informed that Mr. George Bell, of Edinburgh, has a preparation of a limb, in which he had divided the femoral artery for popliteal aneurism, and that the obliteration of the artery has not extended to the arteria profunda as usually happens.

The ligatures separated on the 17th day.

On the 23d day after the operation, an incision was made into the aneurism, through the eschar, and the coagulated blood was discharged: the opening from the artery into the sac was very visible, but there was no bleeding from it.

The wound continued in a sloughy state for about three weeks, and then began to granulate; and although the restorative process went on slowly, the man was, after several weeks, discharged from the hospital, completely cured, no lameness remaining.

[Medico-Chirurgical Transactions, Vol. VIII.]

Three Cases of Calculi, removed from the Urethra, without the use of cutting instruments. By Astley Cooper, Esq., F. R. S. *Surgeon to Guy's Hospital.*

In the first volume of the Medico-Chirurgical Transactions, a very interesting paper is given by Mr. Thomas, on the *Dilatation of the Meatus Urinarius.* When I perused that paper, I resolved to take the first opportunity which might occur of employing the same principle in the extraction of a stone from the bladder; and having made the successful issue of a case known by relating it in my lectures, two of my friends, Mr. Wright, of Nottingham, and Mr. John Oakes, of Cambridge, employed the same means, and with similar advantage.

CASE I.

Phillis Keen, who had not been able to retain her urine from her last delivery, which was in the summer of 1809, was admitted into Guy's Hospital on May 30, 1810, with symptoms of stone. At twelve o'clock on Thursday, the 21st of June, a piece of sponge was passed into the meatus urinarius, which, on the following day at one o'clock was withdrawn, and a pair of middle-sized stone forceps were passed into the bladder, and a stone more than one inch long, and three-fourths of an inch wide, was extracted. On the 27th of June, she was discharged cured, being free from every symptom of the stone; but the incontinence of urine, when she quitted the hospital, continued as before the operation.

CASE II.

Mr. John Wright, of Nottingham, having heard of the preceding case, performed the operation and sent me the following letter :

"Dear sir,

"I am in hopes that the following case of extraction of a stone from the female, will be acceptable to you, and beg your acceptance of the calculus. I am dear Sir,

"Yours, &c.

"JOHN WRIGHT."

Elizabeth Nutt, a small weakly child, six years of age, had laboured under symptoms of the stone for four years, when she was admitted into the Nottingham General Hospital, on the 28th of April, 1812, The urethra was distended by means of sponge tent, until the 5th of May, when a large stone, weighing an ounce and a half (avoirdupois) was extracted with a pair of polypus forceps, and the girl left the house free from complaint on the 9th, only four days after the extraction.

Nottingham, May 12, 1812.

I received the following letter from my friend and pupil, Mr. Okes:—

"Dear sir,

"Allow me to submit to you the particulars of the extraction of a calculus vesicæ urinariæ after artificial dilatation of the urethra.

"I am, dear Sir, with all respect,

"Your very obliged and sincere friend,

"JOHN OKES."

CASE III.

Case of extraction of a calculus vesicæ urinariæ, after dilatation by sponge tent, by Mr. John Okes, Member of the Royal College of Surgeons in London, and Surgeon in Cambridge.

The case here recorded is not offered to your notice on account of its novelty, but as a further confirmation of the dilatability and contractability of the female urethra. The os uteri, vagina and rectum, are capable of dilatation to a most prodigious extent; and Mr. Thomas, in a case in the first volume of the Medico-Chirurgical Transactions, has demonstrated, that not only may the female urethra be very extensively dilated, but that it will, after such extension, recover its tone, and the patient be left free from incontinence of urine, a circumsta e almost invariably the result of an incision through the sphincter visicæ urinariæ.

In June, 1815, a girl about eleven years of age having a calculus in the urinary bladder, consulted me, and expressed herself willing to submit to any operation which held out a prospect of relief from her dreadful sufferings. It was determined to dilate the urethra by sponge tents, and as she was in good health, no other preparation was necessary than to empty the bowels by a cathartic medicine previously to the attempt at dilatation. In the evening after this had been administered, a piece of prepared sponge, with a string affixed to it, as large as could be introduced, was passed into the urethra, and directly afterwards she took forty minims of tinctura opii; she passed a tolerably quiet night, the urine draining away through the sponge. On the following morning the sponge which was excessively swelled was removed, a larger piece introduced in the same manner as before, and the same dose of tinctura opii was directed. This second tent produced more pain than the first did, but not enough to discourage a perseverance in the plan; the sponge was therefore repeated morning and evening for three successive days, increasing the size of it as much as could be borne, and giving at intervals as much tinctura opii as was necessary to keep down the pain. On the afternoon of the third day, the urethra appeared to be sufficiently dilated to justify the attempt of extracting the calculus, and a pair of forceps were easily passed into the bladder, and the calculus extracted without much difficulty. The difficulty in the extraction of the stone was increased by the forceps having seized it from point to point at its major axis; the parts, however, received no material injury, as only a few drops of blood followed the operation. The child slept comfortably during the night, and only very slight feverish symptoms came on the next day. The treatment common upon such occasions was adopted; the urine flowed involuntarily for three days, at the end of which period the incontinence ceased, and she has ever since retained her urine perfectly well. The calculus, of which I send you an etching of its natural size, weighed four drachms, and is in circumference at its major axis three inches and three-eighths, and at its minor three-inches and one-eighth, and as the forceps unfortunately seized the stone at its major axis, it may fairly be allowed, that if the thickness of the blades of the forceps be included, the urethra was distended to a circle of three inches and three-fourths in circumference. The result of the operation being favourable, even under the disadvantageous circumstances of the stone being seized at its major axis, is an additional argument for the use of distention, and it is proper also to observe, that much advantage was obtained by the use of sponge for dilating the urethra, as it at the same time allowed the urine to drain off, and by that means prevented the irritation which must have taken place if any other tent had been used, which might have prevented the flow of urine from the bladder.

REMARKS.

In the adult it will only be necessary to introduce a piece of sponge for twenty-four hours, and a stone of large size may be extracted without any great irritation being excited by it; but in the child the dilatation should be more gradual, as they suffer more from it on account of their greater irritability. The retention of their urine whilst the sponge is in the urethra also occasions considerable irritation, and it will be proper to have a groove made in the side of the sponge, to allow of the gradual escape of the urine, or as my friend Mr. C. Hutchinson suggested, a catheter might be placed in the centre of the sponge.

A great advantage will result from this mode of operation, if it should be found that in the majority of cases the urine is retained after the extraction of the stone, as the great objection to the use of the gorget or knife in the operation in the female, is the loss of power of retention which follows it, leaving the patient offensive to herself and friends, and the subject of continued excoriation. It is true, Mr. Hey has suggested the introduction of a sponge into the vagina, in the hope, that by the constant application of the surfaces of the wound to each other, they might be made to unite, and when cutting instruments are employed, such a trial will be proper.

Another advantage will be derived from this plan, *viz.* that it may be employed as soon as a small stone is discovered in the bladder, when it can be extracted with great ease, and at a time that a more dangerous, important, and painful operation would be hardly proposed.

[MEDICO-CHIRURGICAL TRANSACTIONS, VOL. XI.]

An Account of a Case in which Numerous Calculi were extracted from the Urinary Bladder without the employment of cutting instruments. By Astley Cooper, Esq., F. R. S. *Surgeon to Guy's Hospital.*

ALTHOUGH the operation of Lithotomy is now performed with a degree of celerity and safety which renders it much less appalling to the patient, and less difficult to the surgeon, than prior to the time of Cheselden; yet every candid person must admit, that if means could be suggested, by which the operation could be rendered less frequently necessary, it would be one of the greatest blessings which could be conferred upon mankind; for even when performed under the most favourable circumstances, the operation of extracting a stone is attended with severe pain, and when the calculus is large, with considerable difficulty and danger.

It was, therefore, with a high degree of pleasure I witnessed the following case, in which numerous calculi were extracted from the bladder, by means which did not expose the patient to any loss of blood, did not produce the slightest danger, or occasion any very considerable degree of suffering.

I am fully aware of the impossibility of extracting large urinary calculi by the means which are here recommended; yet I cannot but feel a hope that they may be removed in the early stages of the disease by the following means before they have acquired a bulk too large to pass by the urethra.

In the infant also, it will be ever extremely difficult to contrive an instrument of sufficient delicacy to be introduced into the bladder through the urethra, which shall possess such a degree of strength as to enable it to grasp the stone firmly, and to extract it with safety.

I shall now proceed to detail the circumstances of the case as they have been related by the patient himself, and will then conclude with some observations upon the means which were employed to obtain relief, and explain the particular case in which it is practicable to afford it.

CASE *as related by the Rev. Mr. Bullen.*

The Rev. John Bullen, of Barnwell near Cambridge, aged 64, of a spare habit of body, and of a sanguine temperament, having enjoyed an uninterrupted state of good health, capable of partaking largely of the amusement of hunting, and living always with great moderation, was attacked, in May 1818, with the symptoms of which he gives the following account:—

"I was suddenly seized with a frequent inclination to pass my water, and an uneasy sensation along the course of the urethra, which continued with greater or less violence for about a fortnight, when I was surprised by the appearance of a small round white stone at the orifice of the passage. The escape of this small calculus, which was attended with scarcely any pain, failed to produce any beneficial effect on my former symptoms, which continued unabated both as to the degree of irritation and the frequency of making water. In this state I remained till June following, during which month several similar calculi passed, to the number of about thirty, producing no other inconvenience than a slight smarting pain along the urethra. At the end of June, without any assignable cause, I was suddenly relieved from this discharge of calculous matter, and from every other symptom but that of a frequent desire to void my urine, which latter inconvenience occasioned me no feelings of anxiety or apprehension.

"In the ensuing winter, I was seized with pains across the back and loins, for which Mr. Brewster, of Cambridge, supposing they proceeded from gravel, ordered me medicines which he considered likely to alleviate them, but without producing any permanent good effect.

"I was however still enabled to pursue my favourite amusement of hunting, though frequently obliged to dismount to make water: at this time making no alteration from my accustomed mode of living.

"Without any material change, I remained until the December of 1819, when I found the exercise of riding was becoming considerably more painful, and the inclination to pass my water, more frequent, attended with some degree of difficulty in its passage, and a change from its usual colour and clearness to a fluid resembling chocolate. For these symptoms several formulæ of medicines having been prescribed without any material benefit, I was induced to consult Mr. Abbott, a most respectable surgeon, at Cambridge, who ordered me medicine shighly beneficial in their first effects; the relief, however, they afforded me, was but of short duration, for my symptoms recurred with all their former violence; and though the prescriptions were repeatedly altered at Mr. Abbott's suggestion, no sensible impression could by the most judicious treatment be made on the disease.

"My friend Dr. Thackeray of Cambridge was in June following called in consultation with Mr. Abbott; and both agreeing that the symptoms were produced by stone in the bladder, the sound was introduced to ascertain its presence, but failed to discover it. My symptoms continuing unabated, Mr. Abbott, a fortnight afterwards, still impressed with idea of stone, again sounded me, but the stones, for the reasons hereafter given, escaped detection. To relieve my frequent inclination to make water, and to mitigate the pain I experienced in its discharge, I was recommended the use of an opiate glyster at bed-time, which afforded me considerable relief; but if the injection were omitted but for a single night, the symptoms returned with all their former violence.

"In this state of suffering, I determined to consult Mr. Astley Cooper, and on the 17th of August went to town for that purpose. Mr. Cooper, suspecting from my account that a stone was present in the bladder, sounded me, but after searching for some minutes, was unable to detect one; he then directed me to discharge the water from my bladder, and the sound being again introduced, was distinctly heard to strike upon a stone. He then informed me that there was no hopes of permanent relief, but from the operation of Lithotomy, at the same time remarking, that as I had not been sufficiently reduced by the irritation of the disease, to render me a favourable subject for the operation, it would be better for me to return to Cambridge, and by pursuing a certain plan of diet, and regimen to reduce the high state of health which I appeared to possess. He also prescribed alkaline medicines for the purpose of lessening irritation. With this advice I returned home, where I remained till October 1820, pursuing the use of the soda and the opiate injection. My sufferings being alleviated only for the moment, and seeing no probability of experiencing further relief from medicine, on the 23d of October I came to London to submit myself to the operation; and the 30th was the day proposed for its performance.

"On the day appointed, Mr. Cooper, his nephew Mr. B. Cooper, and Mr. Merriman, junior, attended at my house. Upon sounding me, the instrument could be distinctly heard by every person present, and even by myself, to strike against a stone. Mr. Cooper, however, was of opinion that the stone was so small as to admit of extraction without cutting into the bladder, and therefore determined not to perform the operation, but told me that he would try less dangerous means to rid me of this complaint, and happily under these circumstances the operation was deferred.

"On the 3d November, I called at Mr. Cooper's house, when he passed a full-sized bougie into the bladder, for the purpose, as he said, of dilating the urethra, and thus giving the stone an opportunity of passing with the flow of urine. This operation was repeated on the 6th, 10th, and 13th of November; but on the 14th, an inflammation took place in the prostate gland from the introduction of the bougies, and put a stop to the prosecution of this plan of treatment. The effect of this inflammation was retention of urine, rendering it necessary for Mr. Cooper to draw off my water every twenty-four hours, at which time the calculus could always be distinctly felt by the catheter. After the inflammation had subsided, the power of making water not having returned, Mr. Cooper passed an elastic catheter into my bladder, and directed me to wear it, teaching me at the same time how to withdraw it when it became either painful or obstructed; and on several occasions I discovered small white stones in the opening of the instrument, similar to those which I had passed in 1818. Mr. Cooper, upon being acquainted with this circumstance, expressed a wish to remove the instrument himself, when upon withdrawing it, a stone was seen large enough to fill the opening in the side of the elastic catheter. The passage of this calculi suggested to Mr. Cooper the possibility of inventing an instrument by which he might remove those which remained in the bladder; and on the 23d of November, he brought with him some instruments contrived for the purpose, one of which he directly employed, and was so fortunate in the first trial as to remove eight calculi of small size. The operation was productive of a very inconsiderable degree of pain.

"On the 28th, eight more were removed by the same means, of a larger size than the former, two being as big as horse beans. This operation was attended with even less pain than the former.

"On the 30th, eleven were extracted, three or four being engaged each time the instrument was withdrawn. The removal of these gave me great relief, for I was immediately enabled to pass a considerable quantity of urine by my natural efforts, and previously to this, ever since the large bougie had been introduced, I had been unable to pass my water without the aid of the catheter.

"On the 8th of December, six stones were removed by the same means.

"On the 13th, nine more were taken away.

"On the 19th, three more were extracted.

"On the 23d, twelve were removed, and thus only allowing the intermission of a day or two for the irritation to go off. The operation was continued until eighty-four calculi were by these means, extracted from my bladder, when Mr. Cooper pronounced, after a most careful examination, they were all removed. My health has been all this time uninterruptedly good, with the exception of the attack of retention of urine from the use of the large bougie, and I am now able to discharge my urine without the use of the catheter, and to walk nearly as well as I ever did."

REMARKS.

When a great number of calculi are found in the bladder, as was the case in the Rev. Mr. Bullen, the circumstance is generally attended with an enlargement of the prostate gland, and it depends upon a sacculus being formed in the bladder directly behind the enlarged gland. In these cases the bladder is rarely completely emptied of its contents, and the calculi crystallize from the urine retained in this sac.

Such stones do not in general acquire the magnitude of those formed under the usual circumstances, and, from their number and collision against each other, their surfaces are generally smooth, and their shape is commonly rounded. Fifty-six such calculi were found in the bladder of Mr. Perkins the brewer, who died from retention of urine; and a hundred and forty-two I extracted from a patient of my friend Mr. Carden's, surgeon at Worcester, who had for some time attended him for retention of urine.

Persons who labour under this form of disease, sometimes pass the smaller of these calculi whilst making water; but the larger still remain, produce retention of urine, and the operation of Lithotomy has been frequently performed for them.

When calculi are thus placed, they are so concealed in the bag in which they are contained, that, in sounding, the instrument is liable to pass over them without their being discovered, and it is therefore necessary to dip the point of the sound towards the rectum as it enters the bladder, in order to detect them, or to pass the finger into that intestine, to raise them from the bed in which they are concealed ; and it is for want of attention to this circumstance that I have known a person pronounced not to have the stone, from whom I afterwards removed thirty-seven by the operation of Lithotomy.

The instrument which I first had made for the purpose of removing these stones from Mr. Bullen, were merely common forceps, made of the size of a sound, and similarly curved ; but Mr. Weiss, surgeons' instrument maker, in the Strand, showed me a pair of bullet forceps, which he thought would, with a little alteration, better answer the purpose I had in view. He removed two of the blades of these forceps, for there were four, and gave them the form of the forceps which I had constructed: the blades of this instrument could be opened whilst in the bladder by means of a stilette, so as to grasp and confine the stone, and they appeared so well constructed for the purpose, as to induce me to make trial of them. On the 23d of November, 1820, I first employed them, and the manner in which they were used was as follows: Mr. Bullen was placed across his bed, with his feet resting on the floor, and a silver catheter was then introduced, and the bladder emptied of its urine. I then passed the forceps into the bladder, and was so fortunate in my first operation as to extract eight calculi.

The instrument gave but little pain on its introduction, but when opened to its greatest extent, and the stones admitted between its blades, their removal was painful, more especially at the glans penis, which appears to be the portion of the urethra, which furnishes the greatest resistance to the removal of the stones.

A dose of opium was given after each operation, which Mr. Bullen has described ; it frequently allayed all irritation ; and in the intervals between the latter operations, he walked from Brompton into London; nor was he ever, after the symptoms of retention had left him, either confined to his bed or to his room.

[MEDICO-CHIRURGICAL TRANSACTIONS, VOL. XI.]

Case of a Large Adipose Tumour successfully extirpated. By Astley Cooper, Esq., F. R. S. *Surgeon to Guy's Hospital, and Lecturer in Anatomy and Surgery.*

ADIPOSE tumours acquire a greater magnitude than any other swelling ever reaches. They are not composed of fatty matter only, but the adipose membrane is increased, and their structure is similar, only somewhat more compact, to that of the fatty membrane in other parts of the body.

The cases which have occurred to my knowledge, in which these tumours acquired great magnitude, and have been successfully extirpated, were one which weighed 14lbs. 10 oz., removed by myself in Guy's Hospital, from Mrs. Smith, an innkeeper at Yarmouth, in Norfolk, one which was removed by Mr. Cline from Mr. Ayres, a silversmith, in Fenchurch Street, which weighed 15lbs. Mr. Copeland also extirpated a swelling of this kind from the thigh of Mrs. ——— of Tottenham, the weight of which was 22lbs.; but the magnitude of the swelling in the following case, was considerably greater than the largest of these.

As these tumours usually arise from those parts of the body in which the larger arteries are not found, and as they are commonly pendulous and extremely moveable, they do not lead to so formidable an operation as many swellings which are of less bulk, but which are either more vascular in their structure, or are seated in the neighbourhood of the larger blood-vessels. But the swelling in question was placed upon the abdomen, enveloping the umbilicus, and occupying that portion of the linea alba at which herniæ are so often found; and it was impossible to be quite sure that this swelling might not contain protruded omentum. This tumour therefore presented more than common danger and difficulty in the operation, independently of its enormous size.

CASE.

Nicholas Pearson, aged 57, on the 26th of September, 1820, was admitted into Guy's Hospital, for the purpose of having a large tumour removed, which grew from the front of the abdomen; and of which he gave the following account:

At the age of 17 he perceived a swelling, about the size of a pea, situated midway between the umbilicus and ensiform cartilage; it was unattended with pain, and did not in any way interfere with his duties as a sailor, which was, at that time his occupation; but it gradually enlarged, and in sixteen years had acquired the magnitude of the head of a child, still producing no uneasiness, except from the inconvenience of its size and weight, which was yet insufficient to oblige him to give up his employment. The tumour, however, continued gradually to increase; and in the space of twenty-nine years from its commencement, had acquired such a bulk, as to render him no longer fitted for the sea, or any useful occupation, he being obliged to support the tumour by a bandage passed round the neck; but, even at this advanced period, it was productive of no pain.

At about this time he was attacked with fever, which, to use his own expression, "settled in the tumour;" and from his description, there is no doubt, it became inflamed, with subsequent ulceration on its surface.

The tumour retained sensibility, but evidently not to the degree of the healthy natural parts of the body; for upon one occasion, while sitting before the fire, an extensive portion of the surface of the tumour was burnt, before he was aware of the circumstance. He did not recover from the ill effects of this accident for a length of time.

In this state without any other change than the gradual increase of the tumour, he sustained his disease for forty years, when the tumour had acquired the following prodigious size; measuring one yard and a quarter around its greatest circumference, and eighteen inches around its neck, extending, when he was sitting, down to his knees; it had increased most rapidly during the last three years, but, up to the time of his admission, he expressed no other inconvenience than that of the weight he had to support, which of itself rendered him so perfectly incapable of obtaining his bread, that he was driven to the necessity of its removal; and on the 13th of October 1820, the operation was performed in the theatre of Guy's Hospital, in the following manner:—

The first step of the operation was to draw the tumour to the patient's right side, and then to make an incision through the integuments and cellular membrane at its base; separating the swelling so far from its connexions as to be enabled to ascertain that it was not connected with hernia, or in any way with the abdomen; but in this investigation it was found, that a considerable portion, much more sensitive than the rest of the tumour, did project from the swelling into the umbilicus, but that it was not a hernia. Having ascertained this important point, the remaining part of the operation consisted in a simple dissection, with the application of ligatures to the veins which were of considerable size, and bled freely, and to the arteries, which, considering the bulk of the tumour, were not so much enlarged as might have been reasonably expected. The patient lost but an inconsiderable quantity of blood during the operation.

The weight of the tumour was taken immediately after its removal, which independently of the blood which it contained, was 37lbs. 10 oz.

No bad symptoms followed the operation, excepting a slight pain in his head on the second day. The wound healed partly by adhesion, but principally by granulation; in eight days he was sufficiently well to rise from his bed, and to walk in his ward.

In order to ascertain the relative weight of the tumour of the patient, my apprentice, Mr. D. Babington, weighed him after his complete recovery, and found that the tumour was rather more than one-fourth the weight of the man. Had this experiment been tried before the operation had been performed, it would of course have been attended with a more correct and satisfactory result.

The tumour is preserved in the Museum at St. Thomas's Hospital.

[MEDICO-CHIRURGICAL TRANSACTIONS, VOL. XII.]

Account of a Stone and of a portion of Catheter extracted from the Female Bladder by a Dilator. With an Appendix by Mr. Chapman of Wandsworth, and by Mr. Birt of Diss, Norfolk, on the Removal of a Catheter and of a Stone from the Female Bladder by Dilatation. By Sir Astley Cooper, Bart. F. R. S. *Surgeon to the King, and Surgeon to Guy's Hospital.*

THE dilatability of the female urethra, or meatus urinarius, is established by papers in the volumes of the Society's Transactions, by Mr. Thomas, Mr. Travers, and by myself; and it only remains that it should be considered, if better means cannot be devised to produce its dilatation than the introduction of sponge tent into the urethra, which is liable to the serious objection of its requiring to be borne for several hours, and during that time exposes the patient to the pain and inconvenience of retention of urine. I therefore resolved, on the first opportunity, to employ an instrument, constructed upon the principle of the speculum ani and speculum oris, to enlarge the passage to the bladder; and which would have the advantage of permitting the escape of the urine, whilst it dilated the urinary canal sufficiently to allow of the admission of forceps into the bladder, to extract a stone of considerable dimensions.

An opportunity was soon afforded me by the kindness of Dr. Nuttall and Mr. M'Nab, who requested me to visit a patient of theirs, suffering under the symptoms of calculus.

CASE I.

Mrs. M'C——. I accompanied Dr. Nuttall and Mr. M'Nab to visit this lady, who had been for six months labouring under extreme irritability of her bladder, and such pain and interruption in passing the urine, as to lead those gentlemen to believe she had a stone in her bladder. Upon passing the sound I immediately discovered a stone, which Dr. Nuttall and Mr. M'Nab could distinctly hear. I informed the patient of the nature of her disorder, but assured her I could remove the stone without the use of any cutting instrument, and she had no difficulty in submitting to its extraction. In my return home I called upon Mr. Weiss, in the Strand, and requested him to make me a speculum to dilate the meatus, and he, with his accustomed ingenuity, immediately suggested an instrument infinitely better devised than any I could have contrived for the purpose.

On the 7th of January, 1822, the above medical gentlemen accompanied me to the house of our patient, and at eight o'clock in the morning I introduced the dilator. At four o'clock in the afternoon of the same day I removed the instrument, and readily introduced my finger into the bladder by the meatus, which was sufficiently dilated for that purpose, and directly felt the stone. I then passed a pair of forceps into the bladder, and immediately grasped the stone with them, and extracted it. The stone was soft, and its outer shell separated from its interior; I therefore passed a pair of flat forceps into the bladder, and removed the larger fragments of calculus; but for several days some small portions passed away with the urine.

During the removal of the stone she was resting across the bed, unconfined by bandages.

For a few days after the operation she had a severe attack of irritative fever, which required Dr. Nuttall's attention, and she was obliged to lose blood, and to have the abdomen fomented; but I had the pleasure of seeing her gradually restored to health, having never lost the power of retaining her urine; and young, and but recently married, a constant distillation of urine from the bladder, would have been an evil greater than death itself.

From the facility with which the meatus yielded to the dilator, in the foregoing case, it seemed that no absolute necessity existed for the lapse of several hours before the instrument was withdrawn, and the attempts at extraction made; and I therefore determined in a future case, to dilate the meatus for a few minutes only, and then to extract any extraneous body which the bladder might contain.

CASE II.

On Monday, the 24th of March, I was requested by Mr. Ilott, of Bromley, in Kent, to visit a patient of his, residing in West Square, St. George's Fields, who had been occasionally subject to retention of urine, for which she had been under the necessity of employing the catheter, the introduction of which, she was enabled to accomplish for herself; but the last time she introduced it the catheter broke, and a part of it remained in the bladder. Excessively alarmed at the circumstance, feeling much pain in making water, and great uneasiness at the extremity of the meatus in walking or in exercise in a carriage, she mentioned the case to Mr. Ilott, who advised her to submit to the extraction of the broken instrument. In the presence of Mr. Ilott I performed the following operation:—

The patient was placed across the middle of a bed, with her head raised upon a pillow, her knees were separated and bent back to her chest, in which position they were held by a nurse, without the aid of bandages, or necessity for other means of confinement.

I then passed the dilator into the meatus urinarius, and turning its screw, I readily dilated the passage to admit my finger. The dilator was retained for two minutes only, when I passed a pair of forceps between its blades into the bladder, whilst Mr. Ilott withdrew the dilator.

The catheter not being immediately felt with the forceps, I removed them and passed in my finger, when I felt the broken catheter upon the portion of the bladder above the rectum, and having raised it from thence into the axis of the bladder and meatus, I again passed the forceps, and readily extracted it.

This lady suffered very little during the operation; it was very quickly accomplished; her urine passed involuntarily until her next menstrual period, when she recovered the natural power of retention.

REMARKS.

The advantages derived from this mode of operating, in comparison with that by the knife or gorget, consist

First, In the facility with which it is executed. A knowledge of anatomy beyond that which every surgeon possesses who has been educated within the last twenty years, in this metropolis, is not required for it. Indeed, I believe that any surgeon, who practises as an accoucheur, would not hesitate to perform it.

Secondly, It is attended with but little danger; unless the dilatation be violently made, and the instrument be left in the meatus for a length of time; then contusion and irritation might be produced by it, which, in an irritable person, would lead to fever; and perhaps, inflammation of the bladder.

Thirdly, It may be accomplished with very little pain, and in a short time; but still, further experience will be required to determine if it be best to dilate the meatus in a few minutes, or hours, or in several days, by more gradual dilatation. I feel disposed to believe, that if the stone be small, the dilatation should be accomplished in a few minutes; but if it be large, it will be better to dilate but little, from day to day, until the greatest degree of extension is accomplished; carefully avoiding contusion, which is much to be dreaded.

Fourthly, But its greatest advantage is in the preservation of the powers of retention of urine; for if the operation destroys this power, as that by incision does, I can scarcely acknowledge it to be of value, for although it is the means of removing the pain produced by the stone, it exposes the patient to great suffering from excoriation, and with every attention to cleanliness, the constant distillation of urine renders the patient offensive to all around her.

ASTLEY COOPER.

APPENDIX.

I have long ago received the following cases from two medical friends; but have had no opportunity of making them known; but as they possess considerable interest, I shall beg leave to insert them as an appendix to this paper.

Wandsworth Dec. 29th, 1817.

DEAR SIR,

Finding by a perusal of the Second Part of the last Volume of the Medico-Chirurgical Transactions, that the subject of the dilatability of the female urethra has occupied your speculations; I am induced to send you a catheter, which (as its tarnished appearance will indicate,) remained nearly three weeks in the bladder of a female, it having been allowed to slip in, in consequence of the operator leaving his patient's bed-side to reach a basin from a table; the bladder at the same time being much distended with urine. The extraction of this instrument was effected by the agency of the finger alone, without any previous process of the sponge tent, and though not without difficulty, yet with comparatively little pain to the patient, notwithstanding it was done under circumstances the most unfavourable, it being necessary to conceal both from the patient and her friends, the real nature of the accident. I had no notion the canal would dilate so readily, until having repeatedly introduced a common forceps without effect, I was led to try my little finger, in order to ascertain with greater certainty, the precise situation of t.e catheter, when finding it pass pretty readily I introduced the forefinger of my right hand, till it came in contact with the handle of the instrument, which I gently raised and conducted toward the orifice of the meatus, when by a combined movement of my right hand finger in the bladder, and my left hand upon the abdomen, I succeeded in extracting the instrument without my patient or any body else being at all aware of what I was doing. I merely mention this as additional evidence, if any were necessary, of the facility with which dilatation of the urethra may be effected, and as confirmation of the propriety of the practice pursued in Mr. Thomas's case of the ivory ear-picker, whose patient must be congratulated upon her fortunate escape from the effects of the bistourie cachée.

Should this account be of any use in encouraging surgeons to adopt the practice of dilatation, in cases of calculus, in preference to the more painful and hazardous operation of cutting, you are at liberty to make what use you please of it, or if that should be thought necessary, I would draw up a statement of the case at length.

I am, my dear Sir,
with the greatest respect,
your obliged and obedient servant,
THOMAS CHAPMAN.

P.S. I have a calculus in my possession, of pretty large size, which I took from the urethra of a male, by excision, when within four or five inches of the extremity of the glans penis; the man not knowing up to the time of the operation that he was subject to stone, never having felt any previous pain or difficulty in voiding his urine.

A Case of artificial Dilatation of the Female Urethra, &c. By George Birt, Esq., *Member of the Royal College of Surgeons.*

In January, 1814, I was consulted by Mrs. Borton, a small woman of relaxed habit, about forty-five years of age. Her various symptoms led me to suppose she had a stone in the bladder, and I urged the necessity of an examination to ascertain whether my conjecture was correct, but she positively refused it, alleging that a physician she had consulted had done it repeatedly, without being able to detect any stone: as she would not accede to my proposal I declined visiting her.

On the 30th of April her husband came to me very early in the morning and informed me that his wife was in excruciating agony, which arose from her not being able to pass any urine for many hours, and requested my immediate attendance upon her. Upon my seeing her, I found the bladder was very much distended, and I stated the immediate necessity of my drawing off the urine with the catheter, with which she very readily complied. Upon my introducing the catheter into the bladder, I distinctly heard and felt it strike against a calculus, which receded, and about four pints of urine was drawn off. I then stated to her the necessity of her having the stone extracted; and she told me she had been advised by a medical gentlemen to go into the Norfolk and Norwich Hospital, to undergo the operation of lithotomy, to which she objected. I assured her I had every reason to believe I could extract it without cutting, and she greatly wished me to do every thing I thought right for her; I then left her with the promise of seeing her the following day; but in the evening her husband again came, and informed me his wife was in the same situation as when I went to her in the morning and begged me to go to her assistance immediately. Upon my arrival she told me she had not passed any urine since I left her, and was in very great pain from distortion of the bladder. Upon passing the catheter I struck against a stone as in the morning. I then placed her in the situation for lithotomy, and passed a probe into the bladder, I then passed another probe into the bladder, and very gently dilated the urethra, which in a few minutes allowed me room to pass in a pair of forceps and lay hold of a stone. I then passed the fore-finger of my left hand along the vagina, and kept the stone from slipping back into the bladder; in less than ten minutes I extracted it. I passed a catheter into the bladder, to ascertain whether there were any more stones. As soon as the catheter had entered the bladder it struck against another stone, which I distinctly felt by introducing my finger into the bladder through the meatus urinarius. I introduced the forceps a second time into the bladder and grasped another stone. My finger was passed into the vagina as before; but this stone being larger than the first, was not quite so easily extracted, and the woman growing quite impatient, and my not having sufficient assistance to keep her quiet, induced me to touch the orifice of the meatus with the point of a lancet, which immediately gave exit to the stone; the incision which I made was not more than the eighth of an inch in length, and could I have prevailed upon her to have been quiet a few minutes longer, I am certain the stone would have been as easily extracted without this slight incision.

I was not half an hour from the commencement till I extracted both stones. Upon sounding the bladder a third time, no more stones could be detected.

I directed her an opiate, and upon calling the following day found she had not been able to void any urine. I introduced the catheter, and the next day she could retain her urine and expel it whenever she wanted, without any inconvenience, and was able to attend to her domestic concerns. She has remained up to the present time perfectly well.

Diss. Norfolk,
Dec. 19, 1817.

[MEDICO-CHIRURGICAL TRANSACTIONS, VOL. XII.]

Further account of the Extraction of Calculi, from the Bladder, without the use of any cutting instrument. By Sir Astley Cooper, Bart., F. R. S. *Surgeon to his Majesty and Surgeon to Guy's Hospital.*

IN a former Volume of these Transactions, I had the honour of stating that an idea had occurred to my mind, that calculi might be extracted from the bladder by forceps introduced by the urethra; and that by the ingenuity of Mr. Weiss, Surgeons' Instrument Maker, I was provided with an instrument well calculated to carry my idea into effect. From the Rev. Mr. Buller, of Barnwell, Cambridgeshire, I extracted more than eighty calculi; but I had not flattered myself with the hope that opportunities of using this mode of relief would often occur, and I have, therefore, received great additional gratification from being able so soon to add three cases to my former account, for one of which I am indebted to my excellent and intelligent friend Mr. Brodie.

Saville Row, Nov. 10, 1822.

DEAR SIR,

I HAVE much pleasure in sending you the following history of a case, in which I was led to adopt a method of treatment which was originally proposed, and successfully practised, by yourself.

Your's truly,

B. C. BRODIE.

To Sir Astley Cooper Bart.

A gentleman, seventy years of age, came to London in the spring of the present year, complaining of the following symptoms. He had frequent desire to void his urine; the act of voiding it was attended with more or less difficulty, so that he sometimes required the introduction of the catheter; he had a good deal of pain during and after each attempt to make water; and, at different periods, he had passed several small oval calculi. He consulted Dr. Baillie, who referred him to me, for the purpose of having his bladder examined. On introducing a sound, some calculi were distinctly felt, previous to the instrument entering the bladder; and on an examination being made from the rectum, a number of calculi were perceived in the situation of the prostate gland, apparently contained in one cyst, and sliding on each other, under the pressure of the finger. In a consultation between Dr. Baillie and myself, it was determined that I should endeavour to extract the calculi, which seemed to be of a moderate size, in the manner which you have described in the XIth Volume of the Medico-Chirurgical Transactions. On the first introduction of a pair of forceps, made by Mr. Weiss, I removed two very small calculi only; but, in the second attempt, I was more successful, and as many as six or seven were brought away, of a larger size. The operation was repeated about ten or twelve times, at various intervals between the middle of June and the end of July; and, in all, about sixty calculi were extracted. These were of various sizes, a few not larger than a pin's head, a great number of the size of ordinary peas, but of an oval shape, and some of them considerably larger. The largest measured half an inch in one diameter, and five-eighths of an inch in the other, and had four sides and angles; and it was not until after two or three trials that I succeeded in removing it. In each of these unsuccessful trials some small fragments were broken off by the instrument, and it was in consequence of its being thus diminished in size that I was at last enabled to extract it. At the end of July, the symptoms were very much relieved, and no more calculi could be discovered, either with the sound or with the finger from the rectum. There was, however, still some degree of irritation, which led to the suspicion of some concretions being still left. Unfortunately our patient's private affairs prevented his remaining longer at this time in London, and he set off on his journey homeward. When he had travelled about thirty miles, he was seized with some difficulty in voiding his urine, which led him to return to London, and apply to me again. I discovered a calculus lodged in the membranous part of the urethra, which was readily extracted. It was of an oval form, about the size of a small horse-bean. On the following day, he resumed his journey.

On the 11th of August, he wrote to me from his own house, in the northern part of the kingdom, that he was again troubled with much sense of irritation, that he had a good deal of difficulty in making water, and that the urine deposited the same ropy mucus as formerly. In consequence, I recommended him to apply to an eminent surgeon at Liverpool, for the purpose of having it ascertained whether any calculi remained, and that those might be extracted in the same manner as the others. Since then, however, I have received the following communication from him, dated the 11th of October: "Since I last wrote to you I have passed three very large round calculi, which, for some time, tormented me much. One of them was squeezed out of the urethra by the finger, the other two were passed in the same night in making water. I have, since that time (which was nearly a month ago,) been very much easier, and continue so, although I believe more calculi yet remain, which, in time, I trust, may pass off without my having again recourse to the instrument.

The following case is in part detailed from the patient's account of his symptoms, and in part from the statement of Sir Gilbert Blane, who is the patient's physician.

CASE II.

SIR WILLIAM B——'S ACCOUNT OF HIS CASE.

"Sir William B. is in his sixty-seventh year: he suffered much at times from long and severe attacks of gout from about his thirty-fifth to his sixtieth year; since which period, the attacks have been much less frequent, much mitigated, and of short continuance. He thinks he first perceived red gravel or sand to come from him occasionally, soon after a long fit of the gout, about seven or eight years since, but did not suffer much inconvenience from it. About four years since, he passed pieces of gravel at different times, and has continued occasionally to do so ever since, sometimes larger than a pea, but generally of an oblong shape. When they occasioned any stoppage in the passage, he used a hot bath at 94°, and drank plentifully of some diluting drink, which, after a little time, succeeded. In the summer of the year 1820, having had occasion to use a great deal of walking exercise in London for three or four days, he was much surprised on passing, first, a considerable quantity of very dark

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stuff, nearly like coffee-grounds, and afterwards, a considerable quantity of what appeared chiefly blood. He did not experience any pain of consequence with this, and, by the following day, his urine was as clear as before. Upon going into the country, he found that if he rode fast at any time, it brought on the passing of the dark stuff, and afterwards, if persisted in, of blood. By degrees he gave up riding, and finally ceased to ride about Christmas last; and finding the same effects to arise, in a slighter degree, from walking much, he has very much given up that also for the last six months. Sir Astley Cooper and Sir Gilbert Blane attended him for these symptoms in June and July, 1821, when he left London for Ireland. Whilst there, he continued to experience the same inconvenience as before, with but little pain, and the same on his return to London. Early in June last, he called on Sir Astley Cooper, to say he was going again to Ireland, and wished to have some conversation with him, when Sir Astley Cooper advised his being sounded, which he then was, and it was ascertained that there was a stone. As it appeared to Sir Astley Cooper to be a small one he proposed trying to extract it, and, on the fourth trial, with intervals of a week or so between them, a stone weighing seventeen grains and a half was extracted on the 18th of July. About three weeks after, Sir William, having some fears that there still remained some stone behind, again applied to Sir Astley Cooper, who, upon sounding, found that such was the case; and on making at that time at his own house, an attempt to extract, he brought it part of the way, but found it too large to bring forward, and therefore returned it; and as soon after as the parts would permit, he commenced enlarging the passage by bougies, which he continued at intervals for nearly a fortnight, and then extracted a stone weighing fifty-four grains, on the 28th of August, 1822."

Sir William B. suffered pain in making water, swelling of the corpus spongiosum, at the scrotum, with considerable urethral discharge, until September 23d, when the symptoms subsided under the application of fomentations and poultices.

When the size of the stone is observed, it will not excite surprise that I had considerable difficulty in extracting the larger, which weighed fifty-four grains, and which I have sent for the

Society's inspection. It was in that part of the urethra near the glans that the chief impediment was found ; and if I had thought it proper to do so, I could have easily removed it from thence by incision, but I preferred completing the extraction without occasioning a wound ; yet I am now disposed to believe that, in a stone of equal magnitude, it would be better to make a small incision into the urethra anteriorly to the scrotum, than employ force for the extraction of the stone through this narrower part of the urethra.

A. C.

Sackville Street, 11*th Dec*., 1822.

DEAR SIR,

In compliance with the wish which you expressed that I would state what I knew concerning the case of Sir William B., the interesting subject from whom Sir Astley Cooper had extracted, by the urethra, the largest calculus which had ever been removed from the bladder in that manner, I have consulted my notes concerning it. I find that I have at various times, attended that gentleman for more than twenty years. He states himself from memory, that he had been subject to gravel for seven years, which accords with my notes, the first appearance of the complaint having been in July, 1815. He found speedy and effectual relief from a short course, consisting of two scruples of subcarbonate of potash twice a-day, half neutralized with lemon juice and combined with hemlock and extract of poppy*. He had returns of it in the three following years, all of which were removed by the like means, except that in one of the attacks, magnesia was substituted for the potash. After this he remained nearly free from the complaint for two years, but it returned in the month of May, 1820. The same remedies were had recourse to, but without the same success, for after several weeks' trial, the symptoms were rather aggravated, I then found that I had not been sufficiently vigilant in examining the colour of the sand ; for though it was red at its

* See this method of cure fully detailed in an article in the Third Volume of Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, 1812, by Sir Gilbert Blane. Also in an article in Select Dissertations by the same author, Lond. 1822.

re-appearance on this occasion as it had been on all the former occasions, I now found, on inspection, that it consisted of sand of white colour. This accounted for the want of success from the alkaline medicines, and immediately the muriatic acid was ordered in the dose of seven minims, combined with seven minims of vinum opii, three times a-day, duly diluted. Sensible relief was experienced in the course of nine days, and, in fourteen days, he was free from complaint. In the course of the following year, in place of sand, small *calculi* were passed after pretty severe pains in the region of the kidneys. These calculi were red internally, and white on their external parts. But having passed great part of his time in Ireland in the course of this year, the history of the treatment is not well ascertained; but the history of the symptoms is very distinctly related by himself, till the period of the operations detailed by Sir Astley Cooper.

The history of this case will at first sight, suggest doubts unfavourable to the character of the remedies that have been employed in the treatment, for it cannot be denied that, in spite of them, concretions had formed, of such formidable magnitude, that had it not been for the new method, so happily conceived and so skillfully executed by Sir Astley Cooper, the patient would have been subjected either to the sad sufferings of the stone, or to the pain and danger of lithotomy. But in answer, let it be remarked, first, that the relief from the remedies was so speedy and so frequent that no doubt can be entertained of their efficacy; and if the prosecution and seasonable repetition of them had not been interrupted by his frequent and long residences in Ireland and on the continent, there is good reason to believe that the cure, in place of temporary, would have proved permanent and radical, as I have observed it to be in similar cases which had been perseveringly treated in this manner. Secondly, much suffering was prevented by the imperfect use of these remedies; for upon questioning him, he says, that he never had any real pain in the bladder, but only an uneasiness, and that the only suffering deserving the name of pain was in the kidneys, and, on one occasion, in the urethra, from the passing of a stone, only one that had a rough surface. It is no small recommendation of these remedies, that by preventing additional accretions, the stone becomes smooth, and gives little or no pain, as was eminently exemplified in the case of Lord Walpole, related by Dr. Whytt, about seventy years ago, when the caustic, alkalies, soap and lime-water, were first introduced. In this case the freedom from pain was such for several years before death, that the stone was supposed to have been dissolved; but a pretty large one with a smooth surface, was found after death.

Though there may be ocasional failures, therefore, in the full effect of these remedies, such as are incident to all remedies, let us not undervalue the new resources which have recently been devised by chemistry and surgical skill, for the relief of one of the most painful, and, hitherto, untractable maladies incident to humanity. Mankind is deeply indebted to Dr. Wollaston, for the clear light in which he has placed the diversity in the composition of urinary concretions, upon which is founded a corresponding diversity, and even contrast, in the quality of the remedies. Nor does the world owe less to Sir Astley Cooper, for this new method of extracting *calculi* of such size by the urethra, by which, in innumerable instances hereafter, the most severe sufferings and dangers may be averted; and this method has this advantage over internal remedies, that it is applicable to *calculi* of every composition, whereas there are certain species of them, such as those composed of oxalate of lime, upon which neither alkaline nor acid medicines produce any effect.

A question arises on a collateral circumstance in the history of this case, namely, whether or not the great and long-continued alleviation of the gouty complaints may be attributed to the use of the alkaline remedies?

I am, dear Sir,
with great regard,
Your most faithful and obedient Servant,
GILBERT BLANE.

To Dr. Cooke,
President of the Medico-Chirurgical Society.

CASE III.

Mr. William King, aged sixty-six, mariner, residing at Rochester, was sent to me by Mr. Newsom, Surgeon, of Rochester, on account of his having symptoms of the stone.

He came to London on the 29th of October, 1822, and on the 30th he visited me. I sounded him and found that he had, as Mr. Newsom supposed, calculi in the bladder. I passed the urethral forceps into the bladder, and, in a few minutes, extracted four calculi; and although I could still perceive that some remained in the bladder, I did not choose to risk the production of any considerable degree of irritation, but advised him to come on November 1, to have the operation repeated.

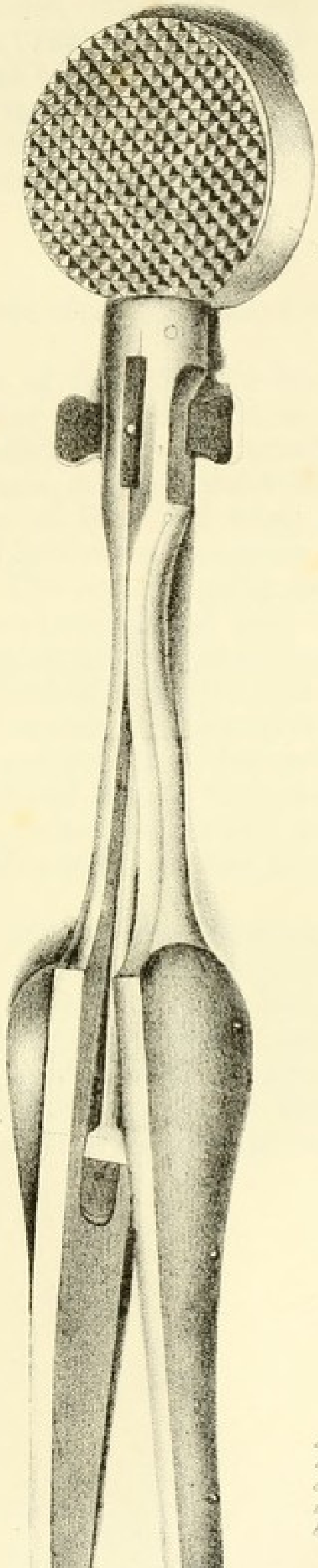
On the first of November, I extracted three calculi; on the 4th, five more; on the 7th, twelve calculi; on the 11th, two; and on the 13th, three more. I then examined the bladder with care, but could not perceive any more stones, and even before the removal of the last, he had experienced considerable diminution of the pain in making water, and difficulty in passing it.

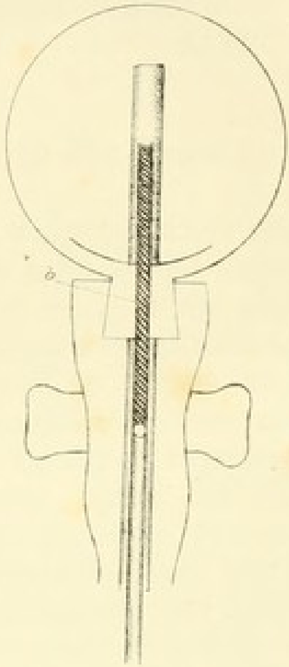
It is delightful to hear the expressions of gratitude which this patient pours forth for the relief which he has experienced from these operations, under which he has suffered but a slight degree of pain, and has never, for a moment, been confined from whatever exercise he was disposed to take.

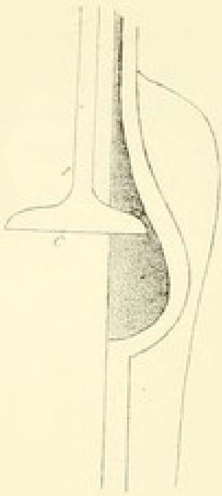
Some years ago he passed red sand (uric acid,) but for several months before he had symptoms of the stone, he has not perceived any.

From Mr. Brodie's patient two other calculi have been since extracted by the same means : and I have lately removed from a young person, a patient of Mr. Rutherford in Radcliffe-highway, of the name of Errington, a calculus of moderate size, and enabled two others to pass, by withdrawing the instrument in its dilated state, and thus extended the urethra in such a degree, that the stones passed, in the afternoon of the same day, in a copious discharge of the urine.

I have heard that it has been stated that there was no novelty either in this idea or in the instrument. To this I have only to observe, that if the idea had previously occurred to any individual, he had so far buried it in his bosom, that I had never heard of it; and as to the instrument, I am quite sure that Mr. Weiss consulted no musty volume for its formation, for so soon as I mentioned my wish that he should construct a pair of forceps by dividing a sound in its middle, and giving it a joint two inches from its end, he, without quitting me, observed, that he should make them to open in the mode which is represented in Plate XXXV. Mr. Weiss has a strong and ingenious mind, and does not use petty artifices to obtain employ-







a. Blades
b. b Screw & Handle.
c. c. The Style, which is drawn back upon the inclined plane of the blades, so as to open them by turning the Screw at b

J. C. French del. *Sinclair's Lith. Phil.ª*

ment or character. But let us for a moment suppose (what I do not believe,) that the idea had occurred to others, and the instrument had been made centuries ago, what are we to say of the apathy of those bright ornaments of their profession, Cheselden, Pott, Hunter, Cline, Home, Blizard, &c., who if they had heard of such an instrument, had never employed it?

A. C.

Result of the Analysis of the Calculi made by Dr. Prout.

THE largest of these calculi, when entire, weighed fifty-four grains, the other seventeen grains. They are both of the same composition, and consist essentially of lithic acid; they also contain ammonia, a little fixed alkali, very minute quantities of the phosphate of lime and triple phosphate of magnesia and ammonia, and, probably, still more minute quantities of the oxalate of lime. The presence of oxalate of lime, however, is rather to be considered as inferred than demonstrated; such calculi, when analyzed on a larger scale, being generally found to contain more or less of this principle. The ammonia and fixed alkali exist, of course, in union with the lithic acid, and the fixed alkali was, very probably, derived from the medicines which had been exhibited during the promotion of the calculi. Both these alkaline principles, as well as the phosphates are chiefly confined to the paler coloured laminæ with which the calculi are stratified.

The nuclei of both calculi resemble each other, and consist, as is usual, of a congeries of highly-coloured nodules, or masses of lithic acid, loosely agglutinated together, and which, as the stone dries, contract, and crack into several portions. Hence, the nuclei of such calculi usually drop out, or fall to pieces, when they are cut through, as was particularly the case with that of the smaller of the present two calculi.

[Surgical Essays.]

Case of Ligature on the Aorta.

I fear that the title of this paper may impress the reader with an idea that nothing could justify me in performing the operation which I am about to describe; for that a ligature made upon the aorta must necessarily prove fatal. But I trust, that it will be seen in the sequel, that the operation was not attended with the immediate danger which might have been apprehended; that the patient complained of but little pain during its performance, that it afforded the only hope of safety, and that we had to lament, not that the operation was performed, but that it had not been sooner done.

Sorry indeed should I be, to sport with the life of a fellow-creature who might repose a confidence either in my surgical knowledge or in my humanity; and I should be equally disposed to consider myself culpable, if I did not make every possible effort to save a person, whose death was rendered inevitable, if a disease were suffered to continue which it was possible for surgery to relieve, as in the case which forms the subject of this essay. In the performance of our duty one feeling should direct us; the case we should consider as our own, and we should ask ourselves, whether, placed under similar circumstances, we should choose to submit to the pain and danger we are about to inflict. Guided by this principle, and having collected all the evidence which applies to the case, we perform our duty without the reproaches of conscience which must await those who unnecessarily subject their patients to pain and danger.

Those who feel disposed to condemn the attempt which I have here described, will have the kindness to recollect, that although my first operation for carotid aneurism proved equally unfortunate with this, yet in the second operation, I was gratified by the successful issue of the case.

In collecting evidence upon any medical subject, there are but three sources from which we can hope to obtain it; *viz.* from observation on the living subject; from examination of the dead; and from experiments upon living animals. By the first, we learn the history of disease; by the second, its real nature, so far as it can be certainly known; and by experiments upon living animals, we ascertain the processes resorted to by nature for restoring parts which have sustained injuries, and then apply that knowledge to accidents in man.

In applying ligatures upon the arteries generally, the only circumstance to be considered is, the probability of the blood being conveyed by means of anastomosis to the parts beyond; but in operations upon those arteries, which are seated in the larger cavities of the body, it becomes a subject of consideration, by what mode the ligature shall be prevented from occasioning destruction. In common parts, it produces suppuration and ulceration, which end in the separation of the ligature; but amidst the vital organs, a suppurative process may endanger life.

The Aorta is so rarely obstructed, that the opportunity of ascertaining the power of anastomosing vessels in propelling the blood is extremely unfrequent. The first impression arising on examination of the structure of the aorta at its curvature would be, that an anastomosis would not be sufficiently free to permit the blood to find its course by circuitous channels; and the only opportunity that I have had of seeing a contracted aorta in the human subject would serve to confirm that opinion: but Mr. Graham has met with a case (which will hereafter be detailed) which shows that even in that part of the aorta, the communication may be sufficient to allow a passage to the blood.

With respect to the case of contracted aorta, which I had the opportunity of seeing, the following are the particulars, as given to me by Mr. Winstone, Surgeon, of Charter-house Square, who solicited me to inspect the dead body:—

"The gentleman who formed the subject of it, was 57 years of age, of a full habit, accustomed to free living, had been in good health for years, excepting in the winter, when he was always troubled with a violent cough; more violent than I ever witnessed in any other person. In the night of April the 7th, 1809, he was affected with cough and difficulty of breathing to a greater degree than usual; and at five in the morning I saw him. He complained of pain under the sternum, the extremities were cold, the countenance exhibited marks of inexpressible anxiety; the pulse was rather weak, but regular, and much altered in frequency. These symptoms continued with but little alteration, notwithstanding cupping on the sternum, blistering and volatile medicines, until about eleven o'clock, when he was prevailed upon to go to bed. He walked up stairs, and fell on the bed lifeless."

Upon our opening the body, the pericardium immediately presented itself, exceedingly distended ; and on making an incision into it, a large quantity of blood was discharged ; upon examination of the heart, one of the coronary veins was found ruptured on the anterior surface of the right ventricle. At first I supposed this was the source of the blood found in the pericardium, but upon more minute examination of the heart, when I had brought it to my house, I found an opening leading into the right ventricle, and that the rupture had begun in this part of the heart and extended through its substance, bursting the vein in its progress. I opened the pulmonary artery, but found it free from disease; the left side of the heart was also healthy, but the lungs adhered in some degree to the inner side of the chest, and a small quantity of fluid was found in each remaining portion of the cavity of the thorax. The finger being thrust into the aorta, opposite to that part at which the *canalis arteriosus* terminates, a stricture was discovered in it, which with difficulty admitted the little finger, and which, on more particular examination, was found to be a thickening of the cellular fibrous structure of the vessel, accompanied with some ossification of its coats. This state of contraction in the aorta impeded the passage of the blood through the heart and lungs, and under the extreme degree of distention thus produced, the right ventricle, from its less power of resistance, gave way, and occasioned the sudden termination of the patient's existence.

The following case has been published in the Medico-Chirurgical Transactions, by Mr. Graham, Physician to the Infirmary, Glasgow.—(Vide Medico-Chirurgical Transactions, Vol. V.)

"The case which I take the liberty of transmitting to the Medical and Chirurgical Society, has, as far as I know, but one parallel on record ; and in it the appearances on dissection only are mentioned ; no history is given of the case. I believe, I have extracted from the books of the infirmary, such parts of the reports taken at the patients bed-side as are of any importance, and have noted some anomalous symptoms which may now appear trifling ; because it may perhaps be found that an improved state of knowledge may give importance to what at present seems adventitious, and without value. I am sorry to say, that as I can see no diagnostic symptom, the occurrence of this derangement adds but another chance to our guessing wrong during life, at the diseases of the heart.

Henry Frere, 14 years of age, a weaver, admitted into the infirmary the 3d of August, 1813, where the following history of his symptoms was entered on the journal of the house:—

"Two weeks ago, after exposure to cold, was affected with dry cough, which for the last eight days has been attended with tolerably copious expectoration and pain, impeding respiration, and excited by the cough, in the left side of the chest; pulse 100, somewhat firm; little appetite; much thirst; tongue rather white; bowels regular; sleeps ill; sweats considerably; has used no medicines."

The disease was regarded as a case of pneumonia, but of such standing, that suppuration seemed to have taken place, and in which, therefore, no material benefit was likely to result from any treatment. However, under the ordinary means, bleeding, blistering, expectorants, and the free use of cathartics, I had the satisfaction of seeing the symptoms decline. The blood from the first bleeding presented somewhat of the buff coat. The pulse, however, generally ranged from 92 to 104, and is variously marked in the reports; full, strong, sharp: it was always regular. The *sputum* became more copious, gross, and tinged with blood. He perspired chiefly from the upper parts of the body, moaned in his sleep, and took little food. On the 8th he was affected with nausea and vomiting. On the 19th he had a febrile attack, which lasted a few days. On the 20th there was much pain in the left eye-ball. On the 27th he complained only of palpitation—the first time that symptom is noticed in the journal, though I rather think this was an oversight. No report was taken from this date till the 6th of October, when he was dismissed from the hospital "cured."

The palpitation had subsided as the strength increased; which encouraged a hope I was willing to entertain, that this symptom proceeded from weakness, though I could not but express fears that the inflammation had extended to the pericardium or the heart. The uncertainty of the diagnosis in cases of this kind, is but too well known to every practitioner. I was inclined to suspect the effusion of serum within the pericardium, or perhaps adhesion of the heart to its capsule, though I had seen at least two cases about that time of the most intimate and general adhesion, without the circulation having been in any degree affected.

These fears were much strengthened by the boy's appearance on returning to the hospital on the 13th of November, when the throbbing of the carotid and subclavian arteries, was very remarkable. On his re-admission, the following report appears on the journal:—

"13*th November*.—Dyspnœa, palpitation at the heart, and pain in the left side of the thorax returned soon after he left the house, and have been gradually increasing; pulse 88, regular; bowels kept open by physic; received temporary relief from the application of a blister."

Blisters and cathartics were again employed, and the symptoms for a time declined. The pain which had been removed, returned to the left side of the chest on the evening of the 29th. A blister was repeated next day, which gave much pain, till he was suddenly seized with a febrile attack on the 2d of December, when the part became quite easy. There was no stranguary. The fever was gone next day. A similar attack, accompanied with nausea and vomiting, was experienced on the 12th, and immediately removed by the operation of an emetic. He had acidity at the stomach, and cardialgia after meals. On the 23d, he is reported as having been affected for ten days with pain in the right side of the chest, increased by motion, and by full inspiration, accompanied by frequent cough, most troublesome in the night. The pulse had again risen; he was blistered, used cathartics, and was twice bled; the blood, especially after the first operation, being very buffy. The pulse subsided, and the pain was removed, but the cough and palpitation continued. The circulation was again quickened on the 27th, and remained hurried till his death; he sunk at length; was drenched in perspiration; took no food; was attacked with frequent vomiting; the urine became sandy; his sleep was disturbed; the dyspnœa and palpitations increased, and he expired about noon on the 2d of January. The pulse, while he was last in the hospital, fluctuated from 90 to 116, and was of various degrees of strength and firmness; latterly only, weak: it was always regular.

Dissection.

There was nearly a pound of serum in the cavity of the abdomen, and the bowels were distended with flatus, but the viscera seemed natural. Immediately on turning up the sternum, the pericardium presented itself very much enlarged, obscuring the lung, and adhering to the pleura costalis. This capsule, which was thin and beautifully transparent, contained about an ounce of fluid, and a heart nearly twice its natural size for a boy of this age. The arteries and trachea were distended above the arch of the aorta; the contents of the thorax were turned downwards; and the aorta, being divided below the whole, was removed from the body. The walls of the left ventricle were about an inch in thickness, but no other derangement in the structure of the heart or its valves, was observed. The capacity of the cavities seemed natural. The aorta expanded unusually near its origin, so as to form a kind of pouch, but after having given off the branches to the head and superior extremities, its diameter was preternaturally contracted. It was continued of this diminished size till after its union with the canalis arteriosus, where it was completely impervious. The coats were not thickened, or in any way diseased, except that about half an inch below the stricture, there was a smooth elevation on the inner surface, less raised, but having nearly the diameter of a split pea; otherwise the appearance was exactly such as if a ligature had been tied tightly round the artery. The obstruction was about a line in breadth. The artery then received three trunks about the size of crow quills, and near them three smaller ones, afterwards resuming its natural size along the vertebræ. These three trunks are evidently the uppermost of the inferior intercostals; their coats were remarkably thin, like those of veins. A probe passed from the pulmonary artery along the canalis arteriosus to the obstructed portion of the aorta; but from its thickened appearance, it did not seem probable much communication by means of it could have been allowed, and the florid countenance of the boy during life establishes the same conclusion. There having been no suspicion of this singular deviation from the natural structure till after the contents of the thorax were removed from the body, it was impossible to trace, with the accuracy that could be wished, the anastomosing branches by which the circulation had been carried on in the inferior parts of the body; but I think enough has been observed to lead us very near the truth. The arteria innominata, the left subclavian, the superior intercostals, and the mammary arteries, were much enlarged. The epigastric was reported to be of its natural size. These facts, and the aorta acquiring at least very nearly its natural size immediately below the stricture, show that the blood did not pass to the inferior extremities, in any material quantity, as might perhaps have been expected, by the inosculations of the mammary and epigastric arteries, but chiefly by the communications of the superior intercostals and the mammary arteries with the three large branches entering the aorta below the stricture: also from the mammaries and thoracics through others of the intercostal and diaphragmatic arteries.

The lungs were very light coloured; the lobes much collapsed. In each side of the thorax there was a small quantity of bloody serum."

After the aorta has formed its curvature, it gives off numerous intercostal arteries within the cavity of the chest; and though these vessels are small, they communicate so freely with each other, that under a gradual obliteration of the aorta, the blood would be still readily transmitted to the inferior parts of the body. An example of this kind is related by Mr. Paris, and is quoted by Mr. John Bell, in his Surgical Observations.

Mr. Paris, Dissector for the amphitheatre of the Hotel-Dieu, in the year 1789, injected the body of a very lean old woman, about 50 years of age, whose arterial system was found to be singularly deranged, and the circle of the blood changed altogether by a complete contraction of the aorta a little beyond the arch. Mr. Paris had his attention particularly excited to the condition of this subject by the unaccountable enlargement of the small arteries upon the fore part of the chest. He had filled the arteries with an injection composed of equal parts of suet and resin, coloured with lamp-black; and this injection, thrown in from the mouth of the aorta, passed along so easily, that far from suspecting an obliteration, he felt that he could have thrown in more injection than is usually required for filling an adult body.

The subject was so meagre, that, without dissecting, Mr. Paris felt the thoracic arteries running down the sides of the chest tortuous and remarkably enlarged. It was natural for him to be very careful in the dissection of this subject. He found the aorta immediately beyond its arch contracted to the size of a writing quill; the coats of the artery were of their usual thickness, and its cavity of course extremely small; the arch of the aorta above this contraction was but very slightly dilated; the part below had lost nothing of its natural size. Nothing could be found either in its own structure, or in the condition of the neighbouring parts, to account for this contraction of the artery.

The carotids were in the natural state; the arteria innominata, and the left subclavian were enlarged to twice their natural diameter; all their smaller branches were increased in the same proportion, and had assumed a curled and zigzag course: the internal mammary and phrenic arteries were greatly enlarged and very tortuous. The transverse arteries of the neck were of twice their natural size; their posterior branches were tortuous, extending to a great distance over the back, with long inosculations which were met from below by the branches of the upper intercostal arteries, and they were also remarkably enlarged; the thoracic and scapular arteries which run along the side of the chest, were twice their natural size.

Below the constricted part of the aorta, the lower intercostals were remarkably enlarged, even to three or four times their natural size; each of them was dilated, but those were most affected which were given off nearest the contracted part; and the posterior branch of each, which penetrates to the muscle of the back, was more dilated than that which runs between the ribs: indeed, those posterior branches were so remarkably dilated with contortions so closely succeeding each other, that they reresembled a necklace of beads; and their inosculations with the branches of the *transversalis cirvicis* were very remarkable. The lower phrenic artery was enlarged, forming considerable inosculations with the superior phrenic; the epigastric artery was dilated to the size of the enlarged mammary, and was joined with it by very numerous and conspicuous inosculations!" This case clearly demonstrates, that the greater part of the blood, usually conveyed by means of the aorta through the thorax, is capable of finding a circuitous course by the branches of the subclavian and intercostal arteries.

With respect to the aorta in the abdomen, I have met with no instance in the human subject of its obliteration or contraction; but if such an event were to occur, little difficulty could arise in the transmission of blood by collateral channels: the mammary and epigastric, the superior and inferior mesenterics, and the lumbar arteries, would furnish abundant opportunity for a collateral course of the blood.

Although in the human subject we are thus deficient in evidence concerning a circuitous circulation in the cavity of the abdomen, yet with respect to other animals, it is probably generally known, that I have several times made ligatures upon the aorta of the dog, and found that the blood was readily carried by anastomosing vessels to the posterior extremities of the animal. Of which experiments an account has been published in the Medico-Chirurgical Transactions.

The incision was, in each experiment, made on the left side of the spine, the aorta was drawn to the surface of the skin by an aneurismal needle, and all the surrounding parts being separated from the vessel, so as to perfectly bare its coats, a ligature was applied around it. An animal under these circumstances was kept for a few weeks, and then killed: being injected and dissected, the lumbar arteries, which were considerably enlarged, were found to be the chief agents of the new circulation. We have a beautiful preparation in the collection at St. Thomas's Hospital, showing the obliterated aorta, and the numerous and enlarged anastomosing vessels which carried on the circulation; thus establishing as far as analogy could go, the possibility of the blood being transmitted in a similar manner in the human subject.

I shall now proceed to detail the circumstances of the case, which forms the principal object of this Paper, leaving the remarks upon the kind of ligature to be employed till a description of the operation has been given.

CASE.

Charles Hutson, a porter, aged 38 years, was admitted into Guy's Hospital April 9, 1817, for a swelling in the left groin, situated partly above, and partly below Poupart's ligament. An obscure pulsation could be perceived in it, and it was concluded to be an aneurism. The history which he gave of himself was, that thirteen months previous to his admission, he had fallen against the corner of a chest, by which accident he received a violent blow upon the left groin, and was so much hurt as to be unable to walk to his home. On the following day, his thigh became so much discoloured and swollen, that he could not rise from his bed.

After a confinement of three weeks, he began to recover, and the limb soon returning to its natural size, he resumed his employment, but was never able to exert that limb with the same freedom as the other: however, he continued to work, though with the greatest difficulty, till within a fortnight of his admission into the hospital: for some time previous to which he had been occasionally troubled with a pricking sensation in the limb, but it was only transient, and seemed to arise from the pressure of the swelling upon the anterior crural nerve. Some degree of swelling had remained in the groin from the time of the accident; and for some weeks previous to his admission, he had been obliged to loosen his clothes on the left side.

At this period the swelling was considerably diffused, several large veins crossed its surface, and pressure upon it gave considerable pain. On the third day after he had been in the hospital, the swelling increased to double its former size, and the pulsation became less distinct, excepting in the course of the iliac and the femoral arteries. The swelling extended from three to four inches above Poupart's ligament, to an equal distance below it, and was of great magnitude. Just below the anterior and superior spinous process of the ilium, a distinct fluctuation could be perceived in the aneurismal sac above Poupart's ligament, so that the blood had evidently not yet coagulated; and the peritoneum was carried far from the lower part of the abdomen, in such a manner as to reach the common iliac artery, and to render an operation impracticable without opening the cavity of the peritoneum. I therefore determined to avail myself of other means, or to wait the efforts of nature towards a spontaneous cure, before I performed any operation; a circumstance which it is well known every now and then occurs.

May 16.—The swelling had suddenly increased; and the pulsation becoming more distinct, twelve ounces of blood were ordered to be taken from the arm.

21.—Pressure was applied upon the fore part of the swelling, by means of a cushion bound down upon it by a broad roller; twelve ounces of blood being drawn from his arm, the patient declared himself to be more at ease.

27.—The pressure upon the tumour being removed, the skin was found abraded and discoloured, with the loss of its sensibility.

30.—In the morning he reported, that he had passed a restless night, and appeared to labour under considerable constitutional irritation. The swelling had very much increased; a tourniquet was ordered to be applied upon it, with directions to adjust it in such a manner as to press upon the aneurism, but upon the surrounding parts as little as possible.

June 1.—He had borne the pressure of the tourniquet tolerably well, but it made no difference in the size of the tumour.

4.—When the tourniquet was loosened, a slight ulceration of the skin over the sac was observed, and it was therefore ordered not to be re-applied.

5.—He complained of the limb feeling so excessively heavy, that he had difficulty in raising it. The skin over the aneurism is showing a disposition to slough.

19.—A slough was observed on the exterior part of the swelling below Poupart's ligament, which had nearly separated with a deep ulceration around it.

20.—At ten in the morning he had a bleeding from the external part of the sac, but the loss of blood was not considerable. A compress of lint was applied, and confined by adhesive plaster. He had no return of bleeding on the following day.

22.—At 7 o'clock in the morning, after some slight exertion, he bled again ; but still the bleeding was not profuse.

24.—The bleeding again recurred, but stopped spontaneously.

25.—About half-past two o'clock in the afternoon, in consequence of a sudden mental agitation, he bled profusely. My apprentice, Mr. Key, fortunately succeeded in preventing his immediate dissolution by pressure, but the man was so much exhausted, that the fæces were passed involuntarily.

At 9 o'clock the same evening I saw him, and found him in so reduced a state, that he could not survive another hemorrhage, with which he was every moment threatened. Yet, still anxious to avoid opening the abdomen, to secure the aorta near to its bifurcation, I determined to ascertain whether it were practicable to pass a ligature around the artery from within the aneurismal sac; for I was of opinion, that if the artery had given way near the centre of the sac, as it usually does in aneurism, I might compress it with my finger, and pass a thread around it. With this view, I made a small incision upon the aneurism, about two inches above Poupart's ligament; and having made a very small opening into the sac, I passed my finger easily into it, and felt for the artery upon which it was formed; in doing which, my finger so completely filled the opening, that it prevented the escape of any blood by its side. I moved the finger to feel for the artery, but found only a chaos of broken coagula, and that the artery entered the sac above and quitted it below, without there being any intervening portion of vessel; and therefore, was constrained to abandon that mode of operation. When I was about to withdraw my finger, I directed two of the students to compress with their hands the aorta upon the spine, and they succeeded in stopping the pulsation in the artery of the right groin. As I withdrew my finger, I put a dossil of lint by its side, and closed the opening which I had made into the sac.

It is proper here to observe, that the aperture made into the aneurism by the sloughing process, was situated too far from the natural seat of the artery, to allow a hope of my finger reaching it from thence. As I was quitting the patient's bed-side, I felt a great regret, in which all the students by whom I was surrounded joined me, that the patient should be left to perish, without giving him the only chance which remained of preventing his immediate dissolution from hemorrhage, by tying the aorta; and I therefore said, "Gentlemen, this only hope of safety I am determined to give him."

The operation was performed as follows: The patient's shoulders were slightly elevated by pillows, in order to relax, as much as possible, the abdominal muscles; for I expected that a protrusion of the intestines would produce embarrassment in the operation, and was greatly gratified to find that this was prevented by their empty state, in consequence of the involuntary evacuation of the fæces; and here let me remark that I should, in a similar operation, consider it absolutely necessary, previously to empty the bowels by active aperient medicines.

I then made an incision three inches long into the linea alba, giving it a slight curve to avoid the umbilicus: one inch and a half was above, and the remainder below the navel, and the inclination of the incision was to the left side of the umbilicus. Having divided the linea alba, I made a small aperture into the peritoneum, and introduced my finger into the abdomen; and then, with a probe-pointed bistoury, enlarged the opening into the peritoneum to nearly the same extent as that of the external wound. Neither the omentum nor intestines protruded; and during the progress of the operation, only one small convolution projected beyond the wound.

Having made a sufficient opening to admit my finger into the abdomen, I then passed it between the intestines to the spine, and felt the aorta greatly enlarged, and beating with excessive force. By means of my finger nail, I scratched through the peritoneum on the left side of the aorta, and then gently moving my finger from side to side, gradually passed it between the aorta and spine, and again penetrated the peritoneum on the right side of the aorta.

I had now my finger under the artery, and by its side, I conveyed the blunt aneurismal needle armed with a single ligature behind it; and my apprentice, Mr. Key, drew the ligature from the eye of the needle to the external wound; after which the needle was immediately withdrawn.

The next circumstance, which required considerable care, was the exclusion of the intestine from the ligature, the ends of which were brought together at the wound, and the finger was carried down between them, so as to remove every portion of the intestine from between the threads: the ligature was then tied, and its ends were left hanging from the wound. The omentum was drawn behind the opening as far as the ligature would admit, so as to facilitate adhesion; and the edges of the wound were brought together by means of a quilled suture and adhesive plaster.

During the time of the operation, the fæces passed off involuntarily, and the patient's pulse, both immediately, and for an hour after the operation, was 144 in a minute; he was ordered thirty drops of tincture of opium and camphorated mixture, and the involuntary discharge of fæces soon after ceased. I applied my hand to his right thigh immediately after the operation, and he said that I touched his foot; so that the sensibility of that leg was very imperfect.

For the following particulars I am indebted to Mr. Cox, one of my apprentices.

At midnight his pulse was 132.

26.—At one o'clock in the morning, the patient complained of heat in the abdomen, but he felt no pain upon pressure; he said that his head felt hot, and that he had pain in the shoulders; his lower extremities, which were cold soon after the operation, were now regaining their heat; his body was in other parts covered with a cold sweat. The sensibility of the lower extremities has been very indistinct since the operation.

At 2 o'clock, he felt so comfortable from his medicine that he wished to have more of it, and ten drops of tincture of opium were given him; his legs were wrapped in flannel, bottles of hot water were applied to the feet, and he then said that the heat of his belly was lessened.

At 6 o'clock the sensibility of his limbs was still imperfect.

At 8 o'clock A.M. he expressed himself as feeling quite comfortable; he however passed no urine, and had no evacuation;

his right limb was warmer than the left, and the sensibility was returning.

At noon the temperature of the right limb was 94, that of the left or aneurismal limb 87½.

At 1 o'clock, P.M. Mr. Cooper visited him, and as he walked up the ward he appeared much gratified at seeing his patient, who was at the point of death the evening before, and who was now adjusting his bed-clothes, and smiled as Mr. C. approached his bed.

At 3 o'clock after a fit of coughing, the man was much alarmed with the idea of the thread having slipped into the wound: it was a false alarm; but, to prevent the idea of its occurrence, it was fastened to a quill: soon after this he complained of pain in the abdomen; it was not very severe, nor did it last long; readily yielding to fomentations. As he had no evacuations, he was ordered an enema.

At 6 o'clock, P.M. he vomited, soon after the glyster had been administered: the heat of the right leg was 96, that of the left or diseased limb 87½.

At nine in the evening he took half a glass of port wine in warm water, which he immediately rejected: he complained of pain in the loins; his pulse was 104 and feeble; he was very restless, and had an involuntary discharge of fæces.

Eleven at night, his pulse 100 and weak; he still vomited.

27.—At 7 A.M. the report was, that he had passed a restless night; the vomiting had returned at intervals; his pulse 104, weak and fluttering; he complained of pain all over his body, more particularly in his head; and the carotids beat with considerable force: he had great anxiety expressed in the countenance, was very restless, and the urine dribbled from him, with some degree of pain at the end of the penis.

At 8 o'clock, A.M. the aneurismal limb appeared livid and felt cold, more particularly around the aneurism, but the right leg remained warm.

At 11 o'clock his pulse was 120 and weak; he appeared to be sinking. To the questions which were put to him he did not return any answer; he appeared to have an uneasiness about the heart as he kept his hand upon the left breast.

He died at 18 minutes after one, P.M. having survived the operation 40 hours.

After being informed of his death, I requested Mr. Brookes of Blenheim Street to attend with me at the inspection of the body. Mr. Travers, surgeon of St. Thomas's Hospital, Mr.

Stocker, apothecary of Guy's, and a large concourse of medical students attended the examination.

When the abdomen was opened, we found not the least appearance of peritoneal inflammation, excepting at the edges of the wound. The omentum and intestines were free from any unnatural colour; the edges of the wound were glued together by adhesive inflammation, excepting at the part at which the ligature projected. We were much gratified to find that the ligature had not included any portion either of the omentum or intestine: the thread had been passed around the aorta about $\frac{3}{4}$ of an inch above its bifurcation, and about an inch or rather more below the part at which the duodenum crossed the artery. Upon carefully cutting open the aorta, a clot of more than an inch in extent was found to have sealed the vessel above the ligature; below the bifurcation, another, an inch in extent, occupied the right iliac artery, and the left was sealed by a third which extended as far as the aneurism; all were gratified to observe the artery so completely shut in 40 hours. The aneurismal sac, which was of a most enormous size, reached from the common iliac artery to below Poupart's ligament, and extended to the outer side of the thigh. The artery was deficient from the upper to the lower part of the sac, which was occupied by an immense quantity of coagulum.

The neck of the thigh-bone had been broken within the capsular ligament, and had not been united.

Upon consideration of all the circumstances of the case, to what are we to attribute this man's death? It did not arise from inflammation, for the viscera of the abdomen were perfectly free from it.

His death appears to me to have been owing to want of circulation in the aneurismal limb; for although the warmth of the other limb was preserved, that on which the aneurism was seated never gained its natural heat, which must have arisen from the great bulk of the aneurism, and from the disturbed state of the coagulum which it contained, which would prevent the free course of the blood through the aneurismal sac. That limb never recovered its natural heat, there being seven degrees difference between the two extremities; the sensibility also in the right limb was returning, which did not appear to be the case in the left. In an aneurism therefore similarly situated, the ligature must be applied before the swelling has acquired any very considerable magnitude.

There is still a circumstance, however, that remains to be decided respecting a ligature upon the aorta; which is, in what manner it is to be afterwards separated: whether it should be left suspended at the wound, or cut off close to the vessel: whether the *presse-artere* of that ingenious surgeon Mr. Crampton should be employed; or some unusual material should be used as a ligature. Although the patient whose case I have here given, did not suffer from inflammation of the abdomen, yet I should much fear that if he had lived longer, an extraneous substance suspended amidst the intestines would have produced that effect.

My friend Mr. Lawrence has proposed that the silk usually employed for ligatures should be cut off close to the knot, so as to heal the wound over it. It has occurred to me that catgut would answer the purpose better, and I shall give the result of the trial which I have made, wishing it to be understood that I consider the subject at present as undecided, and only as one for future investigation.

Catgut, employed as a ligature, being more of the nature of the animal matter in which it is embedded, will be more easily absorbed than silk; or, if even not absorbed, will be less likely to excite irritation in the parts.

I have reason to hope that the following case will be considered as highly interesting and important, as the operation was performed upon a person so advanced in life as to lessen the hope which would have arisen from the more usual operation for aneurism.

I performed the operation at Guy's Hospital, where the patient, who is the subject of it, at present remains; the notes of the case were taken by Mr. Hey, the son and grandson of the celebrated practitioners of that name at Leeds, who is now my pupil and clerk at Guy's Hospital. From the assiduity he has discovered in his studies, and the acquirements made in his profession, there is every probability that he will confer additional brilliancy on a name which ranks amongst the highest in the present race of the medical profession.

CASE.

October 15th, 1817, William Heydon, aged 80, of a spare habit, but enjoying good health, has been for some years without any regular employment on account of his age, but accustomed to take more or less of walking exercise; his habits of life have been always regular. About three months ago he perceived a pulsating tumour situated very low down in the ham, and which at that time was about the size of a pullet's egg; he could assign no cause for its appearance, and took but little notice of it. In a few weeks, however, it increased so much in size, and the pulsation became so strong, that he was induced to show it to a surgeon, who, finding it to be an aneurism, recommended him to come into the hospital.

The tumour was now larger than an egg, compressible, the pulsation very strong and perceptible, and the skin of a natural colour. The pulse, though slow and not weak, intermitted; and the pulsation in the tumour exactly corresponded with it. He complained of a considerable pain in the leg at times, and when the pain was most violent the leg was very much swelled. The motion of the joint was somewhat impeded.

24.—The usual incision for popliteal aneurism was made, and a single ligature was applied round the artery, both ends of which were cut off close, and the edges of the wound brought together by adhesive plaster; the substance made use of for the ligature was catgut, which had been previously soaked in water, about the temperature of 100°. The coats of the artery were very much relaxed, so as to occasion some difficulty in passing the ligature round it.

5½ P.M. About four hours after the operation, complained of a sense of coldness and uneasiness in the limb which had been operated on; its temperature was 80°, and that of the sound limb 84°. The pulse which beat 76 times in the minute was full and very irregular, but did not intermit.

25.—Has not passed a very good night, but feels comfortable this morning. Temperature of the limb that has been operated on 84°, that of the sound limb 92°; pulse 60, and intermits; but very rarely.

26.—Has had a good night, and feels more comfortable, though he still complains of violent pain in his leg at times; temperature of the affected limb 89°, that of the sound limb 92°; pulse intermits once in every 10 or 12 beats.

27.—Much in the same state as yesterday; temperature of the affected limb 89°, sound limb 87°.

28.—The wound was dressed for the first time since the operation, and was found to be *completely* united; the pulse varies very much in its intermissions, but upon the whole they have been much less frequent since than before the operation.

29.—Temperature of the affected limb 89°, sound limb 87°.

30.—Temperature of the affected limb 89°, sound limb 93°; the tumour in the ham is considerably lessened and has no pulsation; nor is any pulsation to be yet felt in the anterior or posterior tibial artery, though a free circulation appears to be carried on in the superficial veins.

31.—Temperature of the affected limb 90°, sound limb 91.°

November 1.—Temperature of the affected limb 91°, sound limb 91°.

7.—Nothing material has occurred since the last report; there has been very little variation in the temperature of the limb, or in the state of the aneurismal tumour, which continues gradually to subside. The wound remains perfectly united and free from irritation.

15.—The tumour continues to diminish in size and is much softer; no pulsation can yet be felt in the anterior or posterior tibial artery: his health is very good, and he can walk about the ward with the assistance of a crutch.

24.—Continues to improve, no appearance of irritation from the ligatures; no pulsation in the anterior or posterior tibial artery.

In three weeks after the operation he walked in the ward with the aid of a crutch, and in the first week, he had no other complaint than coldness in the foot on that side, with some pain in the heel.

December 17.—His health is perfectly good; he walks without the aid of crutch or stick; the swelling is reduced to a small size; and the part at which the incision was made has been and now is quite free from irritation.

I confess that this case gave me much pleasure; the great age of the patient, the simplicity of the operation, the absence of constitutional irritation and consequently of danger, and his rapid recovery, lead me to hope that the operation for aneurism may become at some future period, infinitely more simple than it has been rendered to the present moment.

Since the foregoing Essay was printed, I have seen a paper of Mr. Lawrence's in the Medico-Chirurgical Transactions, wherein an account is given of several cases in which the arteries have been tied with silk; and the ligatures cut close to the knot: the result of these cases is as follows. Mr. Carwardine, of Thaxted, tied the femoral artery in this way for aneurism. The wound entirely united by adhesion. Mr. Lawrence tied the femoral artery of a patient sent to him by Mr. Ilott, of Bromley, on the 29th of March. The ligature came away at the end of May, and the wound then ceased to discharge. Mr. Kenrick Watson, of Stourport, tied the humeral artery for a wound of the vessels; in a little more than two months the ligature was expelled. Mr. Hodgson tied the ulnar artery; a swelling formed about the knot which was removed by incision five or six months afterward. Mr. Cumin, of Glasgow, transmitted to Mr. Lawrence a knot of a ligature which had been discharged from a stump at a considerable distance of time, two or three years from the operation. See Medico-Chirurgical Transactions, Vol. VIIIth.

[SURGICAL ESSAYS.]

On Exostosis. By Mr. Astley Cooper.

EXOSTOSIS is a preternatural growth of ossific matter, generally producing a circumscribed swelling upon the bone on which it originates. This definition, although true, with very few exceptions, is not at all periods of the disease, or in every example of it, strictly accurate; for I have examined exostoses in the early part of the complaint, in which ossific matter had not yet been deposited, but in which, from dissection of other cases, I know that such a deposition would in future have occurred.

Exostosis has two different seats; it is either *periosteal* or *medullary*. By the *periosteal* exostosis, I mean a deposition seated between the external surface of the bone, and the internal surface of the periosteum, adhering with firmness to both surfaces; and by the *medullary*, is to be understood a formation of a similar kind, originating in the medullary membrane and cancellated structure of the bone.

With regard to its nature, exostosis is of two kinds, either *cartilaginous* or *fungous*. By the *cartilaginous*, is intended to be expressed that species which is preceded by the formation of a cartilage, which forms the *nidus* for the ossific deposit; and by the *fungous*, is to be understood, a tumour of softer structure than cartilage, yet firmer than fungus in other parts of the body, containing spicula of bone, malignant in its nature, depending on a peculiar state of constitution and action of vessels: a disease similar to that which Mr. Hey has denominated *fungus hæmatodes*, but somewhat modified by the structure of the part in which it originates.

The venereal exostosis, or node, although depending upon a different cause, is still a cartilaginous exostosis. But this subject I do not now intend to consider, as it ought rather to form part of an essay on the venereal disease.

I know of no bone in the body which is not liable to the formation of these diseases, although there are some in which it much more frequently occurs than in others.

Upon the bones of the cranium we see both kinds of exostosis.

That which forms between the outer table of the skull and the pericranium is of an extremely hard consistence, is generally attended with little pain, and does not usually acquire any considerable magnitude; but a very large tumour, with a basis of bone, was lately removed by Sir Everard Home from the head of a person in St. George's Hospital. Four of these have been known to arise from the same os frontis; one of larger, and three of smaller size. The fungous exostosis springing from the diploë of the skull, is of less firm consistence, and is endowed with a greater degree of vascularity than the former. It is of a malignant kind, and is found to proceed through the inner table of the skull, occasioning disease of the dura mater: and by its pressure upon the brain to produce a diseased state of the functions of that organ, by which means life is destroyed.

Exostosis of the facial bones is of very frequent occurrence. We have in the collection at St. Thomas's, a skull which I took from a fish-woman who died in that Hospital, who had long been remarkable, (even at Billingsgate,) for her hideous appearance. Two large swellings had been formed under the orbits in the fore part of the cheeks, between which the nose appeared wedged, and the nostrils were closed; each eye projected considerably from its socket. This person was seized with a fit, which seemed to be of an apoplectic nature, and in that state was brought to St. Thomas's Hospital, where she almost immediately died. Upon examination of the head an exostosis was found growing from each antrum, and forming the large swellings upon the cheeks: these also projected into the orbits so as to occasion the protrusion of the eyes. On the left side, the exostosis entered the cranium, projecting inwards through the orbitar process of the os frontis, and occasioning such pressure upon the brain as, under a considerable excitement of the vessels of that organ, to produce apoplexy, which proved fatal to her.

The alveolar processes of the upper and lower jaw, are very frequently the seat of this disease; and I have at present in Guy's Hospital an example of exostosis of the lower jaw springing from the medullary membrane and cancellated structure, in a girl, for which I had occasion to perform an operation, which will be related more at length hereafter.

There is a large spongy exostosis in the collection at St. Thomas's Hospital, with the history of which I am unacquainted, except that I have heard from Mr. Cline, that it grew from the lower jaw.

A woman of the name of Williams, who is now an out-patient at Guy's, and whose case will be found more particularly detailed hereafter, has a fungous exostosis growing from the symphysis of the lower jaw, forming two livid projections at the alveolar processes of the *incisores* teeth, and a large fungus at the chin.

Mr. Waring, surgeon of St. Mary Cray, sent me a child, with a similar disease in its jaw, which has since acquired very considerable magnitude. And with Sir Charles Blicke I attended a case of the same kind springing from the upper jaw, which was successfully removed by the knife and subsequent application of the actual cautery, the use of which was proposed by Sir Charles Blicke.

Exostoses from the spine are of rare occurrence, if we except those ossifications of the ligament covering the intervertebral substance, which sometimes in old persons destroy the flexibility of the part, and form considerable projections on the anterior and lateral surfaces of the vertebræ.

Dr. Moncey, formerly physician at Chelsea, who died at a very advanced age, had the intervertebral substance thus covered with ossific matter, rising into considerable masses. Perhaps however I ought not here to mention these appearances; as they are not true exostosis; but ossifications of the natural structures, bearing some analogy in principle to those which are produced in the larger blood-vessels of old people.

I have however seen an exostosis arise from the sixth or seventh cervical vertebra, or perhaps from both. The subject of it was a woman who was admitted into Guy's Hospital having no pulse at the wrist or elbow. Her hand was of a venous redness, always cold, generally benumbed, yet seemed painful; there were small gangrenous spots upon it. On examination of the superior part of the arm, these appearances were found to be the consequence of a projection of the lower cervical vertebra towards the clavicle, and consequent pressure upon the subclavian artery. Whilst she was in the Hospital, by means of warmth and friction, the natural heat of the arm and hand was greatly restored, the further increase of the swelling seemed suspended, and, at the time she was discharged, the arm was in a very improved state; nevertheless the pulse at the wrist had not returned.

The ossa innominata are also sometimes affected with this disease, which is more frequently seated at the posterior sacro-iliac symphysis than on any other part of these bones. Boyer mentions an instance of one growing from the os pubis, which produced a retention of urine, prevented the introduction of the catheter, and thus occasioned the destruction of life.

Exostosis sometimes forms upon the ribs. A lady applied to me with a very large swelling, which was occasionally severely painful, situated directly behind the right breast: it was extremely hard, quite immoveable, and seemed to sink between the ribs. I requested to be informed of this patient's dissolution, which, from her exhausted appearance, I considered to be most probably at no great distance, that I might have an opportunity of examining the part. However, I afterwards heard of her death without having the opportunity afforded me.

We have a preparation in the collection at St. Thomas's Hospital, of a very large exostosis seated between two of the ribs, which seems to have been contained in a tumour between the two bones.

Exostosis of the clavicle is extremely rare, if we except the venereal enlargements of that bone; nor do I recollect to have met with any instance of this affection on the scapula.

Upon the os humeri, I have seen a growth of bone at the insertion of the deltoid muscle. It arose about the size and form of the finger end. As it occasioned no inconvenience and had not lately increased, I did not recommend any thing to be done for it. We have likewise, amongst the preparations at St. Thomas's Hospital, an exostosis of the os humeri of considerable size, which occupies the whole circumference of the bone; the periosteum appears in this bone to have been generally diseased, as the surface of the humerus is extremely irregular. We have beside an immense exostosis occupying the superior half of the os humeri, excepting that the cartilaginous head of the bone is unaffected. The particulars of this case will be hereafter detailed.

There is also, in the same Museum, a humerus with the shell of the bone considerably expanded, the periosteum over it thickened, and in the seat of the cancellated structure several hydatids had formed, which had been the cause of the enlargement of the exterior surface of the bone as well as of the increase of its cavity.

The ulna is very rarely affected with exostosis, excepting sometimes at its lower part near to the wrist, where I have, in the living subject, seen some enlargement of the bone.

On the radius we have an excellent preparation of this disease growing to an enormous size, ulcerated upon its surface, and that ulceration having gone on to sloughing; thus exposing the exostosis. This case occurred in Saint Thomas's Hospital, where the arm of the man was obliged to be amputated in order to preserve life.

We have also a fine specimen of exostosis upon the metacarpal bones growing to a very considerable magnitude; a section of which shows extremely well the internal structure of the disease.

A young friend of mine has an exostosis growing on the metacarpal bone of the little finger, which undoubtedly arose from a blow.

I have twice removed an exostosis from the second phalanx of one of the fingers; a considerable portion of it was still cartilaginous, but at its root it was bony. The first operation being insufficient to prevent a recurrence, a second was rendered necessary.

The os femoris, of all the bones of the body, is most frequently the subject of this disease. I have seen it arising from its upper part at the trochanter major, and spreading into enormous masses which projected into the groin, and upon the ilium. We have a preparation of it occupying the whole of the bone from a little below the trochanter to the condyles, forming a considerable mass, or rather masses of bone: and some specimens where it is principally periosteal; the shell of the original bone not being yet absorbed; and others in which portions of this shell have been removed. We have also examples of small projections between the periosteum and the bone, rising in the direction of the triceps femoris; one of the best of which was given to me by Mr. Dodds, jun., son of the surgeon of Haslar Hospital.

Next to the femur, the tibia is most frequently affected with exostosis of the periosteal kind. The seat is at the insertion of the sartorious and gracilis muscles; and now and then at the insertion of the ligament of the patella at its tubercle. We have specimens of this disease in our Museum at St. Thomas's, one in particular, in which the bone has formed a large cavity, covered with a strong bony case, similar to that which I have mentioned in the lower jaw; and another in which it is expanded into a large spongy shell. We have also an example of this disease growing upon the surface of the head of the tibia, and which I believe to have been of the fungous kind. I have lately seen one arising from the fore part of this bone just above the ankle joint, with the flexion of which it begins to interfere.

A man was admitted into Guy's Hospital under the care of Mr. Forster with a large tumour seated upon the upper part of the tibia, which felt soft, and yielded to the finger, so as to give the impression of its being a fungous disease. Mr. Forster directed adhesive plasters to be applied, by the pressure of which the size of the swelling was so much reduced, that the patient quitted the hospital, satisfied that a continuance of the means which he had applied would suffice to accomplish a cure. In a few weeks he returned with the swelling greatly increased, when he was admitted under the care of Mr. Lucas, who made an incision into the swelling, and discharged several hydatids, which were of the common globular kind. However, constitutional irritation, with sloughing of the integuments which covered the swelling, induced the necessity of amputation. An incision being made into the tumour after the removal of the limb, a large nest in the bone was found, containing numerous hydatids. Upon boiling the section opposite the bony nest, a fracture was found in the tibia, which had probably been produced by the disease, as the patient did not mention it. This fracture had united, but irregularly.

The upper end of the fibula, near the head of the bone, is sometimes enlarged, and its lower end very frequently so, where it is connected by a ligament to the tibia. This enlargement, however, arises perhaps more frequently from common adhesive inflammation in the bone than from true exostosis.

The metatarsal bones are now and then the seat of exostosis. I have known half the foot obliged to be amputated for this disease, placed at the extremities of these bones towards the toes. Two instances of exostosis under the nail of the great toe, projecting considerably beyond it, have occurred in my practice; one of which occasioned so much pain and inconvenience to the lady who was the subject of it, that I was under the necessity of removing it; which I easily accomplished with a saw.

In that useful work, Cooper's Surgical Dictionary, an account is given of a case related by Mr. Abernethy, in his lectures, of a boy who came out of Cornwall, who was so excessively afflicted with an apparent predisposition to exostosis, or an exuberant deposition of bony matter, that a very trifling blow would occasion a bony swelling in any bone of his body. His ligamentum nuchæ was ossified, and prevented the motion of his neck; the margins of the axilla were also ossified, so that he was as it were completely pinioned; besides all this, the subject in question had numerous other exostoses in various parts of his body.

Of the fungous Exostosis of the medullary Membrane.

The object of this paper was more particularly to describe the simple cartilaginous exostosis, with the operations which might be undertaken for its removal; but, in the dissection of exostoses, we found varieties, of which we judged it necessary to give some account, in order to prevent the performance of operations which could never be followed by a successful issue. We shall therefore first proceed to say something concerning the *fungous* exostosis of the medullary membrane.

This kind of exostosis is attended with the following symptoms. The disease begins in a general enlargement of the limb in the part opposite to the seat of the complaint, and to a considerable extent around it. It generally occurs in young persons, but I have known it to take place at fifty years of age. Its increase proceeds very gradually; and even when it has acquired considerable magnitude, although it produces some diminution of motion in the limb yet it does not occasion pain, or prevent the patient from using it. When any pain does arise from this disease, it is of an obtuse kind, and is extended very much in the course of the bone and nerve, but becomes very acute whenever a nerve happens to be stretched by it, as in the exostosis of the thigh bone which presses on the sciatic nerve.

The general health is in these cases defective: paleness, debility, irregular states of the bowels, mark the early stages; and, when the disease is confirmed, a sallowness of complexion is observed; the limb at length becomes of an enormous size at the diseased part, but the skin retains its natural colour; the swelling feels hard in many parts of it; but in others, it is elastic, yielding to the pressure of the finger, in such a manner, as to convey an idea of a fluid beneath; but if an opening be made, no fluid issues, excepting blood.

The surface of the tumour next becomes tuberculated, and these tubercles are tender to the touch; they are also frequently slightly inflamed on their surfaces.

To these appearances succeeds constitutional irritation; the rest becomes broken, the appetite impaired, and the bowels extremely irregular.

During the continuance of these symptoms many weeks elapse, and, at length, ulceration takes place on the tubercles; the skin secretes pus, but when the swelling itself becomes exposed, it discharges a bloody-coloured serum; a fungus then arises, which occasionally bleeds, sometimes largely; and, as usually happens in the fungous disease, the blood is loose in its coagulations, and separates a large quantity of serum; the bleeding relieves the painful sensation, but for a very short time; indeed, only for a few hours.

The fungus projects considerably; the skin yields very extensively, and at length sloughs take place, by means of which, considerable portions of the swelling are separated, and the disease becomes so far diminished in volume, as to induce a hope of its ultimate complete destruction by gangrene; a hope, however, which, in this complaint in the bone, I have never seen realized. From the surface of the fungus, there generally occurs a very considerable discharge of serum, mixed occasionally with red particles, which moisten a great many folds of linen in a few hours.

Thus the occasional losses of blood, the immense discharge, but still more, the constitutional irritation, wear out at length the powers of the body; but the time occupied in destruction by these means, is sometimes two years, and at others is a much more protracted period, as from seven to ten years.

It often happens in this disease, that tumours of a similar kind form in other parts of the body during its progress; so also when the affected limb has been amputated, a similar disease will occur at a future period, and in organs of the greatest importance to life.

This disease originates from the medullary membrane of the bone within the cancelli, and if a circular incision be made of the limb, and the parts be observed, the following appearances present themselves. The skin is found in its natural state, excepting that it is projected by tubercles, which proceed from small masses on the surface of the tumour. In one case, in which ulceration had taken place, it was found that the ulcer extended all the way through the tumour to the bone. The muscles are removed to the distance of three inches or more from the surface of the bone, and form a thin layer over the tumour. The large blood vessels are next observed to be carried, as well as the muscles, to the vicinity of the surface of the limb—we have a curious specimen in the collection at Guy's, showing this change in the situation of the vessels, in which the arteries have been injected—in the same manner the nerves are likewise removed from their natural seat.

Under the muscles appears the periosteum, which is separated to different distances from the bone; in some parts of the swelling to two or three inches.

The tumour next appears composed of lobulated masses of various colours, consistence, and materials. A part is yellow like fat, part a substance resembling brain, and a third part composed of coagulated blood, with interstices containing serum. In some parts the white substance is found firm, nearly as much so as cartilage, but in general it is of more spongy appearance, and contains spicula of bone within it. The shell of the bone itself is in parts absorbed, in others it is only thinner than usual; in some cases it has been seen immensely expanded, so as to form a case like wire-work over the tumour; in others it is only absorbed on one side by the pressure of the swelling. In those instances in which fungous granulations arise from the medullary membrane, they are exceedingly vascular, very soft in their texture, secrete abundantly, and are sufficiently luxuriant to rise from the cavity of the bone considerably above the level of the skin.

With respect to the cause of the fungous medullary exostosis, nothing certain is known. In some instances it has been attributed to a blow; in others to a jump from a very considerable height. Either of these causes, by disturbing the interior action of the bone, might produce the effect. In the lower jaw I have seen this disease arise from a decayed tooth. When, however, the exostosis proves of the fungous kind, it is required that there should exist an unhealthy state of the constitution, in order to produce the unusual action which follows the injury.

In the treatment of this complaint, we have not only to combat the local disease, but likewise to effect a change in the constitution in which it occurs. When it has however produced any great changes of structure, or occasioned very considerable increase of parts, no medical means will suffice to restore them, or prevent the fatal tendency of the complaint. But in the commencement of any deep-seated disease in bone, the best medicine, so far as I have had opportunity of observing, is the oxymurias hydrargyri in small doses, given either in, or with, the decoct. sarsaparillæ compositum. This mercurial medicine, by reproducing the natural secretions of the body, and the sarsaparilla, by lessening its irritability, restore the general health, and will sometimes crush in its bud a disease, otherwise likely to become formidable, and at the same time prevent the formation of a similar affection in other structures.

The local treatment consists in the application of leeches, if there be pain, and of blisters, taking care to keep up the discharge from their surfaces by means of equal parts of Ung. Hydr. and Ung. Sabin. Should the disease, however, after all, refuse to yield to these means, the patient is, by the constitutional remedies, rendered a better subject for the removal of the part by amputation or excision, which becomes then the only resource.

I wished to try what would be the effect of cutting off the supply of blood in these cases of fungus, by tying the artery which supplies them. My colleague, Mr. Lucas, also made a similar trial; but the result of both cases showed, that such attempts will avail but little. They are therefore here mentioned, to deter others from making them.

CASE.

A young woman, aged 20, was admitted into Guy's Hospital, with a large fungous tumour growing upon the lower extremity of the radius. As it did not yield to any of the local or constitutional means which my mind could suggest, and she positively refused to submit to the operation of amputation, I proposed to her to ascertain what would be the result of cutting off the supply of blood to the tumour by tying the brachial artery, assuring her at the same time that it could not be followed by any prejudicial effect, even should it fail to produce a favourable influence. She readily submitted to this operation. A few days after its performance, a slough was produced upon the surface of the fungus, by which its size was considerably reduced. But as the vigour of the circulation was restored by anastomosis, the original malignant nature of the disease again betrayed itself; the fungus grew to nearly its original size, and after the expiration of a few months destroyed her, as she still refused to submit to amputation. The operation which had been performed with the hope of giving her relief, produced but a very transitory influence upon the size of the swelling, and seemed neither to have retarded nor hastened her dissolution.

CASE.

Of this case I have preserved only the following notes in my case-book. The patient had a large fungus on the leg, which had not ulcerated. He refused to consent to the operation of amputation, but submitted to the proposal made to him of tying the femoral artery, which was done on the 8th July, 1814. The measure of the limb was twenty-two inches at the time of the operation, and for four succeeding days, when it increased to twenty-four inches; and the outer part of the leg mortified upon the surface on which the limb rested. Amputation was performed on the 15th July, above the knee, but below the part at which the artery had been tied. Yet when the divided femoral artery was observed, the blood flowed from it *per saltum* on the tourniquet being loosened, and with such force, that he would soon have perished from hemorrhage. The artery pulsated slightly when a ligature was made upon it; which circumstance shows how very easily the blood finds its course by anastomosis; as a week only had elapsed between the two operations.

It appears then from these operations that fungous diseases do not admit of removal from a diversion of the current of blood from its principal channel into the smaller arteries of the limb. The vigour of the circulation is for a moment lessened, but the peculiar action of the vessels does not appear to be ever suspended.

The operation of amputation after constitutional means have been employed, and the continuance of these constitutional means after the operation, hold out the chief hope of safety; for amputation without these will do no more than to avert the blow for a season. The following case, however, holds out a hope of benefit from an operation, which I have already proposed to the patient, and to which she has promised to consent.

CASE.

—— Williams, a woman, aged 32, has frequently applied as an out-patient at Guy's Hospital during the present summer, on account of a fungous exostosis of the lower jaw, which forms a large prominence on the chin. It began six years ago in the teeth becoming loose, and falling out; when *fungi* arose from the alveolar cavities, which were of a purple colour, and after a time sloughed away; the gum healed. The jaw then began to swell; the *fungi* re-appeared after two years, and again sloughed. At this period a probe could be passed from the alveolar cavity through the jaw to the point of the chin. A large swelling at the symphysis then began to form, which grew gradually, with little pain, excepting some occasional shootings. Five weeks ago, the skin ulcerated at the chin. From this ulcer the fungus now projects, and two purple swellings appear upon the gum. She was of a delicate habit when young, always confined in her bowels, yet has twice bred during the existence of this swelling, and produced healthy children.

In this case, as there is no surrounding disease, the absorbent glands being healthy, and all the vital organs free from complaint, I have proposed to remove the portion of diseased jaw.

Of the cartilaginous Exostosis of the medullary Membrane.

There is an exostosis produced within the cancellated structure of the bone, arising from a diseased state of the medullary membrane, which differs greatly both in appearance and nature from the former.

In this case, the shell of the bone becomes extremely expanded, or rather the original shell is absorbed, and a new one deposited; and within this ossific cavity thus produced, a very large mass of cartilage is formed, elastic, firm, and fibrous.

In its commencement, there is nothing of a malignant tendency. It arises from common inflammation, brought on in a constitution not unhealthy; but the irritation is kept up for a length of time, and a very extensive disease is thus produced. I cannot better illustrate this complaint, than by the introduction of the following cases.

CASE.

Sarah Dulwich, aged 13, in the year 1812, was admitted into Guy's Hospital with a very large osseous tumour on the chin, which first made its appearance twelve months before, in the form of a small tumour on the gum of the lower jaw. It was in its commencement unattended with pain. At the period of her admission, the upper surface of the tumour was globular, and occupied the whole of the left cheek, but beneath the integuments it was irregular, protruding below the jaw, and extending from the dens cuspidatus of the lower jaw of the right side irregularly under the tongue, which it thrust close to the right angle of the jaw; consequently rendering articulation difficult and indistinct. Internally, it was very irregular and hard, and had been superficially ulcerated from the pressure of the teeth of the upper jaw upon the left side during the last six months; but no fungus had arisen from the ulceration. Externally, it reached from the chin on the fore part, passing up to the side of the left nostril, even to the edge of the orbit, round towards the ear, and was nearly half the size of the head. The skin, in some places had a slight blush on it, and veins here and there of considerable size were seen running over its surface.

For five or six months, she has had severe pains in the left side of the head, and a suppuration from the right ear. Mastication is extremely difficult and painful, in consequence of the pressure of the teeth of the opposite jaw upon the tumour. On the left side, the upper jaw, together with the teeth, are pushed somewhat toward the opposite side from the pressure of the tumour. Her appetite is good, but her appearance altogether is delicate. She affirms, nevertheless, that her health had been generally good. Before the tumour appeared, she had been subject to the toothach of the two molar teeth of the lower jaw constantly, for two or three months.

The tumour continued to increase until it became of most enormous size, measuring five inches and a half from side to side, and four inches from the incisores teeth to its anterior projecting point. The circumference of the swelling was sixteen inches; and less than half of the tumour, after death, deprived of the integuments, measured seven inches and a half.

At length it pressed the epiglottis upon the rima glottidis, so as to occasion difficulty of breathing, and this source of irritation caused the destruction of her life.

Dissection.

The tumour projected from the symphysis internally, and from the inner sides of the lower jaw backwards, more than three inches, occupying the space between the angles where the tongue was usually seated.

The tongue was thrust back into the throat, and to the right side, where it rested in a hollow, between the angle of the jaw and the tumour, extending only to the cuspidatus tooth; it was completely rounded. The epiglottis was bent down upon the rima glottidis, so as to produce great difficulty in swallowing.

The tumour originated from the medullary membrane within the cancellated structure of the bone, and was composed of cartilage and bony spicula, but upon the surface, chiefly of a white, fibrous, elastic mass, resembling the elastic ligaments of the body.

The shell of the bone was entirely absorbed: the alveoli of the external shell were greatly elongated, and bristled with bony spicula.

The external shell had numerous large holes in it. The incisores teeth were directed forwards, and the molares outwards.

The foramen in the jaw, for the transmission of its large nerve, was capable of receiving the extremity of the finger, so greatly was it enlarged.

The condyloid process was directed backwards instead of upwards, on account of the elongation of the jaw.

CASE.

Elizabeth Hall, aged 19, was admitted into Guy's Hospital on the 5th November, 1817. She says, that three years ago, while eating a crust of bread, she distinctly heard something snap, feeling at the same time a pain, on the right side of the lower jaw; she felt certain that it was not a tooth. Shortly after, a small immoveable tumour appeared about the centre of the jaw on the same side, which has since continued to increase gradually. She had previously had a decayed tooth, which was extracted about two years subsequent to the appearance of the swelling, without producing any effect either on the pain or increase of the tumour. On her admission, the swelling occupied the whole length of the side of the jaw from which it grew, from the angle to the symphysis; since that period it has rapidly increased, she thinks, from the frequent handling for the purpose of examination. The surface was very smooth and regular; centre considerably prominent, and on firm pressure in that part, the elastic parietes gave way, but immediately forced back the finger, as the pressure was discontinued, with a sudden jerk like parchment. She complained occasionally of lancinating pains in the tumour, particularly after being handled. Her general health was good.

With regard to the cause of the disease above described, it was evidently the irritation of the decayed tooth, the fangs of which projected into the cartilage which was effused within the bony cavity, and which, instead of producing suppuration and ulceration, as it frequently does, kept up a degree of irritation, that did not pass beyond the stage of adhesive inflammation, and a cartilaginous deposit took place in the first instance, to which succeeded an ossific effusion.

I have seen a similar diseased state of the tibia, but am unacquainted with the circumstances of the case.

As to the treatment of this disease, it consists in first seeking the source of irritation, and removing it as soon as discovered, in order to prevent the further progress of the disease; and indeed it may be probable that the removal of the source of irritation might sometimes, even when the disease has advanced to a considerable extent, succeed in producing a cure, and therefore it is desirable to wait the event before any further operation is undertaken.

Should this however prove insufficient, it will be necessary that the external shell of the bone be removed by means of a saw, and that the cartilage which it contains be dislodged by an elevator. If the integuments be carefully preserved, little deformity follows; and thus by a simple operation, destruction, otherwise inevitable, is prevented.

The operation performed, on the 21st of November, in the case of Elizabeth Hall, above detailed, (page 132,) I shall here describe. An incision was carried from half an inch below the angle of the mouth, to the lower margin of the inferior maxilla, and continued along it to its angle. The flap was then dissected up, and a uniform tumour was exposed, of a hard consistence, composed of thickened periosteum upon the outer surface, and of a thin, bony, and elastic shell within it. The surface of this bony nest I with difficulty removed with a knife, and thus exposed a considerable bed of cartilage, occupying the place of the cancellated structure of the lower jaw, and expanding the remaining part of the jaw into a bulky swelling. The cartilage was removed from its bony nest by means of an elevator. The inferior maxillary nerve was seen crossing the side and bottom of the cavity, in its passage to the mental foramen.

It was necessary in the operation to avoid as much as possible inflicting any injury upon this nerve, as every time it was touched it produced considerable pain. In the course of the dissection, some hemorrhage occurred, and several vessels were obliged to be tied. The flap was then brought over the cavity, and united by suture and adhesive plasters. The tumour, on examination, was found to consist of cartilaginous substance; but of a nature softer than that which is produced from the shell of bone.* The patient supported the operation extremely well. Some hemorrhage took place after she was removed to bed, and she complained of great pain during the whole of the afternoon, in consequence of which an opiate was administered. She suf-

* In describing a bone, I divide it into its shell, or solid surface, and its cancellated structure.

fered some pain, and was extremely irritable during the three days after the operation; but as soon as she could bear the extraction of the tooth, it was removed, and, on the 25th of November, the flap had in a great degree adhered, and she appeared to be suffering but little from the operation, although some discharge still continued.

Of periosteal Exostosis.

This disease, like the preceding, is both of a fungous and cartilaginous kind. The former of these scarcely differs in its symptoms from the fungous exostosis of the medullary membrane, except that the general swelling of the limb is less, and the particular tumour is more prominent; but there is the same want of sensibility in the commencement, with some pain afterwards; the skin remains free from discolouration, and has a similar tuberculated appearance. Ulceration, bleeding, and sloughing, with great discharge ensue, and occasion the destruction of life, if some operation be not performed.

The following case will illustrate the history of this disease.

CASE.

A girl 19 years of age was admitted into Guy's Hospital for what was at first supposed to be an enlargement of the knee-joint, but upon more particular examination, it was discovered, that the swelling occupied the lower part of the os femoris, to which it was immoveably attached. The countenance of this girl was sallow, her general health appearing extremely defective. The swelling was small at her first admission, but during the time she was in the hospital, it rapidly increased; the skin was undiscoloured, and the surface of the tumour was tuberculated, hard as bone in some parts, but elastic in others. It was at first entirely unattended with pain; but as it increased it became occasionally extremely painful, and evidently re-acted upon her constitution in such a manner as to threaten her life, unless the operation of amputation should be had recourse to. The limb was consequently removed. Violent constitutional irritation succeeded to the operation, which for several days excited an apprehension for her life.

When these symptoms subsided, the stump, put on an unhealthy appearance. Its irritability was excessive, so that she dreaded extremely the approach of her medical attendants for the purpose of changing the local application. A fungus arose from the cancellated structure of the bone, which it was necessary to destroy with caustic. Many weeks elapsed before the closing of the stump, notwithstanding a sufficient quantity of integuments had been preserved. And indeed, at length, when she was discharged from the hospital, some slight ulceration of its surface was still remaining: but it was thought adviseable that she should have the advantage of a more salubrious air than that of a hospital in a large town.

Dissection.

The exostosis was seated at the lower part of the femur; the periosteum passed over it, and adhered strongly to its surface. The tumour itself was very firmly fixed to the external surface of the shell of the bone. It was injected minutely with size. In some parts it appeared extremely red from the injection; in others, where the injection would not enter, it was white, so that it was found very vascular in some parts, and in others not at all so. The surface of the tumour was lobulated. The periosteum at one part appeared to have formed, upon its external surface, a tumour composed of similar materials to that which was seated between it and the bone.

Such swellings generally are found on dissection covered with a thickened periosteum, within which a white elastic substance is discovered, having numerous small spicula of bone passing in radii from the surface of the original bone; the shell of the bone is in a great part remaining: I have seen this however in some places removed by absorption. Within the cancellated structure, there appears in some instances to have existed a slight inflammation, for in the cancelli I have seen small portions of ossific matter deposited. I made a section of a tibia, on which a large exostosis of this kind was placed; one half of it I immersed in diluted muriatic acid, and found that when the phosphate of lime was removed, that the swelling remained of its former size, and that a bed of cartilage had supported the bony deposit. The shell of the bone, in the remaining portion of the section, continued entire; spicula of bone in radii, passed from the shell of the bone to the periosteum, whilst in the cancellated structure, opposite to the seat of the exostosis, a very slight deposit of bone in small nodules had taken place. What structures preceded the formation of the cartilage, I do not know; but Mr. Howship, in an ingenious paper which he has published in the Medico-Chirurgical Transactions, on the growth of bone, has shown, that a membranous structure precedes the formation of cartilage and the deposit of ossific matter in the ordinary formation of bone.

We have in the collection at St. Thomas's, a considerable number of specimens of exostoses, chiefly seated upon the lower part of the os femoris, and the upper portion of the tibia. Those which have been macerated, exhibit appearances similar to that which I have just described, in which a section had been made; but those which have been preserved moist, in which the soft parts have not been destroyed by putrefaction, present the following marks. The periosteum thickened passes over the surface of the swelling, to which it firmly adheres. The tumour itself occupies a great extent of surface between the shell of the bone and the internal surface of the periosteum. The swelling is lobulated: the greater part of it is composed of a white substance, somewhat elastic, but not so firm as common cartilage: part of it is coloured by blood, and the texture of this part is softer than the rest. When injected it shows a very unequal vascularity; being in some parts rendered extremely red by the injection, and in others remaining white; and this I have observed to be the case with fungous swellings generally, that they are only partially organized. In their incipient state, spicula of bone have not yet been formed in them; but in proportion to their extent and duration the ossific process occurs, though the spicula are smaller and less numerous than in the cartilaginous exostosis. In one specimen, it appears, that a small portion of this fungous substance is thrown out upon the external surface of the periosteum. The medullary membrane and cancellated structure of the bone in these specimens, have not undergone a similar change to that which has taken place upon the external surface: but in one of the specimens, there are distinct marks of inflammation in the medullary membrane, and in another, this membrane is beginning to participate in the disease. The surface of the exostosis viewed by the microscope exhibits numerous vascular pores.

This disease is attributed to accident; but any irritation upon a bone in an unhealthy constitution will produce it. We have a very fine specimen of it in the collection at Guy's Hospital arising from an internal exfoliation of the os femoris: between the periosteum and the bone, in this case, instead of the cartilaginous process which accompanies internal exfoliation, an immense fungus is thrown out between the periosteum and the surface of the bone, showing that the nature of the inflammation is determined by the state of the constitution at the moment, and that a very unusual and malignant effect may be produced by a frequent cause of irritation.

The treatment of this disease is similar to that required in the fungous exostosis arising from the medullary membrane; but it is only in the first dawn of the disease that we are to entertain any hopes of a benign influence from medicine. It would be dishonest to assert that we have a knowledge at present of any medicine having a specific influence over cancer or fungus. We may indeed improve the constitution a little, and keep the disease at bay; but once formed, it proceeds more or less rapidly to its fatal termination, unless prevented by the operation of amputation or excision; which the state of the constitution improved by medicine will render more safe at the moment, and hold out a better grounded hope for the future.

Of the cartilaginous Exostosis, between the Periosteum and the Bone.

This is a very different affection to the preceding, and more deserving the attention of the surgeon, since it admits of relief by operation, though sometimes with the loss of the affected limb. It originates in the inflammation of the periosteum and of the corresponding part of the bone; and a deposition of cartilage, of very firm texture, and similar to that which forms the nidus of bone in the young subject, adheres to both these surfaces. The periosteum adheres to the external surface of the swelling, and the swelling itself is attached still more strongly to the surface of the bone. Within this cartilage a bony matter is deposited, which is first thrown out from the original bone; it continues afterwards to be secreted as the cartilage increases in bulk; for it appears that between the periosteum and bony mass, cartilage is constantly secreted, which constitutes the exterior surface of this tumour. Thus, on dissection, we discover, 1st, The periosteum thicker than natural; 2d, the cartilage immediately below the periosteum; and, 3d, ossific matter deposited within the cartilage, extending from the shell of the bone nearly to the internal surface of the periosteum, still leaving on the surface of the swelling a thin portion of cartilage unossified.

When the accretion of these swellings ceases, and the disease has been of long standing, they are found to consist, on their exterior surface, of a shell of osseous matter, similar to that of the original bone of the same cancellated structure, and communicating with the original cancelli of the bone. Consequently, when an exostosis has been formed in the manner here described, the shell of the original bone becomes absorbed, and cancelli are deposited in its place. In the mean time the outer surface of the exostosis acquires a shell resembling that of the bone itself. When the exostosis has been steeped in an acid, and by this means deprived of its phosphate of lime, the cartilaginous structure remains of the same form and magnitude as the diseased deposit; and as far as I have been able to discover, it is effused precisely in the same manner as healthy bone. From which it appears, that the formation of these excrescences differs in no respect from that of original bone, since they are composed of cartilage for their basis, and of an earthly salt to impart to them firmness and solidity; a circumstance which I have shown for many years in my lectures.

For the most part these diseases are attended with very little pain, and, especially at their commencement, are but little complained of: when, however, they have acquired some considerable bulk, they do not fail to occasion painful sensations by their pressure upon the surrounding parts; very considerable inconvenience likewise frequently arises to the patients from the impediment and interruption they present to the action of muscles, the tendons of which are sometimes detained by means of them in particular positions, at other times they glide suddenly over them, attended by a snapping noise which can be distinctly heard by the by-standers, and occasioning by these means painful and unpleasant sensations. Others again produce considerable pain in the limbs when the tumour advances to the surface of the skin. I have seen instances of its being ulcerated from this circumstance, but the sore exhibited no signs of malignancy, as will be seen in a case which I shall presently relate, in which the ulcer formed on the surface of the skin had not an unhealthy character. We have also a preparation of exostosis upon the radius, in which the diseased growth is exposed by common ulceration.

The most frequent seat of the periosteal exostosis is upon the inner side of the os femoris just above the internal condyle, and in the direction of the insertion of the triceps muscle. In this situation I have seen several instances of it. I have also seen it seated on the tibia, immediately under the insertion of the sartorius and gracilis muscles. A considerable enlargement of the bone is occasionally produced upon the fibula at its connexion with the tibia; it seldom however in that situation rises into any thing like a circumscribed exostosis. After long continued courses of mercury, when the patient has been debilitated to an extreme degree, if he exert himself much in walking, not only is this thickening of the bone of the fibula produced, but a suppurative process is instituted, which is followed by exfoliation, and lays the foundation of a very tedious, and sometimes of a dangerous disease.

At the insertion of the deltoid muscle in the os humeri, I have also seen this disease occur.

The periosteal exostosis occupies either a very small portion of the bone, or is extended over a considerable surface, sometimes nearly its whole circumference, sometimes several inches of its length. The following case, extracted from the Medico-Chirurgical Transactions, forms a circumstantial detail of its history, when it is of great magnitude.

CASE.

"Catherine Coulson, aged 30 years, unmarried, was admitted into Guy's Hospital, under the care of Mr. Astley Cooper, Nov. 29, 1809, on account of a firm equable and immoveable tumour situated at the upper and external part of the left arm, so high up, that on a superficial inspection, it seemed to be connected, not only with the humerus itself, but also with the clavicle and scapula, rendering it probable that it had an attachment to the glenoid cavity of the latter bone. The arm, however, could be moved forwards and backwards; but in consequence of the weight of the tumour, and the great attenuation, and perhaps complete obliteration of part of the deltoid muscle, produced by its pressure, the voluntary motion upwards was lost. On minute examination it was ascertained, that this enlargement arose from the superior part of the humerus; but as symptoms of inflammation of the shoulder joint were present, a doubt still remained, whether the morbid action, which caused its formation, had commenced in those portions of bone, which entered into the composition of that part. That the humerus itself was diseased, seemed evident, from an obvious enlargement and irregularity, felt at its inner part, commencing high up in the axilla, and ending about four inches from that point. The circumference of the tumour, at its most bulging part (the admeasurement being taken parallel with the arm) was 25⅜ inches; and a line carried round its most prominent part, so as to surround both it and the arm, measured 24⅛ inches.

This swelling was in general covered merely by common integuments; it was extremely painful when handled, and the skin over it felt much hotter than natural; upon it many large veins were ramified. Motion of the arm gave considerable pain, which was referred both to the tumour and shoulder joint; and the patient complained much of the weight she had to support. Her appetite was impaired, and she had some degree of fever.

After her admission, the account collected of the commencement and progress of this disease, was the following: about three years and a half previously, after having once struck the summit of the shoulder forcibly against a wall, afterwards fallen on it, and repeatedly received blows on the same part in mangling, she observed a firm tumour, about the size of a nutmeg, at the superior part of the arm. Subsequently to this, she was always affected with pain about the shoulder when employing the limb freely. The enlargement gradually increased; and about two years and a half before, when it was equal in size to a common tea-cup, she was admitted into Guy's Hospital by Mr. Cooper. She remained under his care six weeks, during which time, repeated blisters were had recourse to without benefit. In about six months, she again applied for admission, and was re-admitted under Mr. Cooper. The tumour had then attained the size of a pint basin; and the motion of the arm had become less free than on the former occasion, though not so considerable as to prevent the general use of the limb. For this reason, and because her constitution had suffered little, she would by no means consent to the operation of amputation at the shoulder joint, the necessity of which was strongly urged; and at the expiration of eleven months, she quitted the Hospital. Within the year and half antecedent to her last admission, the augmentation of the tumour had been very rapid; but she did not notice the enlargement mentioned, to have been observed in the humerus itself, till six or seven weeks previously. Although her nights had been long restless, her general health continued good till the 26th of November, when she was attacked with severe pain in the tumour (which felt hot) and about the shoulder, with loss of appetite and languor.

From the period of admission to the 8th December, blood-letting from the veins over the tumour was twice employed, which diminished the pain and tenderness: the blood was sizy.

As the patient's arm had now become useless, and her sufferings, both from the weight, and the symptoms under which she laboured were very great, she was prevailed on, without much difficulty, to undergo an operation, which was speedily concluded on, and performed on the 8th of December. The state of the deltoid muscle before mentioned, prevented the possibility of executing it in the manner usually directed; for no flap, except of the common integuments, could have been preserved. It was concluded, therefore, that the most advisable plan would be to aim at covering the wound with those portions of integument and muscles, which anteriorly and posteriorly connected the arm to the trunk of the body.

The first step of the operation, was to secure the artery. An incision therefore was made in its direction, high up in the axilla, two ligatures put on it, and secured; when a division was made between them. The application of a ligature on the part of the artery most distant from the heart, was to prevent the possibility of any hemorrhage from such anastomosing vessels as empty themselves into it. An incision was next commenced, immediately anterior to the acromion process of the scapula brought forwards, and ended in the axilla, passing just below the end of the artery on which the ligature had been applied; and another was carried from the same point posteriorly, and made to meet the former one. The next part of the operation consisted in the gradual division of the muscles surrounding the joint, and the application of ligatures to such vessels as it appeared at all probable might furnish free hemorrhage. These, being numerous and large, in consequence of the great size of the tumour, it became necessary to secure ten arteries. As a further precaution also against any bleeding which might have taken place, either from returning vessels, owing to the circulation kept up by undivided branches of arteries, or from regurgitation, the veins accompanying the axillary and posterior circumflex arteries were tied by two ligatures each, and divided at the intervening space. The capsular ligament being at length laid bare, an incision was made into it, and the cavity of the joint exposed, which was filled with coagulable lymph, of a reddish colour, and gelatinous consistence, mixed with some serum or synovia. The arm being removed, the glenoid cavity was accurately examined, and presented no mark of disease: the internal surface of the capsular ligament was more vascular than natural, but the articulating surfaces were not destroyed. The cartilage was pared from the glenoid cavity, in order to facilitate the process of granulation; and after all hemorrhage was stopped, the integuments were brought together, and secured in apposition, by three sutures and straps."

It is not necessary here to detail the circumstances of the case subsequent to the operation, they have already been described at length in the Second Volume of the Medico-Chirurgical Transactions.

The wound was cicatrized about the 18th of April, but the patient still remained impressed with the idea of having the arm, and that she could move the fingers. Attempts, however, at such motions, were always attended with pain and sense of pricking of the whole extremity; which, as before, when she is in the recumbent posture, feels to be placed over the breast, but when erect, it appears to be placed posteriorly.

Dissection of the Tumour.

The weight of the tumour, including that of the os humeri, was eleven pounds.

The periosteum, in a considerably thickened state, covered the surface of the swelling.

The principal part of the tumour was composed of cartilage, which adhered firmly to the external surface of the bone, and to the inner side of the periosteum.

The bone was much increased in its diameter. Where the tumour was attached to it, numerous processes of bone passed into the cartilaginous matter.

The cancellated structure of the bone was obliterated opposite the disease, and a red pulpy mass was found in the cancelli, at that part at which the otherwise healthy bone joined the diseased.

I have lately examined the preparation made from this case with considerable care, and on making a section of the os humeri, found it spread into a large and very solid bony mass at least three times its natural size. Its cancellated structure nearly obliterated by cartilaginous and ossific deposit. The bone towards the axilla is less extended than that part which is covered by the deltoid muscle. On the outer side of the enlarged humerus, there is an immense mass of cartilage, in which numerous ossific depositions have taken place. The periosteum covers the swelling, and adheres firmly to its external surface: the swelling is composed of one-third bone and two-thirds cartilage, with bony masses intermixed. There is also in the collection at St. Thomas's Hospital a very fine preparation of this disease, made by Mr. South, from a patient whose leg was amputated by Mr. Chandler.

With respect to the cause of the periosteal exostosis, which has but a small base, and which follows the course of the tendons or ligaments, as that in the direction of the triceps femoris and gracilis, I am of opinion that it arises from exertions disproportionate to the strength of the subject. The tendons which are fixed in the bone becoming sprained by over exertion, inflammation is excited in them, which is thence communicated to the periosteum and bone, and a deposition is consequently produced in the direction of the tendons sprained and inflamed, upon which the weight of the body is more particularly thrown. We see also in horses that the disease denominated *splent* is produced by sprains of the ligaments. This disease is exostosis. The same effect also is produced in the human subject by a sprain of the ligament which connects the fibula with the tibia. Those who are attentive in observing disease must have seen enlargements of the fibula at its lower part, frequently succeeding considerable exertions in walking, pending, or immediately succeeding to a long-continued course of mercury, as I have already observed.

Blows also occasionally produce this disease: I have known an enlargement of the tubercle of the tibia, produced by a fall upon the knee, continue for many years. I have seen likewise an exostosis of the metacarpal bone of the little finger occasioned by a sharp blow.

Pressure is also sometimes a cause of exostosis: Mr. Cline, Mr. Hutchinson, and myself, were consulted respecting a tumour of this kind, upon the symphysis of the lower jaw, which owed its origin to a considerable degree of pressure long applied to the chin.

The periosteal exostosis admits of remedy, from internal medicine, from external applications, and when considerably advanced, from surgical operation. The internal and local treatment of these cases differs in no respect from that which we have already given, when speaking of the medullary exostosis. The common alterative plan of small doses of mercury, with decoction of sarsaparilla, combined with stimulating plasters, as the emplastrum ammoniaci cum hydrargyro, with the view of promoting absorption of that which has been effused, by its stimulating qualities and by its pressure, are the means which are generally adopted. But in this instance, as in the former, my experience does not furnish me with an example of such remedies having any influence, except in the very commencement of the disease; and too often the insensibility of such swellings prevents their being discovered until they have acquired some magnitude.

When these swellings have acquired a considerable bulk, they sometimes remain stationary and produce no inconvenience: but at others, they continue to grow, occasion considerable pressure upon the surrounding soft parts, interfere with their motions, and render removal necessary. I have known a gentleman who had an exostosis upon the inner part of the thigh bone, suffer great inconvenience from it in riding, and he was under the necessity of having a leather pad contrived to wear upon the inner side of his knee, to prevent the pressure of the saddle upon the unnatural growth of bone.

The operation for their removal is performed by means of a saw, and may be effected with comparatively little pain to the patient, and generally, I believe, without any danger, if the nature of the disease be well discriminated, by distinguishing the fungous from the cartilaginous swelling.

Mr. Machell, surgeon, Rider-street, St. James's, has invented a saw which answers the purpose of sawing to a great depth exceedingly well, by which the operation is much facilitated, as this instrument admits of being applied at a considerable depth amongst the muscles without doing them any injury. I have had the position of the handle altered in order to enable me to support and apply it more easily, but in every other respect the instrument is delineated precisely according to his invention. Beside the saw, it will be necessary for the surgeon to be provided with a strong pair of nippers for the purpose of removing any irregular fragments of bone that may remain after the exostosis has been removed. The highly ingenious instrument of Dr. Jeffries of Glasgow, called the chain saw, may also be sometimes employed with considerable advantage.

The following cases will serve better to illustrate this operation than any separate detail of the operation itself.

CASE.

Sarah Hart, aged 48, was admitted into Guy's Hospital, 25th June, 1800, under the care of Mr. William Cooper, at that time surgeon to this hospital. She was the subject of a large exostosis which grew out of the anterior part of the tibia. When I succeeded to the surgeoncy of that hospital, she became my patient, and was the first person on whom I performed any operation in that institution. In answer to my inquiries respecting the first appearance of this tumour, she stated that it had begun in her childhood, and had now existed forty-four years. It was of the form of an inverted pyramid, the apex being attached to the tibia, and considerably narrower than the base, which constituted the surface of the exostosis. A small ulcer was seated on its external surface. It was not, nor indeed had it ever at any time been extremely painful, and what little pain she had suffered was of the obtuse kind. As the ulcer above-mentioned rendered her apprehensive of ill consequences, and I had represented to her that she could not hope to obtain relief from any other means than that of sawing off the tumour, she readily submitted to the operation.

I made an elliptical incision through the integuments, preserving enough of them to cover again the surface of the tibia after the exostosis should have been removed. When the skin was turned back sufficiently to expose to view the surface of the original bone, I attempted to saw through the exostosis by means of a small metacarpal saw, but found the structure of the tumour of too solid a nature to admit of an impression being made upon it by that instrument; I was consequently obliged to have recourse to the common amputating saw in order to effect my purpose, sawing first in a direction from the upper part of the tibia, and then from the lower part, so as to make the section meet in the centre, and in this manner the exostosis was readily detached.

Little blood was lost during the operation, nor did the patient suffer much pain. I endeavoured by approximating the integuments to unite the wound by adhesion, but did not succeed. Granulations of a very healthy nature arose from the surface of the wound, and six weeks after the operation, two small portions of bone exfoliated; the patient, not only recovered from the operation, but regained also the perfect use of the limb.

CASE.

The result of the foregoing case gratified me exceedingly; for I felt a hope that exostosis, when seated on any accessible part of the body, might be safely removed by an operation similar to that before described: but I have a case now to relate which proved by no means so fortunate in its result. This case, however, was of the fungous and not of the cartilaginous kind. A man who lived near to me when I resided in the city, had a large tumour growing out of his forehead. Anxious to examine it, I called upon him, and found him labouring under a swelling of great magnitude. It had been growing several years, the skin over it exhibited a blush of inflammation. Its fixed state, and the firmness it presented to the touch, convinced me that it was exostosis; yet at the same time it was less resisting and more vascular than the cartilaginous exostosis usually is. I related to the patient the case above given, stated to him its favourable result, and advised him to become a patient in the hospital, where he might undergo a similar operation; as, without it, I conceived that the disease must necessarily prove fatal. To my advice he readily assented, and submitted to the operation I had recommended to him a few days after his admission into the hospital. I began by making an incision through the integuments directly over the tumour, from the surface of which there issued a very considerable quantity of blood. I continued to turn aside the integuments until I reached the surface of the cranium, and then with a metacarpal saw, succeeded in cutting through a substance much softer than common cartilage, containing numerous but slender spicula of bone within it. Each part of the swelling bled freely; but on bringing the integuments over the surface, and making use of pressure upon them, the bleeding from the bone was stopped, and it was only necessary to secure a few vessels of the integuments. Upon examination of the removed tumour, it appeared softer than cartilage, although it contained some osseous spicula, and I was able readily to break it down with my finger.

On the following day the patient had a considerable degree of fever, which continued to increase until the fourth day, when he became comatose, and on the sixth day he died. Upon examination of the body I found that the swelling occupied the internal as well as the external table of the cranium; it extended through both, and affected the dura mater which had several fungous projections proceeding from it; and that the inflammation which had been excited by the operation, had extended to the membranes of the brain opposite to the part where the disease had been seated.

This complaint seems to have originated in the diploë of the os frontis, and to have produced an effusion both between the pericranium and the skull, and between the skull and the dura mater. The swelling upon the outer part of the head, was, however, much larger than that which had arisen from the inner table. It was evident, too, that this case must ultimately, and at no distant period, have proved fatal, if no operation had been performed.

An exostosis on the external table of the skull, growing slowly, very little vascular, unattended with any considerable pain, may safely be rendered the subject of an operation; but a swelling of more rapid growth, red upon its surface, showing signs of considerable vascularity, and attended with great pain shooting through the brain, is one for which I should now hesitate to perform an operation.

CASE.

Miss E. O., 11 years of age, was brought to my house in July 1817, by Mr. Prior, Surgeon, of Clapham, on account of having an exostosis on the thigh bone: it was seated a little above the inner condyle of the os femoris in the line of the insertion of the triceps muscle. The account she gave me was, that it was accidentally discovered about eight months before she applied to me. At first, it did not interfere with her daily exercises, and it produced no pain on walking; but from the month of May last she found some difficulty in bending the limb. Mr. Mortimer, Surgeon, of Bristol, wrote to me, that he was requested to examine Miss E. O.'s thigh in the beginning of the year, and found a small tumour about two inches above the inner condyle of the femur, directly under the seat of the garter. This tumour was evidently an osseous enlargement, insensible to pressure, and by no means painful. The skin was perfectly free from inflammation, and there was no reason to suppose that the tumour had acquired any addition to its bulk for years. Its origin was unknown; it occasioned no pain or inconvenience whatever, nor did it in any way impede her walking or dancing, or produce any degree of lameness. Mr. Mortimer's view of the case was perfectly correct. In the month of May last she first found that on going up stairs, she was under the necessity of advancing her right foot on each stair; and the same in descending, when she was obliged to proceed sideways, being unable, without great inconvenience, to bend the limb. Whilst sitting down, and more especially on a low seat, she felt considerable pain in bending the knee: and after having sat for some time, she experienced pain and difficulty on rising. Her lameness, just before her journey to London, had considerably increased, and her leg had become painful down to the heel. When she attempted to run, she felt a snap upon the swelling, as if a cord had slipped out of its pulley, which was owing to the tendon gliding over the projecting part of the bone.

On Monday, the 21st of July, the operation was performed for the purpose of removing the swelling, in the presence of Mr. Prior and Mr. Plowman. An incision was made over the projecting portion of the bone, and the muscles drawn aside from its surface: the periosteum, which was much thicker than usual, was divided by the knife, and turned aside from the exostosis, which was covered by a bed of cartilage, in which bony matter had not yet been deposited; and this was about the thickness of ⅛ of an inch. The exostosis was next cleaned of the soft parts from the surface of the thigh bone upon which it grew, and a spatula was passed down to confine the muscles from interfering with the saw. The saw was then attempted to be used without the forceps, but it could not be well fixed: the forceps were therefore added to it, and the bone was sawn through. Some irregularity remained upon the thigh bone, which I endeavoured to remove by means of a saw recommended by Mr. Hey, but the muscles interfered with its employment, in consequence of the depth at which the bone was seated; and I removed it readily, by means of a pair of bone nippers.

No vessel of any importance was wounded in this operation, nor was there any necessity for applying a ligature. The edges of the wound were approximated, and retained, by means of adhesive plasters; and an evaporating lotion was applied.

On the 22d she had some fever, which on the 23d had subsided.

On the 24th she was carried to the sofa, after which she experienced no further inconvenience from the operation; and before leaving town had entirely lost the painful sensations which had previously existed.

CASE.

James Aris was admitted into Guy's Hospital August 13, 1817, with an exostosis occupying from one to three inches of the thigh bone, above its internal condyle, which felt, through the integuments and muscles, about the size of the finger, and which was directed rather upwards, not being exactly at right angles with the thigh bone. His age was 24 years; and 14 years ago, while jumping over a post, he first discovered pain in the part which afterwards formed the seat of the disease. The pain lasted but a very short time, but it led him to examine particularly the part, when he perceived a small and hard swelling. This tumour gradually increased, and at length began to interfere with the motion of the limb, so as to render him anxious to have advice respecting it. When walking, he felt what he described as a snapping in the part, which probably arose from the extension of the sartorious muscle, and its sudden slipping over the swelling. When he placed the limb quite straight, he found a difficulty in bending it; and when bent it was almost equally difficult to extend it: each flexion and extension producing a snapping noise, which could be distinctly heard.

On considering the inconvenience which the swelling had produced, and that the disease was obviously on the increase, I recommended to him the operation which I had performed in the preceding Case, and advised him to become a patient in the Hospital, and to submit to one of a similar kind. He procured admission immediately.

On the 22d of August I performed the operation. The man was lying upon a table, with his thigh slightly bent, and I made an incision through the integuments over the swelling, and thus exposed the sartorius muscle, which appeared to have gained an increase in its breadth, and to be incapable of being sufficiently drawn aside to completely expose the tumour without considerable violence; I therefore made an incision through it in the direction of its fibres, sufficiently large to allow the exostosis to pass through the opening. The periosteum which covered the swelling, was then exposed, and being cut through, and turned aside, a surface of cartilage was laid bare, and beneath it a large process of bone. Mr. Machell, the inventor of the saw, who was present at the operation, himself applied it, and with a very few turns of it removed the osseous tumour. The edges of the wound were brought together, and union attempted by adhesion.

In the evening of that day he had some symptoms of constitutional irritation, and some blood was taken from his arm. On the following day, he took a brisk purging medicine, and after this time no unpleasant symptoms appeared.

My dresser, Mr. Humble, informed me that the wound was as nearly as possible cicatrized on the 12th of September, and he was discharged from the Hospital a few days afterwards, and continues free from the inconveniences which he had experienced prior to the operation.

It appears, then, that bones, after operations, unite by adhesion to the soft parts; if adhesion cannot be produced, healthy granulations arise from the surface of the bone, and cicatrization takes place upon these, as upon other parts of the body; and that there is reason to believe, that these structures may, with properly constructed instruments, become much more the subjects of operations, than they have hitherto been considered.

[SURGICAL ESSAYS.]

Of Unnatural Apertures in the Urethra.

THAT openings made into the urethra by cutting instruments are healed without difficulty, is evinced by the operation for the stone in the bladder, in which this canal is extensively opened; and in the removal by incision of a calculus lodged in any part of the urethra. But when apertures are formed in this part, either from diseased states of the constitution and of the urethra, or from disease in the canal only, and when they are accompanied by any considerable loss of substance in the urethra and corpus spongiosum, they are generally very difficult of cure.

It most frequently happens that fistulous orifices from this canal are the result of strictures in the urethra. The impediment which this disease produces to the passage of the urine enlarges the lacunæ situated behind the stricture, and the frequent pressure of the urine upon them and upon the sides of the urethra leads to an ulcerative process by which the urine becomes applied to a new surface; it irritates the part, occasions the formation of an abscess, into which the urine gains access; and when the matter is discharged, be it by nature or by art, the urine passes through the aperture, and continues generally to do so, whilst the stricture remains. As the seat of the greater number of strictures in the urethra is beyond the middle of the canal towards the bladder, the apertures are most frequently seated in the perineum; but they are in different persons from an inch within the urethra to its extremity at the bladder.

As soon as the abscesses which are the forerunners of such fistulæ, can be distinctly discovered to contain fluid, it is the best practice to pass a lancet into them, to discharge it. It is advantageous in preventing extensive destruction of the parts by ulceration, and they not unfrequently immediately heal so as even to prevent the fistulous orifice, and it becomes the means of lessening the tendency to those dangerous extravasations of urine into the scrotum, which if they are not early opened often prove destructive to life.

The mode of treatment of such apertures is readily understood in principle, and their cure in most situations is easily effected in practice. It consists in principle in removing the impediment to the passage of the urine, by enlarging the urethra at the strictured part, and thus prevents the urine from making unnatural pressure against the side of the canal; and in practice it depends on the introduction of metallic bougies, increasing their size gradually until it reaches somewhat beyond that of the natural diameter of the passage, and thus the urethra becomes stretched in a degree to admit readily the passage of the urine through what was previously a contracted canal.

In other cases it is sometimes required to introduce a pewter catheter of large size into the bladder, to suffer it there to remain to draw the urine through it, and thus produce the double effect of extending the stricture and preventing the passage of the urine through the opening, it often becomes the means of permanent relief.

The size of the instruments employed for these purposes must be varied according to circumstances, for there is in different persons a great diversity in the natural diameter of the canal, and at different ages, even after manhood, the urethra varies exceedingly in its dilatability.

Caustic, which was formerly much employed, is now comparatively seldom used for this purpose; yet cases do occur in which, from long neglect, the urethra and the parts surrounding the stricture become so exceedingly altered in their structure that no instrument can be passed through the part without a degree of violence which will be dangerous to life, and in which the slower influence of the caustic will be attended with less danger than the use of the metallic bougie. But it is principally in the class of patients who are admitted into our hospitals, in whom such extensive mischief has arisen from long neglect, as to require the application of the caustic.

But there are apertures of this description so situated and connected with other parts as to preclude the possibility of healing them by the usual means of treatment, and in which other measures are consequently obliged to be employed.

CASE.

A gentleman came to London under the following circumstances. He had an abscess formed upon the anterior and lateral part of the rectum, which had discharged itself after long continued suffering into the rectum, just above the verge of the anus. The surgeon, whom he consulted in London, discovering the aperture, divided the sinus, and he returned into the country; but the wound did not heal, and a considerable discharge proceeded from it. Observing the discharge with attention, he found that after making water the urine passed through the aperture, and that consequently there was some communication between the urethra and rectum. Alarmed at this circumstance he came to London, and placed himself under my care. I examined his urethra, and finding some obstruction at the apex of the prostate gland, advised him to make use of large metallic bougies until the natural diameter of the urethra at that part had been re-established, hoping that in this way the opening would be disposed to heal as the urine found a more ready course than through its natural channel. He persevered in the use of these instruments for several weeks, but with no apparent advantage, as the urine still passed by the fistulous aperture. I therefore advised the introduction of a metallic catheter of large size into the urethra, and to give it full effect recommended that he should steadily observe the recumbent posture, which he did for a month, during which period the urine did not pass by the rectum; but as soon as the instrument was withdrawn the urine resumed its former unnatural course. He returned into the country greatly disappointed, and after remaining there for some time, and finding his complaint increased, he again applied to me, and I advised him to undergo the following operation for his relief. I introduced a catheter into his bladder, and my finger into the rectum, and then made an incision, as in the operation for the stone, in the left side of the rhaphe, until I felt the staff through the bulb. I then directed a double-edged knife across the perineum, between the prostate gland and rectum, intending thus to divide the fistulous communication between the urethra and the bowels. A piece of lint was introduced into the wound, and a poultice was applied over it. When the lint was removed the urine was found to take its course through the opening in perineo; the aperture in the rectum gradually healed, and that of the perineum quickly closed, after which the urine took entirely its natural course. Whilst the wound which I had made was healing, one of the testicles became enlarged and inflamed, as I supposed from the irritation on the extremity of the vas deferens, or in sympathy with an irritated vesicula seminalis on that side. This inflammation left some hardness of the epididymis, but no further inconvenience, and the urine has never since deviated from its natural channel.

Apertures are sometimes formed in the urethra from a process of ulceration beginning in a bad constitution, without their being accompanied with stricture.

A person whose constitution is broken by excess, or who is naturally feeble, will have a slight discharge take place from his urethra without any previous sign of disease, or without the possibility of a well founded suspicion of gonorrheal infection; a swelling forms in a line with some part of the urethra; which proceeds to suppuration; a poultice is applied, and the abscess breaks, or it is opened by art, and the urine takes its course through the wound, whilst a considerable discharge still continues from the urethra. These circumstances arise either from ulceration in the mucous membrane of the urethra, or from abscesses in the lacunæ; and I believe more frequently from the latter than the former. It is the usual practice in these cases to begin directly with the use of bougies, but it is not judicious to do so, as they only add to the tendency to ulcerate, and increase both the local and constitutional irritation.

CASE.

A nobleman came to London with one of these abscesses, and with a copious discharge from the urethra. His constitution was previously much enfeebled, and it suffered extremely from the local irritation. A bougie was once passed into his bladder, but no stricture was found. He had great fear of bougies, and requested that no more might be introduced. The abscess was poulticed, and the matter discharged by the perineum, but still it continued to pass both by the urethra and by the aperture in perineo. The poultice was continued, and his constitution was endeavoured to be improved by attention to his diet, by alterative and by tonic medicines. He soon amended in his general health; the discharge from the perineum gradually lessened, and that from the urethra entirely ceased. He recovered and has remained well with respect to this disease for several years. Contrast this with the following example. A gentleman had a slight discharge begin from his urethra. He was a married man, of excellent moral character, who had never exposed himself to the possibility of any infection. The discharge from his urethra at first appeared gleety, but it afterwards became purulent, without any pain or difficulty in passing the urine. A bougie was notwithstanding employed, under the use of which the irritation increased, the discharge became greater, and his general health suffered. A swelling then formed under the urethra, within the scrotum. And which after great local and constitutional irritation discharged itself, and the urine passed through the aperture in the scrotum. The bougie was again employed, to extend the urethra and to heal the opening from it into the scrotum; but in a short time another abscess formed in perineo, and from this the urine became extravasated into the perineum and scrotum, and a free opening was obliged to be made for its discharge; but extensive sloughs followed; his constitution became extremely irritated and reduced, and he died of this complaint. Upon opening him, two ulcers were found in the urethra, without any appearance of stricture. If this disease had been from the first constitutionally treated, instead of being irritated by the injudicious employment of bougies, this person would probably have had his life preserved.

Apertures connected with loss of substance in the urethra are extremely difficult to heal. They are usually seated in that part of the urethra which is placed before the scrotum. They generally pass longitudinally, and reach to the extent of from half an inch to an inch; sometimes one-third of the urethra is removed; at others, half the canal, and with the membrane of the urethra, the lower part of the corpus spongiosum which adhered to it. A part of the urine passes by this unnatural opening, and sometimes the whole of the urine and semen, when the opening is large. The patient's mind suffers extremely from the defect, as he considers himself emasculated; and the greatest inconvenience arises from the direction which the stream of urine takes in its discharge. The cause of the aperture is an abscess in one of the lacunæ attended with a disposition to the sloughing process; and when the matter is discharged, the slough which follows removes the lower portion of the urethra opposite to the lacuna, and thus produces a large aperture.

These cases are, I know, considered by some of my professional brethren as incapable of cure, and patients labouring under them have been abandoned to despair; but the following examples may, perhaps, lead to attempts at relief which have not hitherto been made; and it is the favourable result of these which has induced me to venture to give this short essay upon the subject.

CASE I.

A gentleman who had lately returned from India had a chancre at the orifice of the urethra, accompanied by a high degree of inflammation of the glans, prepuce, and skin of the penis which reached to the pubes and scrotum. The urethra sloughed at the junction of the scrotum with the penis, leaving an opening by which the urine was freely discharged. This opening became healed at its margin, but a large fistulous orifice still remained in the urethra showing not the smallest disposition to heal, and exposing the patient to great inconvenience in the discharge of the urine.

The first surgeon whom he consulted advised him to introduce bougies three or four times in the day; which he persevered in doing, without effect. The next attempt which was made to heal it was by the application of blisters, probably in the hope that excoriating the edge might give a disposition to granulation, and thus lead to the closure of the aperture. This was, however, entirely unsuccessful.

The next trial consisted in paring the edges of the wound, introducing pins, and bringing the edges of the wound together by the twisted suture; but this also proved abortive.

At this time he applied to me; and conceiving that a simple suture might answer the purpose better than the pins, I pared the edges of the sinus and sewed it together by two threads; I then passed a catheter into the bladder, to discharge the urine without inflaming the cut surfaces. On the third day, however, I found that the urine had passed by the side of the catheter, destroying the adhesive process; and when the ligatures separated on the fifth day, no union had been produced. Feeling it would be quite useless to repeat these trials, and seeing that the scrotum formed two-thirds of the opening, and the skin of the penis the other one-third, I thought that it might be possible to heal it upon the principle of the contraction of the skin in cicatrization. In June, 1818, I applied the nitrous acid upon the edge of the fistulous orifice and upon the skin, to the extent of three-quarters of an inch around it; the skin sloughed superficially, formed granulations, and healed. It soon afterwards began to contract, so as to show that the principle would ultimately much diminish the orifice. In the month of October succeeding, I again applied the acid, and with increased effect; at the end of November the application was repeated by himself, and the opening, from the size of a pea, was reduced to that of a pin. On January the 22d, 1819, it was again touched, but very lightly. In March the caustic was last applied, and in a fortnight the orifice was closed, and not the smallest quantity of urine has since passed. The mental sufferings produced in the patient by this orifice, cannot be described; and the happiness he felt in his recovery was unbounded.

But still it is only in cases in which the skin is very loose, or the scrotum is forming a part of the fistulous orifice, that this plan would succeed; as, when the skin is much confined, it would be scarcely possible to draw it together so as to produce its union. Some other plan must be therefore resorted to when this is the state of the parts; and I thought that an operation might succeed similar in principle to that which has been performed for time immemorial, in India, of making a new nose, and which has been successfully performed by my friends, Mr. Carpue and Mr. Hutchinson, in London, as well as the operation of making a new under-lip from the skin beneath the skin, which was performed by my friend Mr. Lynn, surgeon of the Westminster Hospital, and is so highly creditable to him; by which, not only a new lip was produced, but even the beard growing upon that lip. I conceived that a piece of skin might be raised from the scrotum; that the edges of the fistulous orifice might be pared, and the skin removed to a small extent around it, and that the skin thus raised from the scrotum might be turned half round, so as to apply its raw surface to the opening, and upon the edges where I was in hopes it would unite. The case which led me to contemplate this operation, I attended first with Mr. Tipple, surgeon at Mitcham; the patient afterwards removed to London under the care of Mr. Hunter of Tower Street, and his son, Mr. Hunter, jun., a very excellently well-informed surgeon and amiable man, who has had the kindness to furnish me with the following particulars of a case, the result of which has afforded me a great deal of satisfaction; and as the operation is so simple that it may be performed even by those who are not frequently in the habit of operating, and is likely generally to succeed, I hope it will be useful to many who have been deemed incurable.

CASE II.

Of Abscess in the Urethra.

In the beginning of July, 1818, Mr. H——t, æt. 56, had a violent attack of inflammation in the penis and scrotum, attended with enormous swelling, the consequence of neglected stricture; this was treated in the usual manner, by purgative medicines, fomentations, and poultices.

July 9th.—A large abscess was opened opposite the bulb of the urethra, which discharged a great quantity of very fetid matter.

July 30th.—Mr. Astley Cooper found it necessary to introduce a silver catheter, which was effected with great difficulty, on account of the resistance of two firm strictures, and the highly inflamed state of parts; this was worn for three weeks, during which time another abscess opened at the under part of the urethra, immediately anteriorly to the scrotum; the swelling and inflammation gradually abated, and the fistulous orifice behind the scrotum closed; but that at the forepart continued to enlarge till it measured half an inch in length, and was of sufficient width to admit with ease the largest catheter; in this state it continued nearly four months without any sensible diminution in size; the edges were quite callous, and never showed the least disposition to granulate, notwithstanding the repeated application of the nitrate of silver and other stimuli. Attempts were also made to produce union by adhesion, but from the great loss of substance it was impossible to keep the edges in contact. The urine passed almost wholly by this aperture, unless drawn off by a catheter. As there appeared no means of relief from this distressing condition, except by surgical operation, and from the extent of the wound, bringing the edges together either in the transverse or longitudinal direction, offered very little chance of success, Mr. Cooper proposed to supply the deficiency by a covering of integument from the scrotum. With this view the following operation was performed.

December 9th.—An elastic catheter being passed into the bladder, the callous edges of the opening were pared off, so as to produce an entire new surface; a portion of integument was then dissected from the scrotum (leaving it attached at the upper part) and turned over upon the wound, to which it was exactly fitted; this was held down by four sutures covered by small strips of adhesive plaster; a bandage was applied to support the scrotum, and the patient placed on his back in bed.

December 10th.—Much aching pain in the part; a slight oozing of matter by the side of the instrument at the extremity of the penis. An enema was exhibited to prevent straining during the evacuation of the bowels; a little urine was, however, forced through the wound.

December 11th to 14th.—The discharge of matter through the natural orifice of the urethra increased; scrotum swoln and inflamed; a small quantity of urine again escaped by the wound on the 12th and 13th; the bowels were kept soluble by the daily administration of clysters and mild aperient medicines. Saline medicines produced considerable inconvenience by their diuretic operation.

December 15th.—The dressings were entirely removed; the edges of the flap appeared in perfect apposition with the parts beneath, but the skin was thick and œdematous, particularly at the upper part; the sutures all retained their hold; the scrotum was much excoriated and inflamed by the acrid discharge; the wound was carefully cleaned; two straps of adhesive plaster were applied, over these a piece of lint spread with simple cerate, and the bandage to support the scrotum. After this the dressings were renewed every day in the same manner.

December 18th.—A little urine again escaped by the wound.

December 19th.—The catheter which had remained in the bladder ever since the operation, became this evening completely stopped up; it was therefore withdrawn, and another introduced; the slight pressure upon the wound, in passing it, did not appear in the least to disturb the union, though it was followed by a great deal of pain at the end of the penis.

December 20th.—Much acrid discharge from the wound, (principally from a small opening on the right side;) considerable excoriation of the cuticle.

December 21st.—The upper and left side of the flap appears perfectly united; the urine, which had hitherto been loaded with a thick mucus, and very offensive to the smell, assumed a more healthy appearance, and soon became perfectly natural.

December 22d.—The two upper sutures ulcerated through the skin.

December 23d.—The whole of the sutures were removed, as they kept up considerable irritation; the discharge from the wound passes only by the small sinus opening on the right side; the upper edge of the flap still very thick, owing perhaps to the slow circulation.

December 24th.—The wound looked less irritable.

December 25th and 26th.—Wound going on well; skin becomes rather thinner; a small pouch formed in the situation of the upper suture.

December 27th.—The catheter again withdrawn, and another introduced, which passed with very little difficulty; several hairs sprouting out on the flap of skin; the discharge still continuing from the sinus; the effect of pressure was tried in preventing it, keeping the sides together by a pad of lint bound down by adhesive plaster.

December 28th.—The compress has completely stopped the discharge by the sinus.

December 29th, 30th, and 31st.—Compress applied daily; no discharge from the sinus, but the opening does not appear perfectly closed; matter still passes through the extremity of the urethra; the edge of the flap becomes gradually thinner beginning from that part which is least twisted.

January 1st and 2d, 1818.—The same.

——— 3d.—Passed a fresh catheter.

——— 4th.—He sat up; slight irritation in the urethra; matter tinged with blood.

January 5th.—Much pain and uneasiness in the urethra; matter tinged with blood.

January 5th.—Much pain and uneasiness in the bladder, and pains relieved by a dose of saline aperient medicine; a quantity of urine which passed through the urethra by the side of the instrument produced no effect upon the wound; the same thing occurred in a greater or less degree every day till this catheter was discontinued on the 18th instant, and without any apparent inconvenience.

January 10th.—Sat up without the instrument, between three and four hours; it was afterwards withdrawn daily, but he was not allowed to pass his water without it.

January 15th to 31st.—The catheter was withdrawn for a few hours every day; slight discharge from the wound.

February 1st.—Had an evacuation from the bowels during the time the instrument was out of the bladder, attended with a considerable discharge of urine by the natural passage, the first time it had occurred since the operation; not a drop of urine passed by the wound, and no ill effects followed.

February 2d to *March* 2d.—As the flap of integument and adjacent parts had still rather an irritable appearance, and an occasional oozing was observed from a very small orifice on the right side of the wound, it was thought improper to hazard a repetition of this experiment; the catheter was therefore introduced twice a-day, and continued in the bladder at night.

March 3d.—By the direction of Mr. Cooper, he now began to pass his urine without the aid of an instrument, using it only once a-day (to prevent the return of an old stricture, of very long standing, in the membranous part of the urethra;) after the first effort it came in a tolerably free stream, more so than it has done for many years. A weak solution of sulphate of zinc soon removed the irritable appearance of the integuments.

May 8th.—A common bougie was substituted for the elastic catheter, and introduced once every day till the latter end of September; since which time he has passed it but once in two days; he is now, October 14th, in perfect health, and very thankful for the operation; the stream of water becomes gradually fuller and stronger; the penis is somewhat drawn down by the contraction of the integument, and the small pouch which was formed by the ligatures at the upper part of the flap is removed.

I have the greatest expectation that this operation will in others be found useful, as this gentleman's wound has remained perfectly well for seven months.

[Surgical Essays.]

On Encysted Tumours.

There are different species of encysted tumours, but that to which I at present intend to confine my observations, is the tumour which is situated just under the skin, and is so frequently seen upon the head, the face, upon the back, and occasionally, but less frequently, under the skin upon other parts of the body.

Having been myself the subject of one of these tumours upon my back, I was led to observe it with more than common attention, and am induced to hope that I shall be able to show from what source these swellings derive their origin.

The encysted tumour is generally nearly globular, and when seated on the head feels very firm, but upon the face it possesses a fluctuation more or less obscure; the skin over it is generally uninflamed, but it is now and then streaked with blood-vessels, which are larger than those of the surrounding parts.

In the centre of the tumour on the skin, it often happens that in its early state, a black or dark-coloured spot may be seen, which sometimes continues through the whole course of the disease. In general they are unattended with pain, are never in themselves dangerous, and only require removal from the parts in which they occur, and the unseemly appearance they produce. They move readily within the cellular membrane, if they are free from inflammation, but the skin in general does not easily move over them.

The scalp is more subject to them than any other part of the body, but they also frequently are seen upon the face, and not unfrequently one is found at the outer canthus. Upon the shoulders they are often met with, more especially in men who wear braces, and in women who have very tight shoulder-straps to their stays. On the back they are occasionally formed and sometimes, but much less frequently, upon the extremities.

The greatest number which I have known to exist in the same individual, was in a patient of Mr. Hall's of Dulwich, who had sixteen upon his head, some of which, as large as a walnut, I removed. I have seen nine in another person, and four, five, and six, are not uncommon.

The largest size I have known them acquire, has been that of a common sized cocoa-nut, and this grew upon the head of a man named Lake, who kept the house called the Six Bells at Dartford. It sprung from the vertex and gave him a most grotesque appearance, for when his hat was put on, it was placed upon the tumour, but scarcely reached his head, and this man will be, on this account long remembered in that neighbourhood. The cyst is in the collection at St. Thomas's Hospital, and an excellent cast of his head, taken just prior to the operation. He recovered very well and I believe is now living, at least he was when I last inquired, and it is now many years since the operation was performed. In a relation of Mr. Toulmin of Hackney, I saw one on the arm of very considerable size, but in general these swellings do not exceed from one to two inches diameter.

They are in some degree hereditary, for often I have heard a patient observe, I have several swellings upon my head, and my father (or my mother) had several.

They also occur in several of the same family. I was asked by Dr. Pacifico to remove some of these tumours from the head of one of a family who resided near him in Bury Street, and when I had accomplished this, another said, and I will be obliged to you to do the same, and then a third made the same request.

When these cysts are opened, a curd-like substance is generally discharged from them, having a sour and sometimes a most abominably offensive smell, if the swelling has undergone any change from inflammation.

When they acquire any size, there seems to be an attempt made by nature for their removal; the skin inflames over them and the swelling then becomes painful, ulceration slowly follows, and the curdly substance mixed with pus is discharged; the opening sometimes closes, but often remains fistulous, occasioning some inconvenience to the patient.

When they have acquired their usual size, from one to two inches diameter, they sometimes suddenly decrease, and then again begin to enlarge and acquire their former magnitude.

Sometimes in combing the head, the tooth of the comb is caught in the swelling, and a suppurative inflammation is in this way induced, which removes the swelling for the time and even sometimes permanently.

In dissecting these swellings, some part of their surface is found adhering firmly to the skin; in other parts its connexion is merely by cellular membrane.

The skin being removed, a cyst is found which is imbedded in the cellular membrane, and extends from the skin to different depths, according to the size of the swelling; this cyst is composed of a membrane differing in thickness in the different parts of the body. If placed on the face or near the canthus, the cyst is thin so as to bear little pressure without bursting, but if seated on the back it is much thicker; on the head it acquires the greatest density, for on this part it is so thick and firm as to maintain its form when its contents are discharged, and so elastic that if it be compressed, it expands itself readily to its former size.

Within the cyst there is a lining of cuticle, which adheres to its interior, and several desquamations of the same substance are formed within the first lining, apparently secreted at various periods of the growth of the cyst.

The substance which is contained within the bag, has the character to the eye of coagulated albumen, but as it varies much, this swelling was formerly absurdly named, according to the appearance of its contents, atheroma or meliceris, names which only expressed different states of the substance contained in the same disease.

If the vessels which nourish these cysts are injected, they are found to be but of small size although they are numerous.

They sometimes contain hair when situated upon the temple and near the eyebrows, and in other hairy parts of the body; the hairs have no bulbs or canal, and differ therefore from those which are produced in those surfaces of the body which naturally form hair.*

The cyst is sometimes ossified.

From these cysts horny excrescences sometimes grow, and I have given a drawing of two of these, one of the natural size taken from a preparation in our Museum, and the other a section of one which I removed from the pubes, and which is also in the Anatomical Museum. For the former of these I am indebted to my friend Dr. Roots, of Kingston, who wrote me the following letter respecting the man, and who, before he operated, had the kindness to send the patient for my inspection.

"MY DEAR SIR,

"The case of Kennedy, the gardener, is as follows:

"In the year 1796, John Kennedy, a gardener, in the service of the late Sir Richard Sullivan, Bart. of Thames Ditton, in the

* These cysts in the sheep sometimes contain wool.

county of Surrey, first perceived a tumour growing on the upper part of his head, which was taken off by the knife, in about three years from its first appearance, and shortly after this operation, a horny substance began sprouting forth on the same part, which continued increasing during the four following years, till it accidentally fell to the ground, whilst the patient was taking off his hat to some company walking in the gardens, at which time it was not more than three inches in length, and it was particularly observed by myself and others, that the surface from which it dropped, was perfectly smooth and free from any discharge whatever. In a few months from this time, a new horn began to appear, putting on the figure and resemblance of a ram's horn, which I suffered to continue growing during the seven following years, keeping a constant watch upon its progress, and expecting it would drop off *de se*, when it had arrived at a certain stage of maturity, and which process had taken place under my own observation in its former period.

"But in the year 1811, the poor man suffering greatly from its increasing inconvenience, and becoming, in a measure, the laughing-stock of his ignorant neighbours, I was induced, *after having shown it in its living state to yourself*, to put an end to his misery, not only by amputating the horn, but by dissecting out every portion of the cyst, so as to prevent any fresh formation of the horny matter, and in consequence of the entire extirpation of the part, there has been *no appearance of the disease recurring up to this date*, which embraces an interval of eight years. For a further account of this curious case, I refer you to the article of *Horny Excrescence* in *Dr. Rees's New Cyclœpedia*. It has been stated, that this identical gardener had another formation of the same nature, *after the operation I have just mentioned*, but this statement is erroneous, as I have not lost sight of the man up to the present time.

And I have the pleasure to be,

My Dear Sir,

much and truly yours.

W. ROOTS."

Kingston on Thames.
Oct. 15*th*, 1819.

Sir Everard Home has, in the Philosophical Transactions for the year 1791, given an excellent account of the growth of these horny excrescences, and has clearly shown they owe their origin to these cysts.

The manner in which these horny excrescences are produced is as follows:—The horn begins to grow from the open surface of the cyst; at first it is soft, but soon acquires considerable hardness; at first it is pliant, but after a few weeks, it assumes the character of horn: sometimes several of these grow from the same scalp.

In their removal it is necessary to prevent their recurrence, that the cyst as well as the horn should be dissected out.

With respect to the origin of the encysted tumour, I believe it arises from a follicle extremely enlarged and incapable of discharging its contents from an obstruction of the orifice, by which it opens upon the surface of the skin.

Follicles are glandular pores which are found in numbers on the surface of the skin, more especially upon the face and head.

These follicles appear upon superficial examination to be only pores in the skin, but upon the introduction of a fine probe they are found to proceed through the skin into the cellular membrane beneath it. They are productions from the skin, are naturally lined by the cuticle, and their internal surfaces secrete a sebaceous matter, which lubricates and defends the surface of the skin upon which they are found. This matter may be pressed from the follicles of the nose in the form of worms, very considerably longer than the skin is deep; thus proving that these pores extend beyond the skin.

The first circumstance which induced me to believe that an encysted tumour was an obstructed follicle, was examining a tumour of this kind situated upon my own back. It had acquired a diameter of about two inches, and was situated at the lower part of the dorsal vertebræ. I thought of requesting a friend to remove it, but examining it by means of two mirrors, I saw a small black spot in the centre of the swelling; and picking this, I extracted a piece of sebaceous matter with a black head, like those seen in the follicles of the nose. I then squeezed the tumour, and through the orifice occupied by the black sebaceous matter I emptied the tumour, by squeezing out a large quantity of sebaceous substance. This was effected without pain, and without succeeding inflammation, but gradually the secretion became renewed; but by frequent pressure I have now for several years kept it empty, although the bag and its orifice still remain.

A lady applied to me with one of these swellings upon her shoulder. It had a small black spot upon its centre, through which I could squeeze its curdly contents. I removed it with the skin over it, and found that the opening was a follicle leading into the hollow of an encysted tumour, which contained sebaceous matter lined with cuticle, and having a cyst of the usual character.

Often have I since seen the follicular aperture over these swellings, by which the point of a tent probe was readily admitted into the cavity of the cyst, and through which I could immediately squeeze its contents. The follicle is, however, generally entirely obstructed at its orifice, and a depression only is seen, (and not always even this) when the sides of the swellings are compressed.

These encysted tumours begin in the following manner:—A follicle becomes obstructed at its termination upon the skin, and the secretion still proceeding, its sides are extended in the cellular membrane, where it can most easily yield; and this obstruction of its secretion produces a swelling of greater or less magnitude, according to the degree of obstruction and the duration of the disease. If it be said, how is it possible that a follicle can be thus extended? the answer is, other membranes expand to much greater comparative magnitude. An ovarium, which would not contain within its membrane more than two drachms of water, will expand to a magnitude capable of containing ninety-seven pints, for of such an ovarium there is a preparation in our collection.

The cysts forming these swellings are more or less dense according to the nature of the follicle: as the skin of the head is very firm, so is the cyst; the skin of the back also produces cysts of considerable thickness, but that on the face is thin and delicate.

The cyst also acquires density according to its duration, for constant pressure, which does not produce high inflammation, is known to add to the density of parts.

Pressure is very frequently the cause of these swellings, as is seen upon the shoulders, where the braces produce them. I have also seen them in the circle pressed upon by the hat, probably from some obstruction being thus produced at the extremity of the follicle. But in a diseased state of the secretions, a want of due moisture will produce the same effect, by inspissation of the substance secreted, and by its incapacity to pass the orifice of the follicle.

When parts are exposed to pressure I have known the follicle obstructed at its mouth, dilating a little, but elongating still more, forming a black head, and a worm of sebaceous matter is thus formed of considerable magnitude.

The reason that these cysts do not easily inflame when opened will now be understood; they are naturally external surfaces, that is, the follicles have an aperture through the skin; into this the cuticle is reflected, and on its outer side is the secreting portion of skin which forms the follicle. All that is done then by opening them, is to make their communication with the surface of the skin more free, thus exposing the cavity of the follicle, but not a new surface, and the cyst will continue to secrete as long as any part of it remains, just as the original follicle had done.

Now also will be seen the reason for their occasional sudden diminution. They open at the follicle, discharge and lessen, but the follicle becomes again stopped, and the swelling is renewed.

With respect to their treatment, it consists in adopting the following rules. If the follicle can be seen only as a black spot filled by hardened sebaceous matter, a probe may be passed through it, and the sebaceous matter squeezed from the tumour, which is done with little inconvenience.

But if violence would be required to squeeze out the contents, inflammation will follow, and the best plan is to make the opening larger, and to squeeze out the contents of the cyst. The relation of Mr. Toulmin, of Hackney, whose case I have mentioned, had an encysted tumour upon her arm, which I thought too large for the removal, and from this the follicle was seen opening of considerable size. I pressed out the contents of the swelling by the aperture, but finding the contents less curdy than usual, I made a large opening, and thus in a great degree emptied the swelling, and directed her to continue to do so.

The common mode adopted for their removal is, to dissect them out whole, but the best manner of doing it is, to make an incision into them, and then by pressing the sides of the skin together, the cysts may be easily everted and removed. If it be attempted to be extracted whole, the dissection is most tedious, and before it is completed the cyst is either cut or burst; so many incisions and so much pain may be readily prevented by opening it freely by one incision, and raising its edge between the forceps, dissect it from its adhesion to the surrounding cellular membrane. When a swelling of this kind in the scalp is to be removed, the surgeon makes an incision from one side of the tumour to the other, directly through its centre, and its contents, which are very solid in this situation, are directly discharged in form similar to the tumour; then a tenaculum is put into the cyst to raise it, and it becomes most easily separated. In half a minute the operation may be accomplished, and with scarcely any pain. The hair is then braided together from each edge of the wound, and the edges are thus approximated being clotted together by means of blood. Pressure upon the little vessels which are divided in this simple operation will be sufficient to stop the bleeding.

The swelling of this description which takes place at the outer canthus, is the most difficult of these encysted tumours to remove; it passes within the orbit, and often adheres to its periosteum, and the inner part of the cyst is with great difficulty reached. The operation of removing it is always very tedious and painful.

The removal of encysted tumours is not entirely unattended with danger; I have seen three instances of severe erysipelatous inflammation succeed the operation of removing these swellings upon the head, and I believe it is owing to the tendon of the occipitis frontalis being wounded when they are attempted to be dissected out whole. It is well known that in cases of injury of the head, when this tendon is contused and inflamed, the inflammation often extends over the head and face. Trifling as the aperture appears, which is occasioned by this operation, care must be taken for a few days after it, when the swelling is seated upon the head. A lady had an encysted tumour removed from the scalp; three days afterwards she went into a cold bath; soon after she had left the bath she was seized with a rigour and severe pain in the head; an erysipelatous inflammation succeeded upon the head and face; and notwithstanding she had promptly the most able medical assistance in Dr. Baillie, she fell a victim to this inflammation.

[GUY'S HOSPITAL REPORTS, VOL. I.]

Some Experiments and Observations on Tying the Carotid and Vertebral Arteries, and the Pneumo-gastric, Phrenic, and Sympathetic Nerves.

THE anastomosis of arteries in all parts of the animal frame, and the circuitous channels through which the blood, when arrested in its progress along a principal trunk, is conveyed to its destination, have been for some time well ascertained; and the advantages arising from this arrangement of vessels in the natural condition of the body, as well as the safety afforded by it under certain accidents, diseases, and operations, are perfectly understood.

The existence of these anastomosing vessels has been proved, by the examination of diseases in which blood-vessels have been obliterated, by experiments performed upon the arteries of living animals, and by the result of surgical operations upon the human subject, and the dissections after death; and the injected preparations contained in our anatomical museums exhibit, for the principal arteries of the body, the place at which the main trunk has been rendered impervious, and the mode in which the circulation has been preserved.

In the chest, the aorta has been obliterated by disease, and the intercostal arteries have supplied its place in carrying on the blood. In the abdomen, the aorta has been entirely obstructed by an aneurism situated above the bifurcation; the two iliacs below being reduced to mere cords. The common iliac has been successfully tied by Mr. Guthrie; and the internal iliac by Mr. Stevens. The external iliac, and the arteries below it, have been now so frequently tied, and the anastomosing vessels so clearly demonstrated, that no doubt is entertained of an adequate supply of blood being sent to the lower limbs after these operations.

The subclavian arteries have but few anastomoses; but they are still sufficient to nourish the upper extremity; and the arteries of the arm below may be tied without danger of an insufficient supply by subsidiary currents.

The carotid arteries have been found, by Baillie, obliterated by disease. That artery has been now frequently tied on one side of the neck; and it has even been secured, at distinct periods, on both sides of the neck of the same person: and in these cases, the current of the blood has still flowed freely into the remote branches.

Still, however, the intimate connexion between the functions immediately essential to life—of the brain and other organs, and the necessity for a due supply of blood for the maintenance of cerebral action, gives to the vessels of the head extreme importance in the eyes of the surgeon and physiologist, and justifies him in pushing his inquiries respecting them to the utmost limit.

It will be seen that some animals die immediately from interrupting the circulation in the carotid and vertebral arteries; but that others survive the experiment, and give an opportunity of ascertaining the means of anastomosis.

LIGATURES PLACED UPON THE VERTEBRAL AND CAROTID ARTERIES OF A DOG.

On the 28th of January, 1831, I tied the right and left vertebral and the right and left carotid arteries of a dog, and all was completed within half an hour. The animal appeared insensible, or as if it were intoxicated; it had difficulty in breathing; its pupils were dilated; its volition was diminished; and it ran against the leg of the table, or any other body, without seeing or regarding it. When placed upon its legs, it fell down on its right side, and had spasmodic twitchings, of its hinder extremities.

At the expiration of a quarter of an hour, it was still insensible: it had shiverings, although placed near the fire: it rested its head upon the ground on the right side: its respiration was still laborious; and its pupils were dilated.

After an hour and a half, however, it was able to stand, and, although with difficulty, to stagger around a small room.

On the 29th, it was dull, and indisposed to move. On the 30th, it was much the same, and not inclined to move or eat. On the 31st, it walked round the room; and ate about an ounce of food, but would not lap. On the 1st of February, it was much better: it ate and drank; and from that time gradually recovered. It afterwards became a good house-dog; and I kept it for nine months, when it was killed, that I might inject it. The number and the size of the anastomoses were very extraordinary.

The left carotid was obliterated from near its origin, but filled with injection above the obliterated part, by the inferior thyroideal artery communicating with the superior, and by the ascending cervical artery from the subclavian, by numerous and large anastomoses, and by an œsophagal artery from one of the intercostals communicating with the superior thyroideal artery.

The right vertebral artery was obliterated near its origin on the seventh cervicle vertebra, but filled with injection above the obliterated part by two branches from the superior intercostal arteries, which passed, on the back of the spine, into the arterial canal of the vertebræ, at the fourth, fifth, and sixth intercostal spaces. The vertebral artery thus produced passed to the second vertebra of the neck, where it formed the basillary artery, and, in its course, had festoons or loops formed in it, as far as the first vertebra, at each intervertebral substance; and here, upon the transverse process of the first cervical vertebra, it formed communications with the carotid.

The left vertebral artery was obliterated close to its origin; but was filled with injection by an anastomosing branch from the superior intercostal artery, which entered between the fifth and sixth vertebræ of the neck; and by a second branch, also, from the intercostal artery passing on the posterior surface of the transverse processes of the fourth and fifth cervical vertebræ: then, over each transverse process was a loop of arterial communication, forming down each side a beautiful display of festoons.

The basillary artery began at the base of the second cervical vertebra; passed to the junction of the first vertebra to the head, where it again received vessels from the vertebral arteries; and then proceeded, as a single artery, to the points of the petrous portions of the temporal bones; where it formed the commencement of the circle of Willis, which was well filled with injection, and sent off its usual arteries to the brain.

The vertebral artery also joined the internal carotid artery on the transverse process of the second cervical vertebra of the neck.

On a second occasion, I tied the left vertebral artery of a dog. I then secured the right vertebral; and after an interval of eight days I put a ligature on each carotid artery.

The animal was weakened in its fore-legs; but in other respects it suffered less than the former; and on the following days it took its food as usual.

The right carotid was obliterated; the injection passed from the aorta to the obstructed part, and above it, by an anastomosing vessel from the vertebral, and by an ascending cervical artery fro the right subclavian.

The left carotid was obliterated, but filled with injection to the place of obliteration, from the aorta; and above, it was filled by an ascending cervical, an inferior laryngeal branch, and others from the vertebral.

The right vertebral artery was obliterated opposite the seventh cervical vertebra, before it entered the foramen of the sixth vertebra; but above the obliteration it was filled by an anastomosis with the superior intercostal artery: it then ascended through the canal in the sixth cervical vertebra, forming beautiful festoons and junctions with arteries passing over the vertebræ, opposite each intervertebral substance, and joining, by anastomosis, with the carotid at the first vertebra of the neck.

The left vertebral artery was obliterated at the seventh vertebra; but the artery formed anastomoses, one with the subclavian, and two with the superior intercostal.

The artery on this side formed similar but larger junctions than the right, opposite to each intervertebral substance, in festoons or loops; and thus the vertebral artery was reproduced, and filled with injection from these vessels.

The two vertebral united to form the basillary artery as usual, and joined with the internal carotids at the circle of Willis.

Where the basillary artery was first formed, anastomoses were sent to the carotid arteries on the transverse process of the first cervical vertebra.

The result of tying the carotid and vertebral arteries in the dog is such as I have described; but in the rabbit it is different, as in this animal the arrest of the blood in these four vessels is immediately fatal.

Besides the determination of this point, it was my object, in the following experiments, to ascertain the different effects which would be produced by tying separately the vertebrals and the carotids.

The size of the carotid arteries, compared with the vertebrals, is much less in some animals than in man, in proportion to the inferior development of the cerebrum; and the tractus respiratorius being supplied by the vertebrals, the current of blood in these arteries might be supposed to exercise an influence on the respiration.

LIGATURE PLACED ON BOTH CAROTID ARTERIES.

In the first place, I applied a ligature to the carotid artery on each side of the neck.

Little effect was produced; except, that the respiration was quickened for a few minutes, and the animal rendered dull and disinclined to eat during the day: but on the following morning it appeared lively, and ran about with its natural activity. So that it may be truly said, that these two arteries may be tied with very little change in the functions of the animal, excepting that the respiration is quickened; and this perhaps may be attributed to a greater quantity of blood being impelled through the vertebral arteries, in consequence of its interruption in the carotids.

LIGATURE PLACED ON BOTH VERTEBRAL ARTERIES.

I next placed a ligature around both vertebral arteries. When I had tied the first, there was some difficulty in breathing; but when I had tightened the second ligature, this difficulty was greatly increased. The respiration was at first slow, but it afterwards became quicker. The animal retained volition and sensation, but its fore legs were weakened.

At the end of two hours, its breathing was laborious; its ears dropped to the right side; its heart beat quickly; it was dull, and indisposed to move; and its fore legs were still weak.

After four hours and a half, it ran about, but with its ears fallen: its respiration was slower.

On the following day, there was a murmuring in its breathing, which was increased under excitement: its heart beat quickly and forcibly: its pupils were not dilated.

On the second day, the respiration was slow and heaving; it had an irregular action of the heart; it was dull; and its heat was 102. In the evening, its respiration was irregular and heaving; but it moved about, and took food.

On the third day it was dull: its breathing was slow: its heart beat quickly: it ate food.

On the fourth day, it appeared heavy, and indisposed to move. The action of its heart was quick and strong: its respiration was slow, but no longer stertorous.

On the fifth day, its breathing was slow: it appeared dull and heavy: the action of the heart was still quick.

On the sixth day, the respiration was laborious and slow, being only 64, instead of between 120 and 150, the natural number of inspirations in a minute: its heart beat rapidly, and not forcibly: it was very dull, and indisposed to move; it was getting thin, but it took its food as usual.

On the seventh day the animal was found dead; and on the eighth I examined it, after injection, and found an abscess in the neck. The vertebrals had been well secured, and the brain had received injection by the carotid: the basillary and cerebellal arteries were filled from the circulus arteriosus. This animal's death may have been hastened by the abscess.

I have many times repeated this experiment; and it uniformly produces a marked effect upon the respiration, which it renders slow and laborious. The fore legs are weakened; and a much more severe effect is produced upon the animal than when the carotid arteries are obstructed; insomuch, that it will rarely recover from the operation.

THE CAROTIDS FIRST TIED, AND THEN THE VERTEBRALS.

The next step was, to ascertain the effect of arresting the blood in the vertebrals, after the carotids had been secured.

I tied the carotid arteries: the respiration and circulation became quicker: volition and sensation remained in all their activity.

In twenty-four hours, the animal appeared very lively, but its breathing was quicker than natural. After forty-eight hours, it breathed less quickly; it ran about in a lively manner; and it ate heartily.

On the third day, it was difficult to catch: on the fourth, fifth, sixth, seventh, and eighth days, it appeared to be quite in a natural and healthy state: and on the ninth I exposed the vertebral arteries, and found them obviously enlarged. A ligature was tied upon each of these vessels. The respiration stopped immediately, and the animal appeared dead; but it afterwards made seven gasps, from convulsions of the diaphragm: its hinder extremities became also convulsed; but in a minute, all voluntary motion ceased.

On opening the abdomen and chest, it was seen that the peristaltic motion of the intestines remained; and the heart continued to act for a few minutes after apparent death.

This experiment shows how little the functions of the brain depend upon the carotids, and how much upon the vertebral arteries.

CAROTIDS TIED—VERTEBRALS COMPRESSED.

As tying the vertebral arteries is a difficult experiment, it occurred to me that I might compress them with my fingers, after tying the carotids, and produce the same effects.

I tied the carotid arteries. Respiration was somewhat quickened, and the heart's action increased; but no other effect was produced. In five minutes, the vertebral arteries were compressed by the thumbs, the trachea being completely excluded. Respiration almost directly stopped: convulsive struggles succeeded; the animal lost its consciousness, and appeared dead. The pressure was removed; and it recovered, with a convulsive inspiration It laid upon its side, making violent convulsive efforts; breathed laboriously; and its heart beat rapidly.

In two hours it had recovered; but its respiration was laborious.

The vertebrals were compressed a second time. Respiration stopped: then succeeded convulsive struggles, loss of motion, and apparent death.

When let loose, its natural functions returned, with a loud inspiration, and with breathing excessively laboured.

In four hours, it was moving about, and ate some greens.

In five hours, the vertebral arteries were compressed a third time, and with the same effect.

In seven hours, it was cleaning its face with its paws.

In nine hours, the vertebral arteries were compressed for the fourth time; and with the same effect upon its respiration.

After thirteen hours, it was lively.

In twenty-four hours, the vertebral arteries were compressed for a fifth time, and the result was the same; viz. suspended respiration, convulsions, loss of motion, and consciousness. On the removal of pressure, violent and laborious respirations ensued; and, afterwards, the breathing became very quick.

After forty-eight hours, for the sixth time, the compression was applied, with the same effect.

Thus it appears, that if the carotid arteries are tied, simple compression of the vertebrals succeeds in putting an entire stop to the functions of the brain.

VERTEBRALS TIED—CAROTIDS COMPRESSED.

I then reversed the preceding experiment, by impeding the current of blood first in the vertebral arteries.

I placed a ligature tightly around the vertebral arteries.

The respiration became immediately laborious: its right ear fell, and the right fore leg was partially paralyzed.

In one hour, it was indisposed to move; its respiration was slow and laborious; and its right fore leg in a great degree recovered. Its sensation remained; but its volition was less than before the experiment: it smelt at the food offered, but would not eat it.

In three hours, green food was placed in its mouth, which it ate.

In five hours, it was running about; but its right ear remained in the same situation.

On the following day, its respiration was slow, and it appeared dull.

I pressed, with my thumbs, the carotid arteries on each side of the larynx, which was left free.

It fell upon its side; it lost all sensation and volition; and its eyes were drawn back.

Upon removing the pressure, it soon recovered.

On the second day, its respiration was quick; its ear much risen; its fore leg less paralytic: it sat up: and moved from place to place.

A second time I compressed its carotids. Its eyes were drawn back; it was convulsed; and its respiration was quick and laborious; and it was affected in the same way as on the preceding day, but in a less degree.

On the third day, its respiration was hurried, and 150.

For the third time I compressed its carotids. It fell upon its side, and was insensible; but soon recovered, and ran about.

On the fourth day, it was dull, and its respiration was laborious: it ate some green food.

In the afternoon of this day, it became very dull, and refused the food placed before it; and on the morning of the fifth it was found dead.

I injected this animal with coarse injection: and, upon dissection, it was found that abscesses had formed around the ligatures. The vertebral arteries were fairly tied, and the carotids greatly enlarged, but they were compressed by the abscesses.

The injection had entered the cranium by the internal carotids, but not by the vertebrals; nor was there any injection in the basillary artery by the circle of Willis.

CAROTID AND VERTEBRAL TIED ON THE SAME SIDE.

On another occasion, I tied the carotid and vertebral arteries on the same side: the breathing became laborious, and the fore-leg was partially paralyzed. I subsequently compressed the vessels on the other side, with the usual effect of producing apparent death: but the pressure being removed, the animal recovered; and at the expiration of eighteen days it was quite well, excepting that it had a difficulty in breathing, under excitement. It was then killed and dissected. The arteries had been securely tied.

It appears, then, that the obliteration of one carotid and one vertebral, on the same side, does not produce a fatal effect.

VERTEBRAL AND CAROTID ARTERIES TIED AT THE SAME TIME.

In order to cut off at once the several currents of blood to the brain, I tied at once both the vertebral and carotid arteries.

The animal breathed no more; but there were thirteen or fourteen convulsive contractions of the diaphragm and convulsions of the hinder extremities, and the animal ceased to exist.

This is a most decisive experiment; showing the effect of the arrest of the blood in the vessels of the brain, in stopping respiration, volition, and sensation; and the result is striking and immediate.

The same effect of interrupting the streams in the vertebrals and carotids was produced in an equally conspicuous manner, without the application of ligatures, as follows. The animal was held in a convenient position, with its neck extended, and its head thrown back. I then applied my thumbs, so as to compress, at the same time, the two vessels on each side, taking care to leave the trachea entirely free from compression. Respiration ceased in a few seconds: some struggling then took place, and the animal appeared dead. The pressure being then removed, the respiration was completely suspended; but artificial motion being given to the ribs, the animal gasped, began to breathe quickly, and recovered.

I also put a ligature around the neck, close to the sternum, so as to compress the carotid and vertebral arteries; but the trachea was excluded, by passing the ligature behind it. Although the trachea remained free, as soon as the ligature compressed the carotid and vertebral arteries, breathing ceased, and all the functions of the brain were destroyed.

Before I would venture to draw conclusions from the experiments above detailed, I was desirous of convincing myself that no injury done to the nerves could have influenced, in any material degree, effects which had been observed. I proceeded, therefore, to investigate the consequences of applying ligatures to the principal nerves of the neck.

LIGATURES PLACED ON THE PNEUMO-GASTRIC NERVES.

In the first place, I put a ligature on each pneumo-gastric nerve. The animal's breathing became heaving and laborious, and fell from 150 to 48 inspirations in the minute: it was likewise accompanied by a stertorous noise: the heart beat feebly, but rapidly: food was refused. These symptoms continued; and on the following morning it was found dead. The same experiment was several times repeated, and the results were nearly uniform, the animals dying at the end of from nineteen to twenty hours.

In these experiments, it was likewise observed that the blood circulating in the arteries gradually assumed the venous colour, and that the animal heat at the same time decreased in a remarkable degree.*

* These facts were carefully noticed in the following experiments:—

EXPERIMENT I, ON THE RABBIT.

Respiration, 132 in a minute: Heat 104.

The pneumo-gastric nerve was tied on each side: the breathing became stertorous; the animal dull, and disinclined to move.

In 1 hour, respiration 48.
 3 hours . . . . 44.
 4 . . . . 56. Animal Heat 99¼ in the anus.
 8 . . . . 48. . . . . . . 93½.

I opened the carotid artery, and blood of a venous colour escaped. I tied the artery.

In 11 hours, respiration . . . . 36. Animal heat 93.
 11½ . . . . . . laborious, and 30. . . . . . . 90¼ to ½.
 12 . . respiration the same. . . . . . . 89.

The rabbit died at this time, and the heat of the abdomen was 88½.

Examination.

Lungs loaded with dark blood: water in each cavity of the pleura: food in the œsophagus: stomach loaded with food.

The examinations after death exhibited the lungs gorged with blood, and looking like the liver; a fluid in the pleuritic cavity; the stomach full of undigested food; and the œsophagus likewise distended with it, in those cases in which the animals had taken food after the ligatures had been applied.

LIGATURES PLACED ON THE PHRENIC NERVES.

In another rabbit, I divided the phrenic nerves one after the other, in immediate succession.

The diaphragm being then paralyzed, the animal's respiration, which was performed by the intercostal muscles, instantly became excessively laborious. The ribs were heaved violently; and a much greater effect was produced on the respiration than when the vertebral arteries, the pneumo-gastric nerve, or grand-sympathetic, were tied.

In a quarter of an hour it lay upon its side, making great efforts with its intercostal muscles; and sometimes it stopped, as if fatigued, and then again commenced. In twenty minutes it was dead. On examination, the phrenic nerves were found to be completely divided.

The heart's action, and the peristaltic motion of the bowels, were observed for a short period after apparent death.

In this experiment, respiration was rendered difficult, by obstruction to the mechanical apparatus destined to provide the necessary supply of fresh air: whereas, in the former, the difficulty arose from the failure of those processes which in health are carried on within the lungs; and may we not thence infer,

EXPERIMENT 2.

The Pneumo-gastric nerves tied.—Respiration 135 before the experiment. Animal Heat 102.

In 1 hour, respiration 48. Animal Heat 99.
3 hours . . . . 39. . . . . . . 99.—(Stertor, or moaning, under excitement.)
4 . . . . 33. . . . . . . 98½.—(The amimal dull, and disinclined to move.)
6 . . . . 36. . . . . . . 96: cold to the touch.
12 . . . . 36. . . . . . . 97½.
14 . . . . 32. . . . . . . 95½.
16 . . . . 28. . . . . . . 93.
16¼ hours the animal died. Its heat 87 in the abdomen, at the time of its death.

The animal felt cold before it died.

The gradual decrease of the animal heat, the dark blood circulating in the arteries, and the gorged state of the lungs after the application of a ligature to the par vagum, are interesting and important circumstances: and we are led to question, whether the lungs, by this operation, are deprived of a nervous or vital influence essential to the change of the blood; or whether this change is not produced in consequence of the slowness of the animal's breathing: for when the phrenic nerves have been tied, the blood also becomes dark in the arteries. In that case, however, the lungs are not found gorged with blood.

that the changes of the blood are not chemical alterations merely, but dependent also upon the vital agency of the nerves and blood-vessels?

LIGATURES PLACED ON THE GRAND-SYMPATHETIC NERVES.

I now tied the grand-sympathetic nerve on each side. The respiration became quick and irregular; but sensation and volition were unaffected. The heart's action was very quick: there was a general trembling; but, when the animal was put down upon the ground, it ate some greens. Its respiration continued irregular, and its heart's action very quick; and after eight days it was killed. The nerves were found well tied: one had ulcerated below the ligature; the other was nearly ulcerated through; and the ligature was surrounded by suppuration.

In another rabbit, I tied these nerves; and the animal, although it is near a month ago, is still lively and active.

LIGATURES PLACED ON THE PNEUMO-GASTRIC, PHRENIC, AND GRAND-SYMPATHETIC NERVES.

Lastly, I tied, in one rabbit, the pneumo-gastric nerve, the grand-sympathetic, and the phrenic. The respiration became laborious; the animal dull, and indisposed to move; and the heart's action feeble. The breathing continued excessively laborious for a quarter of an hour, when the animal died. Bloody fluid was found in the chest: the lungs were not much changed. In another similar experiment, the animal died in three-quarters of an hour.

We see, then, that an animal with all these nerves compressed may live from a quarter to three-quarters of an hour; that the ligatures on the pneumo-gastric kill in about twelve hours; and in the grand-sympathetic, that the animal will continue to live for a much longer period: so that pressure on these nerves, in the experiments in which the arteries were compressed by my thumbs, could not have been the cause of death.

The effect of tying the jugular veins of the rabbit is not constantly the same in all cases; as the following instances prove.

LIGATURES PLACED ON THE JUGULAR VEINS.

In one rabbit I tied the jugular veins on each side of the neck. When it was set at liberty, it ran about, cleaned its face with its paws, and took green food.

Its respiration was reduced to 68 inspirations in a minute, which is about half the natural number. After four hours, it ran about as if nothing had happened; and eventually recovered.

When it was killed and injected, I found, on each side, three anastomosing veins passing from the anterior to the posterior part of the jugular vein, and conveying the blood from the head to the heart; but the vertebral vein had remained whole, and become enlarged; and it passed, on the fore part of the vertebræ, from the head to the space between the fourth and fifth cervical vertebræ, where it entered the vertebral canal.

In a second rabbit, I tied the jugular veins on each side of the neck, as before. The animal's respiration became slow; but it ate green food, ran about, and was difficult to catch: but for five days after it appeared dull; its ears had dropped. On the seventh day, it was seen to be convulsed, and frequently rolled over. Its voluntary powers were lost, as well as its sensation, in a great degree. On this day it died. On examination, a clot of blood was found extravasated in the left ventricle of the brain.

Hence it follows, that apoplexy will occasionally result from an obstruction to the return of blood in the jugular veins; and this I have known to happen from enlargement of the glands in the neck of a boy.

INFERENCES DRAWN FROM THE FOREGOING EXPERIMENTS.

It appears, from these experiments, that the carotid arteries are designed in these animals rather for the supply of blood to the external parts of the head than to the brain itself; whilst in proportion as the brain is more developed, the carotid artery acquires greater importance. The obstruction of it influences respiration in some degree; probably, because, under these circumstances, more blood is directed to the vertebral arteries.

The internal carotid branches are proportionably less than in those animals which have a large cerebrum and are endued with higher mental faculties.

It passes tortuously to its destination, to prevent the action of the heart from influencing the brain immediately.

The rabbit quickly recovers from the operation of tying these arteries, and seems little affected by it: and in man, as well as in these animals, these vessels are obliterated without the destruction of life.

The vertebral arteries are much more important vessels, as regards the brain and its functions in these animals,* than the carotid arteries. The nervous power is much lessened by tying them; and, in these experiments, the animal did not, in any case, survive the operation more than a fortnight; although I do not mean to say that recovery is impossible. In the dog, also, the carotids may be tied with little effect; but the vertebrals have a great influence.

The effect of the operation is, immediately to render breathing difficult and laborious, from the supply of blood to the phrenic nerves and the whole course of the tractus respiratorius of Sir Charles Bell being stopped. The animal becomes dull, and indisposed to use exertion or to take food.

Very slight injuries, after a ligature has been put upon these arteries, will destroy life; insomuch, that if they are first tied, even dissecting for the carotids, without tying them, will cause death. The best method, in such experiments, is to tie the vertebrals last.

On account of the importance of these vessels, they are securely defended by bone in the greater part of their course; and it is only below the sixth cervical vertebra that they are accessible. If they were exposed to pressure, death would often be suddenly produced.

These arteries are tortuous, to prevent too sudden a rush of blood to the head; and they pass through foramina of bones, which prevents any great increase of their size; although they become somewhat larger than before, when the carotid arteries are tied, and *vice versâ*.

Thirdly, compression of the carotid and of the vertebral arteries at the same moment, in the rabbit, destroys the nervous functions immediately. This is effected by the application of the thumbs to both sides of the neck, the trachea remaining

* Mr. Coleman informs me that the vessels of the horse are different; and he thinks it is designed to counteract gravitation, when the animal is feeding on grass.

quite free from pressure; when respiration entirely ceases, with the exception of a few convulsive gasps.

The same fact is evinced in a clearer and more satisfactory manner, by the application of ligatures of the four vessels, all being tightened at the same instant; when stoppage of respiration, and death, immediately occur.

When the dog is the subject of this experiment, it loses its volition and sensation, and appears as if it were intoxicated; but the anastomosing vessels gradually restore the circulation, by means of the other branches of the subclavian artery at the back and sides of the neck.

But, notwithstanding the decisive nature of the last experiment, conceiving that it might be possible that the pressure upon the nerves of the neck might have an influence in killing the animal suddenly, I made the experiments which I have detailed.

I first tied the pneumo-gastric nerves; and found that the animal lived about twelve hours, although it died on the instant when the carotid and vertebral arteries were tied: the lungs were also loaded with blood,* and twice as heavy as the healthy lung: it appears, therefore, that the change of the blood is either directly or indirectly under the influence of the par vagum.

In this experiment it is also to be observed, as a point of much importance, that the blood in the carotid arteries is found of a venous character, and dark blood circulates in the animal for some time before it dies, the blood being less arterial as the time elapses from the application of the ligature: yet the heart continues to beat; for when the artery is opened, the blood flows *per saltum.*

The blood also flows of a dark colour when the carotid is opened after the phrenic has been tied; but the lungs are not in that case found loaded with blood, but possessing their ordinary weight and appearance.

In this experiment, there was also a remarkable diminution of animal heat. Is this to be attributed to a cessation of that pulmonary process accompanied by the evolution of heat wherein venous is converted into arterial blood? or does it arise from a want of that supply of arterial blood to the nerves from which they derive a capability of evolving caloric? or shall we not approach still nearer to the truth, in supposing that both these causes of a high temperature are suspended at the same time;

* Sir Benjamin Brodie has mentioned this state of the lungs.

and that there is, consequently, a double reason for the gradual departure of the animal heat observed in this experiment?

The œsophagus contained food, in some instances in which the animal had eaten after the experiment, from its muscles being paralyzed; and the stomach was full, from the arrest of the digestive function.

This nerve, then, is most important; 1st, in assisting in the support of the function of the lungs, by contributing to the changing of the venous into arterial blood: 2dly, in being necessary to the act of swallowing: 3dly, in being very essential to the digestive process.*

The pair of nerves upon which I next applied ligatures were the phrenics. As soon as these were tied, the most determined asthma was produced; breathing proceeded by means of the intercostal muscles; and the chest was elevated to the utmost by them; and in expiration, the chest was as remarkably drawn in. The animals did not live an hour; but they did not die suddenly, as they do from pressure on the carotid and vertebral arteries. The lungs appeared healthy; but the chest contained more than its natural exhalation.

When the grand-sympathetic was tied, little effect was produced: the animal's heart appeared to beat more quickly and feebly than usual; but of this circumstance I cannot be positively certain, on account of the natural quickness of its action. The animal was kept seven days; and one nerve was ulcerated through, and the other nearly so, at the situation of the ligatures. The suppurative process was extensively set up around the ligatures. No particular alteration of any organ was observed, on examination.† Another animal still lives, in which the sympathetic was tied nearly a month ago.

Lastly, I tied all three nerves on each side of the pneumogastric, phrenic, and grand-sympathetic; and the animal lived little more than a quarter of an hour, and died of dyspnœa.

The sudden death, then, that takes place from pressure at the sides of the neck must not be attributed to an injury to the nerves, but it is owing to the impediment to the due supply of blood to the grand centre of nervous influence.

* A ligature on one nerve only does not destroy.

† See Swan on the division of this nerve.

APPENDIX

TO EXPERIMENTS ON TYING THE ARTERIES AND NERVES IN THE NECK.

The following Experiments are added to those which have been already detailed (see Note, p. 179,) for the purpose of showing that the gradual decrease of animal heat, from the time of applying ligatures to the pneumo-gastric nerves, does not invariably occur, but is liable to rare though striking exceptions.

THE PNEUMO-GASTRIC NERVES TIED IN THE RABBIT.

EXPERIMENT 3.

Before the experiment, respiration	88.	Animal Heat 104.
After ½ an hour	56.	102½.
2 hours	64.	93.
4 . . .	52.	86½.
6 . . .	ceased	80½.

EXPERIMENT 4.

Before the experiment, respiration	128.	Animal Heat 104.
After	52.	102½.
2 hours	48.	101½.
4 . . .	52.	102½.
6 . . .	60.	104½.
8 . . .	52.	95.
8¼. . .	ceased	90.

EXPERIMENT 5.

Before the experiment, respiration	124.	Animal Heat 104.
After	76.	102½.
2 hours	80.	102½.
4 . . .	52.	102½.
6 . . .	60.	101.
8 . . .	56.	95.
10 . . .	48.	88½.
10½. . .	ceased	86.

EXPERIMEMT 6.

Before the experiment, respiration	96.	Animal Heat 104.
After	56.	$102\frac{1}{4}$.
2 hours	68.	$102\frac{1}{2}$.
4	52.	$102\frac{4}{5}$.
6	72.	104.
8	52.	$105\frac{1}{2}$.
10	48.	102.
$10\frac{3}{4}$.	ceased	98.

The last experiment exhibits an increased temperature until the last moment; a circumstance which I have before observed, but which is not easily explained. The animal was much convulsed; which was not the case with the others.

N.B. The respiration of these animals is easily rendered quick, by excitement: it is quicker also in the young and weak animal. But for these circumstances allowance was made in the experiments.

THE END.