XVI. *On the Nerves of the Uterus.* *By* Thomas Snow Beck, *Esq., Surgeon.* *Communicated by Sir* Benjamin C. Brodie, *Bart., F.R.S.*

Received May 29,—Read June 19, 1845.

In February 1843, during the examination of the body of a woman who died from uterine hæmorrhage immediately after delivery, it occurred to me that the uterus afforded a good opportunity for examining the condition of the nerves in the impregnated state, to which attention had been directed by Dr. Robert Lee in communications to this Society in the years 1841 and 1842. With the view of confirming the researches of Dr. Lee, I commenced the dissection of the nerves of the gravid uterus, but found so many points at variance with his published statements*, and the nerves so small, considering the size of the organ, that it appeared very doubtful whether or not they had increased in size during pregnancy; but in order to arrive at a correct conclusion on this point, a comparison of the nerves of the unimpregnated with those of the gravid uterus was indispensable; and in the following year I commenced a dissection of the nerves of the unimpregnated uterus and of the neighbouring organs.

* To the structures described as nervous ganglia and plexuses, Dr. Lee gave the following names: "The posterior subperitoneal ganglion and plexuses," "a great nervous web under the peritoneum," to which "it adheres firmly," and which covers the posterior surface of the uterus "as high as the fundus." "It represents the appearance of a layer of dense structure composed of fibres strongly interlaced together, having a yellowish-brown colour." "The anterior subperitoneal ganglia and plexuses," "a nervous and vascular mass of great extent, and similar in structure to the subperitoneal ganglia on the posterior surface." It "adheres to the peritoneum firmly," and covers "the whole anterior surface of the uterus." "The left subperitoneal plexuses." "Another ganglion of considerable size," "near the edge of the uterus." "The great transverse plexuses," "which proceed across the uterus," and "present the appearance of a white, pearly fuciculated membrane about a quarter of an inch in breadth." "The left spermatic ganglion," "a dense reddish-brown coloured mass consisting of fibres firmly interlaced together." "The hypogastric or utero-cervical ganglion," which "exceeds in size the semilunar ganglia of the great sympathetic," and "is nearly two inches in breadth." "The middle vesical ganglion," and "the internal and external vesical ganglia," which "form a great web of ganglia and nerves on the side of the vagina." Dr. Lee further adds, "It is chiefly by the influence of these nerves, that the uterus performs the varied functions of menstruation, conception, and parturition, and it is solely by their means that the whole fabric of the nervous system sympathises with the different morbid affections of the uterus. If the nerves of the uterus could not be demonstrated, its physiology and pathology would be completely inexplicable." In the progress of my dissections, I found that the structure considered by Dr. Lee as "the hypogastric or utero-cervical ganglion" was a mass of dense fibro-cellular tissue enveloping several small ganglia and a nervous plexus, formed at the junction of the lateral hypogastric plexus with branches from the sacral nerves; that the "vesical ganglia" were also a mass of fibro-cellular tissue, in about the centre of which were situated small ganglia; and that the remaining structures described as ganglia and plexuses were not nervous structures.—(May 1846.)

The gravid uterus I had dissected was that of a woman about thirty-five years of age, and of middle stature; and to obviate as much as possible any objection that might be raised on the ground of individual peculiarity, the organ selected for the second dissection was that of a woman about the same age and stature as the former. She had also borne children.

The comparison thus made demonstrated the truth of the former supposition, and clearly showed that the nerves had undergone no change of size during pregnancy, nor of position, except such as resulted from the enlargement of the organ over which they were distributed.

The Great Splanchnic Nerve and Semilunar Ganglion.—The great splanchnic nerve is said to be formed by branches which come from the sixth, seventh, eighth and ninth, and sometimes tenth, thoracic ganglia. These branches, after passing forwards and downwards, unite at the side of the dorsal vertebræ, and constitute the nerve, which after piercing the diaphragm ends in the semilunar ganglion. If the branches said to come from these ganglia be examined, it will be seen that this is only their apparent origin, and that they are branches of the intercostal nerves. The branches of communication between the spinal nerves and the thoracic ganglia consist of two distinct portions, marked by difference in colour, consistency and distribution. One portion, the smaller of the two, is soft, semitransparent, and of a light brown colour. It leaves the posterior border of the thoracic ganglion, and joins the spinal nerve about one-eighth of an inch anterior to the giving off of the white portion; a gray communicating cord also passes between the thoracic ganglia. This ganglionic mass, when first exposed in the recent dissection, was of a deep red-brown colour, which quickly faded to a light brown by the action of the water in which it was examined. The other portion, about one-half larger than the former, is firm, of an opake pearly-white colour; it passes to the anterior surface of the ganglion, and divides into two portions. One of these portions joins with a similar part, sent down from the ganglion next above, and then goes out in a curving direction on the side of the dorsal vertebræ to contribute in the formation of the splanchnic nerve. The other half of this branch of the intercostal nerve turns down, constituting a part of the intercommunicating cord between the ganglia, to the ganglion next below, and there joining with a similar portion from the intercostal nerve on a level with this ganglion, passes forwards to join the other branches which form the splanchnic nerve. Each branch sent to the splanchnic nerve contains branches from at least two intercostal nerves, viz. from the nerve on the level with its apparent origin, and from the nerve next above it. This arrangement of the nervous fibres is very apparent in the recent dissection, from the marked distinction which exists in colour and consistency between the gray and white portions of the so-called trunk of the sympathetic.

The splanchnic nerve formed by the branches of the intercostal nerves is a single round cord, which increases in size on the addition of each branch. About an inch below the junction of the last branch it separates into two parts, and upon one of these

a ganglion is formed, similar in appearance to those found on the posterior branches of the spinal nerves. About an inch below this ganglion, the two portions of the splanchnic nerve interchange some fibres which form a small plexus. This plexus terminates in several funiculi, which, surrounded by a common cellular envelope, pierce the diaphragm, and end in a collection of ganglia at the side of the cœliac axis.

This collection of ganglia, when considered collectively, is named the semilunar ganglion, and is described as consisting of six or eight ganglia with cords connecting them together. Yet each of these six or eight ganglia is an aggregation of smaller ganglia. The connecting cords sometimes contain ganglionic corpuscles, but most frequently they are composed of only nervous fibres. Six or seven of the funiculi of the splanchnic nerve end in a common ganglion at the superior and outer corner, and the remaining three pass behind, and, joining with a branch from the lesser splanchnic, end in a ganglion placed anterior to the root of the renal artery. From this collection of cœliac ganglia branches are sent to the viscera in the neighbourhood*.

* Professor CRUVEILHIER, in his Anatomie Déscriptive, vol. iv. p. 1011, says, "Si, sur une pièce qui a macéré dans l'acide nitrique étendu, on cherche à déterminer d'une manière exacte le point le plus élevé de l'origine du grand nerf splanchnique, on verra, d'une part, que les filamens blancs dont la réunion constitue ce nerf, sont déjà distincts au niveau du troisième ganglion thoracique, et, d'une autre part, que ces filamens blancs sont simplement accolés au cordon de communication ainsi qu'aux ganglions, qu'ils se continuent avec les branches émanées des paires rachidiennes; en sorte que l'anatomie de texture démontre de la manière la plus évidente, la continuité du nerf splanchnique avec les paires rachidiennes."

The branches of the spinal nerves which form the white connecting cords with the sympathetic, and which chiefly form the great splanchnic nerve, can be readily traced as high as the third thoracic ganglion. And if the sympathetic be examined in dilute acetic acid, or a solution of bay-salt and arsenite of soda, smaller branches which progressively decrease as we ascend, may be traced from all the superior thoracic ganglia. The branches which form the splanchnic nerve are not exclusively derived from the inter~~spinal~~ costal nerves, but are partly composed of gelatinous nervous fibres derived from the thoracic sympathetic. These gelatinous fibres, although associated with the tubular fibres of the spinal nerves, are yet distinct, and so connected with the thoracic ganglia above and the semilunar ganglion below, as to leave no doubt in my mind that they exist as an independent system of nerves. The gray roots of the sympathetic, as they are called, are branches of the sympathetic given off from the thoracic ganglia, in the same manner as the branches of the sympathetic are given off from the semilunar ganglion. Its composition, as shown by the microscope, is also analogous to that of the branches of the sympathetic nerve, consisting chiefly of gelatinous nervous fibres, with some tubular fibres. It arises from the thoracic ganglion by a single trunk, soon divides, and is chiefly distributed to the vessels: some of the gelatinous fibres join the intercostal nerve, and, becoming associated with other gelatinous fibres which arise from the ganglion on the sensitive root of the spinal nerve, go with the intercostal nerve in its distribution. The ganglia on the sensitive root of the spinal nerves become thus associated with the ganglia of the sympathetic, whose office, anatomically considered, is to give origin to the gelatinous fibre. A few gelatinous fibres are found in both the motor and sensitive roots of the spinal nerves, but the quantity is so small when compared with the quantity found in other parts, as to preclude the idea that the sympathetic arises from them. Most probably these fibres are distributed to the vessels of the cord; as gelatinous fibres, which come from the gray branch of the thoracic ganglion, pass along the motor root in the direction of the spinal cord, and gelatinous fibres, from the same source, also enter the ganglion on the sensitive root; both these sets of fibres evidently pass from the thoracic ganglion towards the spinal cord. We have thus two distinct and separate

The Lesser Splanchnic Nerves.—These nerves having suffered some injury in the removal of the preparation from the body, I cannot decidedly give their origin; but they appear to be derived from the intercostal nerves in the same manner as the greater splanchnic. They are two in number; the superior divides into two branches, one of which joins the ganglion at the root of the renal artery; the other branch divides into three filaments, of which one ends in a ganglion at the side of the aorta, whilst the remaining two end in ganglia on the renal plexus. The inferior splanchnic nerve (posterior renal of WALTER) is chiefly distributed to the renal plexus, but sends one branch to the ganglion at the commencement of the aortic plexus.

The Renal Plexus.—The kidney is supplied by about fifteen branches, twelve of which proceed from the outer margin of the semilunar ganglion, and three branches from the ganglion in which the lesser splanchnic nerve ends. These nerves in their course assume a plexiform arrangement, and form several (eight or nine) smaller ganglia varying from the $\frac{1}{10}$th to $\frac{1}{40}$th of an inch in diameter, which appear of the same kind as those previously noticed by REMAK in various parts of the sympathetic. Some of the branches from the lesser splanchnic nerves also end in this plexus.

The Nerves of the Supra Renal Capsule.—From the centre of the semilunar ganglion, three branches pass upwards and outwards to this body. Three other small cords are also supplied by the ganglion in which the principal part of the greater splanchnic nerve ends.

The Superior Aortic Plexus.—This plexus (plexus intermesaraicus vel plexus aorticus abdominalis) is situated in front of the aorta, between the cœliac axis and the inferior mesenteric artery. It is formed by four or five branches which proceed from the ganglion before noticed at the root of the renal artery; by two or three branches from the ganglion at the side of the aorta in which part of the lesser splanchnic nerve terminates; and by branches from the superior lumbar ganglia. These branches passing downwards and inwards unite with similar branches from the opposite side, and form a plexus in front of the aorta. Several smaller ganglia are formed in the plexus, some of which are so minute as to measure only $\frac{1}{75}$th of an inch. Minute branches are sent from this plexus towards the aorta, and are lost in its cellular coat,

systems of nerves; one composed of gelatinous nervous fibres which have their origin at the different ganglia; the other composed of tubular nervous fibres which arise at the brain and spinal cord; for notwithstanding the opposite opinion held by VOLKMANN and BIDDER, founded as it is upon very careful and elaborate investigations, I have assured myself, that the tubular fibres, which are mixed with the gelatinous in the gray cords of the sympathetic, are really derived from the cerebro-spinal nerves, and do not originate in the ganglia. The claim of the gelatinous fibres to be considered true nervous fibres is further shown, by many small nerves being entirely composed of them, and by the ultimate distribution of many of them to the arteries. The so-called white roots of the sympathetic are then branches of the spinal nerves, and are distributed to the viscera; and the so-called gray roots, branches of the sympathetic, which passed from the thoracic ganglia, and are distributed to the vessels in the neighbourhood. These facts were demonstrated by preparations at the time this paper was presented to the Society, but in consequence of their differing from the received opinions upon the subject, I was diffident of having drawings made from the preparations. The drawings, with their accompanying explanations, will be presented in a supplementary paper.—(May 1846.)

but being so fine it was impossible to trace them further, or to preserve them in the dissection. They measure $\frac{1}{500}$th of an inch in diameter.

The Ganglia at the Root of the Inferior Mesenteric Artery.—These ganglia, after receiving the terminal branches from the superior aortic plexus and branches from the three lumbar ganglia, furnish the nerves accompanying the inferior mesenteric and superior hæmorrhoidal arteries, and send from their lower border branches which form the inferior aortic plexus. The branches supplied by the lumbar ganglia are branches of the spinal nerves, derived in the same manner as those constituting the greater splanchnic nerve. These branches pass over the lumbar ganglia, and becoming associated with gelatinous fibres, end in the ganglia at the root of the inferior mesenteric artery; in the same way as the branches passing over the thoracic ganglia, form the splanchnic nerve, and end in the semilunar ganglion.

The Inferior Aortic Plexus.—The plexus, which forms a continuous plexiform arrangement extending from the root of the inferior mesenteric artery to its division into the lateral hypogastric plexus, below the bifurcation of the aorta, has been variously named: it has been called by VALENTIN *Plexus divisionis aortæ superior et inferior*; and the portion below the bifurcation of the aorta has been called by TIEDEMANN *Plexus hypogastricus magnus superior, vel uterinus communis.* It is formed by twelve or fourteen branches, which proceed from the inferior borders of the ganglia at the root of the inferior mesenteric artery, and passing inwards, unite with similar branches from the opposite side, and form a plexus in front of the aorta. The plexus has no distinct ganglia in its course, nor has it any marked division, but at the bifurcation of the aorta six or seven filaments are sent along the common iliac artery. Some of these accompany the internal iliac artery, and join the pelvic plexus at the side of the vagina, whilst one branch joins the third sacral nerve midway between the third sacral foramen and the sacral plexus. The remainder of the nerves which pass along the common iliac artery from the aortic plexus accompany the external iliac artery.

The inferior aortic plexus, an inch and a half below the bifurcation of the aorta, divides into the two lateral hypogastric plexuses, where a few crossing fibres occur. These crossing fibres are surrounded in this exposed situation by a dense cellulo-fibrous covering, forming a mass which has been figured and described as a triangular ganglion of a dense and firm structure. Only a small ganglion however exists in this situation.

Lateral Hypogastric Plexus.—It is difficult to ascertain what portion of this plexus Professor TIEDEMANN understood by the plexus hypogastricus lateralis, vel uterinus superior, but probably it was the middle portion, where he has figured it joined by the branches from the sacral ganglia. The plexus extends from the division of the inferior aortic plexus, to the junction of the branches from the sacral nerves at the side of the vagina, and forms a lengthened plexus, situated on the side of the pelvis. Like the inferior aortic plexus it forms no large ganglia in its course; but the nerves

which compose it several times unite and again separate, and at each point of junction a distinct swelling or knot is perceived, which contains ganglionic corpuscles lying by the side of the interlaced nervous fibres, though in too small a quantity to produce the usual red appearance of ganglia. A few branches of communication pass between this plexus and the branches accompanying the superior hæmorrhoidal artery.

The Pelvic Plexus.—The union of the branches from the lower part of the lateral hypogastric plexus, with branches from the sacral plexus, constitutes a plexus so peculiar and distinct that I have ventured to propose the name *Pelvic Plexus* for it. It furnishes branches of supply to the bladder, vagina, and rectum, and corresponds with the plexus hypogastricus lateralis, vel plexus uterinus inferior, vel plexus gangliosus, of TIEDEMANN. Twelve or thirteen branches are given off from the third sacral nerve, five or six from the fourth, and one from the second, which passing to the side of the vagina join the short branches which descend from the lateral hypogastric, and the branches which descend with the superior hæmorrhoidal artery, and constitute a plexus. At the points of union between the branches from the sacral nerves, and the branches from the hypogastric, small ganglia generally exist. Several smaller secondary ganglia are also formed in the plexus. The ganglia in this situation are much smaller than those at the root of the superior hæmorrhoidal artery, and the nerves which go to the bladder and vagina contain a much larger amount of tubular nervous fibres than those which proceed to the uterus, the rectum, the intestines, &c.

The Nerves of the Bladder.—From the anterior part of the pelvic plexus, branches of considerable size are sent to the bladder, which at first pass amongst the vessels of this part, but do not continue with them in their distribution on the organ. A few minute ganglia are found in their course.

The Nerves of the Vaginal Erectile Tissue.—From the lower part of the pelvic plexus ten or twelve branches descend to the erectile tissue, situated at the lower and anterior part of the vagina. These nerves are joined by five or six branches, which come directly from the third and fourth sacral nerves, and at the junction of the branches from these two sources, small yet distinct ganglia, seven or eight in number, are formed, from which nerves are sent to the erectile tissue. The branches supplied by the sacral nerves course along the posterior border of the pelvic plexus, but do not communicate with it.

The Hæmorrhoidal Nerves.—The rectum is supplied by minute filaments which come from the posterior border of the pelvic plexus, and accompany for the most part the branches of the hæmorrhoidal artery. They, however, are not the direct continuation of those nerves which accompany the superior hæmorrhoidal artery, for these end in the posterior border of the pelvic plexus.

The analogy which exists between the different collections of Ganglia.—From the foregoing facts it will appear that a great analogy exists between the collections of ganglia at the cœliac axis, at the superior hæmorrhoidal artery, and at the pelvic plexus. The same elements exist in each, viz. tubular nervous fibres derived from

the spinal cord, and gelatinous nervous fibres derived from the ganglia; the size of the ganglia being in apparent relation to the quantity of gelatinous fibres required for the nerves distributed from these points. The constitution of the nerves which come from these ganglia differs according to the size of the ganglia. Those distributed to the bladder and vagina differ from the nerves sent to the uterus, intestines, &c., in containing a much larger amount of tubular nervous fibre*.

Nerves of the Unimpregnated Uterus.—The nerves which compose the hypogastric plexus, on approaching the neck of the uterus, begin to separate, having larger spaces between them, and on a level with the os uteri they are joined by the branches already described, which accompany the superior hæmorrhoidal artery. This expansion appears to be only the spreading out of the posterior portion of the hypogastric and not of the anterior portion; for the latter, after being joined by the branches which accompany the iliac arteries, passes directly onwards by the broad ligament and supplies the lower half of the uterus. These nerves, or it may be said these continuations from the anterior part of the lateral hypogastric plexus, pass towards the uterus, and mixing with the arteries of this part, go on in company with them for some part of their course, but as they approach the body of the organ they separate, and each pursues a separate distribution. As the nerves approach the uterus they lose the plexiform character, and form a number of delicate branches, which pass on as distinct fine cords, dividing and subdividing, but not uniting with each other. For the supply of the middle part of the uterus a distinct branch comes from the inferior aortic plexus, and running down by the side of the pelvis, receives no communication from the hypogastric, but passes directly to the superior part of the body of the uterus. It there divides, supplying the portion between the insertion of the Fallopian tubes and the termination of the previous branches. It also sends a branch to the ovary. The fundus of the uterus, or the portion above the Fallopian tubes, is sometimes supplied by a branch from the nerves furnished to the ovaries, as seen in the dissection of the gravid uterus.

Distinct from these nerves is another set, which comes from the same continuation of the hypogastric plexus, but assumes a plexiform arrangement round the vessels, and has the distinctive character of forming minute ganglia here and there. These nerves are so minute, that a special dissection is required to determine their ultimate distribution, although their arrangement would lead to the inference that

* The sole anatomical purpose of the ganglia is apparently to give origin to the gelatinous fibres, to which end they are distributed irregularly over the body, in those situations where a supply of the gelatinous fibre is required. The true sympathetic system appears to be a system of gelatinous nervous fibres, which are distributed everywhere over the body, and which preside over the organic functions. It appears to exist independently of the brain or spinal cord, although the tubular fibres which come from the brain and spinal cord are associated with the gelatinous fibres in the larger branches of the sympathetic. In the minute branches the gelatinous fibres exist, separate and distinct from the tubular, and are distributed to the arteries. They may however have other distributions; but this, together with the ultimate distribution of the tubular fibre, remains for future inquiry.—(May 1846.)

they were especially destined for the vessels. Before the nerves were cleared from their neurilema, I frequently met with what appeared to be nervous branches distributed to the arteries, but in every instance I have been able, by the aid of the microscope, satisfactorily to ascertain that these were minute vessels passing from the artery to the nerve to ramify in its neurilema, and not branches of the nerve going to the artery. This was proved by their elasticity, by the absence of transverse striæ, and by the mode of distribution; for they ended abruptly at the artery by a single large termination, whilst they divided and branched to the nerve. It was proved, moreover, by their presenting when divided the opening of a distinct yet small tube, from which air escaped when blown into the artery. I have been unsuccessful in tracing large branches of nerve to the ureter, though I have carefully examined many which in the first instance appeared to be nerves; but all of which proved to be small vessels or rounded cords of fibrous tissue, with the exception of one small filament, which came from the anterior margin of the hypogastric plexus after its junction with the branches which accompany the internal iliac artery, and passing upwards to the ureter, divided and apparently supplied it. From the delicacy of this filament and its position in the dissection it was impossible to preserve it.

The Fallopian tube is supplied by a branch which passes off from the anterior border of the hypogastric plexus a little above the level of the os uteri, and, entering the broad ligament, receives two branches from the nerves which accompany the internal iliac artery, and branches from the nerves between the bladder and uterus. It then passes up to supply the Fallopian tube. The branches derived from the nerves between the bladder and uterus were accidentally divided in an early part of the dissection, hence I am unable to speak decidedly from what source they came. That they were branches of augmentation and not of division, is shown by the trunk of the nerve being enlarged after each junction.

The Vessels of the Uterus.—When the vessels of the uterus are divided transversely, they present a wavy outline at the inner border of the section, and when opened longitudinally, the inner surface presents a number of folds, resembling the rugæ of the internal surface of the stomach or bladder when contracted. From these appearances, in which the internal and middle coats of the artery are involved, I am inclined to think that the vessels do not diminish in size after parturition, but are only contracted in their cavity, ready to be again stretched out upon a larger quantity of blood being sent to the organ. This point however remains for further examination, as also the change which occurs during the first pregnancy, in which we would, *à priori*, suppose that the vessels do increase in size.

The Nerves of the Gravid Uterus.—After the description of the nerves of the unimpregnated uterus, it is only necessary to mention that the nerves of the gravid uterus follow the same course and distribution in all material respects. They however differ in two slight points. 1st. In consequence of the increased size of the parts, the pelvic plexus and the inferior part of the hypogastric plexus are extended

over a larger surface, which allows their arrangement to be more readily determined. The continuation of the hypogastric plexus, which supplies the uterus, is seen to approach the side of that organ in company with the vessels, and afterwards to leave them, some of the branches passing to the anterior, and some to the posterior surface, both of which finally enter into its substance. 2ndly. The course taken by the nerve which supplies the middle portion of the uterus appears to be different in the two dissections. This however is more apparent than real, for the nerve passes off from the hypogastric plexus high up in the pelvis, and coming down in company with it interchanges some filaments. On reaching the neck of the uterus it enters the organ, and passing up in a distinct tendinous canal immediately beneath the surface, neither receives nor gives any branches until it reaches the portion a little below the insertion of the Fallopian tubes; there the tendinous canal ceases, and the nerve divides into two branches, one supplying the anterior, and the other the posterior surface. The anterior branch, the larger of the two, after entering deeply into the substance of the uterus, again approaches the surface at the insertion of the Fallopian tube, and apparently sends some filaments to it; but whether this is the case or not I am unable to decide, as the nerve was accidentally divided.

The Nerves of the Ovary.—The nerve supplying the ovary passes down from the renal plexus in company with the spermatic artery, and when about two and a half inches from the gland it separates from the artery, taking a slightly different course to reach the middle of this body. It there divides into four branches, of which three supply the ovary, and the fourth, passing onwards to the uterus, again divides into two branches, which enter the substance of the uterus on the anterior and posterior aspect of the fundus. Before the nerve reaches the ovary to divide into its terminal branches, it forms a considerable fusiform enlargement.

The Size of the Nerves.—The size of the nerves in both these dissections is essentially the same, and when the nerves are carefully compared, no doubt is left that the nerves of the gravid uterus have undergone no change in size; nor any change in position, except that consequent upon the development of the organ. Yet at first sight the nerves of the unimpregnated uterus appear even larger than those of the gravid uterus; this however is due to the manner in which they are arranged. In the unimpregnated state of the uterus, the nerves of the lower portion of the hypogastric and pelvic plexuses, are crowded and packed together so as to occupy a much smaller space than they do in the gravid state of the uterus. The consequence of this is, that the nerves of the former present a wavy arrangement, which gives them the appearance of greater thickness and plumpness. The close manner in which they are packed, and the wavy aspect they assume, can only be fully appreciated when they are first exposed; for in the after process of cleaning and isolating them from the surrounding tissues, these characters are considerably altered.

We may therefore conclude—

1. That the uterus receives its nerves from the hypogastric plexus. It ought

however to be mentioned that some have considered, on physiological grounds, that small branches derived from the sacral nerves, after their union with the pelvic plexus, might reach the neck of the uterus by a circuitous route; but this appears contrary to anatomical evidence.

2. That the ovaries are supplied by branches derived from the renal or aortic plexuses.

3. That the Fallopian tubes are supplied from the hypogastric and aortic plexuses, though it is probable they also receive some branches from the nerves at the superior part of the bladder.

4. That the bladder and vagina are supplied by branches from the pelvic plexus, which contain a large amount of tubular nervous fibres derived from the sacral nerves.

5. That the rectum also receives its nerves from the pelvic plexus, but they on the contrary contain a small amount of tubular fibres.

6. That the nerves undergo no change during a second pregnancy.

7. That it is probable the vessels do not decrease in size after parturition, but are only contracted in their cavity.

Important however as these conclusions are, there yet remain several points which require further investigation; for instance,—

1. Whether any and what change takes place in the nerves at the first pregnancy*. For although it is clear no material difference exists between the nerves of the two preparations described, yet it must not be forgotten that both women had previously borne children.

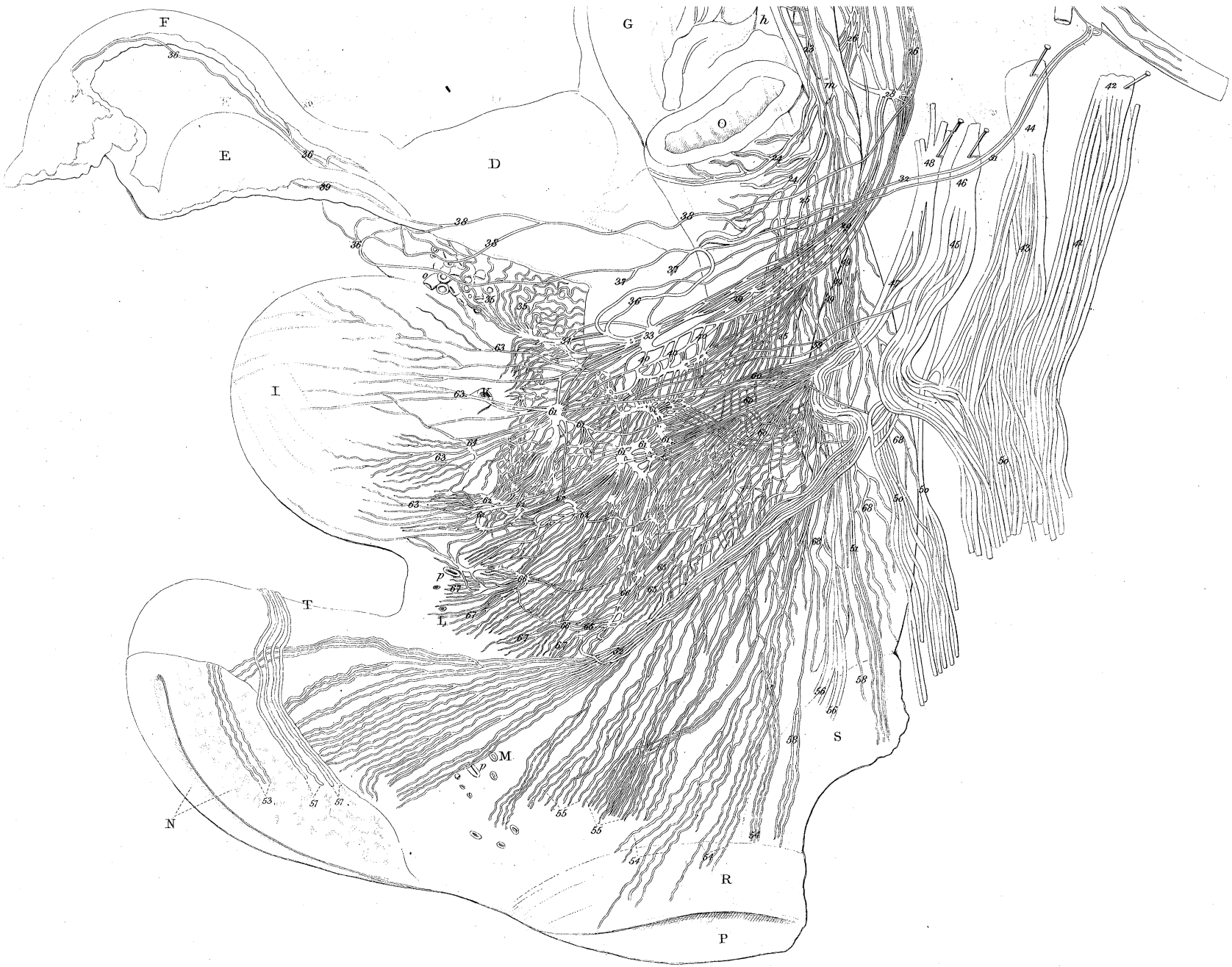
2. Whether any and what change takes place at puberty.

3. The condition of the vessels in a first conception and their subsequent state.

4. In what consists the great enlargement of size in the gravid uterus.

5. Is there any difference in the composition of the nerves distributed to the ovaries and Fallopian tubes, as compared with those sent to the uterus?

* I have recently had an opportunity of making a cursory examination of the nerves of a virgin uterus, and find they do not differ in size from the nerves of the gravid uterus previously described. Time has not permitted me to carry the examination so far as to determine, whether or not the nerves undergo any increase in length in a first pregnancy.—(June 18, 1846.)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On the Nerves of the Uterus. *By* THOMAS SNOW BECK, *Esq.*

DESCRIPTION OF THE PLATES*.

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PLATE XII.

A. The supra renal capsule.
B. The right kidney.
C. The right ureter.
D. The uterus.
E. The left ovary.
F. The left Fallopian tube.
G. The right ovary.
H. The right Fallopian tube.
I. The bladder.
K. The opening of the divided left ureter.
L. The erectile tissue at the lower and anterior part of the vagina.
M. The vagina.
N. The labia majora.
O. The superior part of the rectum.
P. The anus.
R. The sphincter ani.
S. Some fibres of the levator ani.
T. The clitoris.

a. The abdominal aorta.
b. The cœliac axis.
c. The renal artery.
d. The renal vein.
e. The left common iliac artery.
f. The left external iliac artery.
g. The left internal iliac artery.
h. The right common iliac artery.
i. The inferior mesenteric artery.
k. The superior hæmorrhoidal artery.
l. A variety of the superior hæmorrhoidal artery which anastomoses with the other trunk of the same artery.
m. The point where the two trunks of the superior hæmorrhoidal artery anastomose.
o. The divided uterine vessels, arteries and veins.
p.p.p. The openings of divided arteries.

1.1.1. The terminal funiculi of the great splanchnic nerve, which are each composed of definite proportions of tubular and gelatinous fibres. The great splanchnic nerve is, essentially, the union of the visceral branches from all the superior intercostal nerves, which are associated with each other in their course to the semilunar ganglion. The branches from the first, second, third, fourth, and fifth intercostal nerves turn down in the so-called trunk of the sympathetic, and after uniting with each other, pass from the trunk of the sympathetic opposite the sixth intercostal nerve, as a large and single branch. The branch from the sixth intercostal nerve turns down in the trunk of the sympathetic, and leaves it opposite the seventh intercostal nerve. The branches from the seventh, eighth, and sometimes ninth inter-

* This description was necessarily delayed until the Plates were lettered.—T. S. B.

costal nerves follow a similar course. Each of these visceral branches of the intercostal nerves becomes associated with a portion of gelatinous fibres, as it passes over the thoracic ganglion of the sympathetic, on a level with the nerve from which the branch arises. Thus the splanchnic nerve, although essentially composed of tubular fibres derived from the cerebro-spinal nerves, has in its formation a portion of gelatinous fibres derived from each of the thoracic ganglia. These two kinds of fibres, *i. e.* the tubular fibres and the gelatinous fibres, although associated together, are yet as distinct as the motor and sensitive tubules of the cerebro-spinal nerves, after they are mixed with each other; for by spreading out the tubules of the splanchnic nerve, each set of fibres can be distinctly and separately traced to its origin and termination. In the course of the gelatinous fibres down the splanchnic nerve, some ganglia are always to be found; sometimes one, when it is comparatively large; sometimes as many as three, when they are small and may be readily overlooked. Were it necessary to offer any confirmation to the fact, that the gelatinous fibres arise in the ganglia of the sympathetic, these ganglia on the splanchnic nerve would offer a ready and convenient demonstration; for by comparing the fibres which enter at their upper part with the fibres which pass out at their lower part, the latter are found considerably to exceed the former. The splanchnic nerve usually exists as a single round cord, having a ganglion at the lower part; but occasionally we find it divided into two very distinct parts, one white and the other gray. In this instance the white part is chiefly composed of the tubular fibres, to which it owes its white aspect, yet it contains a small portion of gelatinous fibres; and in like manner, the gray part, although consisting chiefly of gelatinous fibres, which give it the gray appearance, contains some tubular fibres. Although an interlacing of the tubular and gelatinous fibres occurs in the whole course of the splanchnic nerve, yet it takes place chiefly at the lower part below the ganglion. The apparent object of this interlacing is the due proportioning of the tubular and gelatinous fibres, which is found in the distinct funiculi, in which the splanchnic nerve terminates. The gelatinous fibres of the splanchnic nerve enter the gray portion of the semilunar ganglion; and although I have been unable to trace them further, yet I do not think they end there; for in the sympathetic ganglia, which are so minute as to allow their structure to be examined, without previous dissection of them, the nervous fibres which constitute the nerve upon which the ganglion is formed, all pass beyond the ganglion, after being joined by other gelatinous fibres, which come from the ganglionic corpuscles of which the minute ganglion is composed. The tubular fibres of the splanchnic nerve enter the semilunar ganglion, and after spreading out in its different lobes, pass through it, and are found in the branches of the sympathetic which proceed from the ganglion. Although the semilunar ganglion, from its size and complex formation, is not well adapted for deciding a minute anatomical point, yet I have, by repeated and careful examination, assured myself that the tubular fibres which are found in the sympathetic branches proceeding from it, are all derived

from the cerebro-spinal nerves, through the medium of the splanchnic nerve; and that none of the tubular fibres arise from the semilunar ganglion. Notwithstanding the contrary opinion held by some most distinguished anatomists, viz. that some tubular fibres arise from the sympathetic ganglia, I have, by examination of various parts of the sympathetic, assured myself that the tubular fibres can, in every instance, be traced to the white connecting cord between the spinal and sympathetic nerves; which white connecting cord is a branch from the spinal nerve with which it is connected.

2.2. The lower portions of the lesser splanchnic nerves. They are composed of gelatinous fibres, and tubular fibres, in the same manner as the great splanchnic nerve (1.1). The gelatinous fibres arise from the lower thoracic ganglia of the sympathetic, and passing inwards, are given partly to the renal plexus (9.9), and partly to the superior aortic plexus (21.21, &c.). The tubular fibres are visceral branches of the lower intercostal nerves, and after passing down the trunk of the sympathetic to opposite the nerve next below it, pass inwards, in company with the gelatinous fibres, towards the semilunar ganglion. Some of the tubular fibres turn outwards, and entering the renal plexus (9.9), they are distributed to the kidney; the remainder enter the superior aortic plexus (21.21, &c.), and chiefly pass off at the root of the inferior mesenteric artery (*i*) in the branches of the sympathetic sent from this point.

3.3.3.3.3. The lobes of the right semilunar ganglion, which, in this instance, are much separated from each other. If we restrict the term ganglion to a collection of ganglionic corpuscles, giving rise to the gelatinous fibre, which collection is distinct from another similar collection of corpuscles lying by the side of it, the two being separated by tubular fibres and blood-vessels, then these lobes are an aggregation of distinct ganglia. The tubular fibres of the splanchnic nerves pass through this ganglion and become associated with the gelatinous fibres which arise from it. The association of the gelatinous and tubular fibres constitutes the ordinary branches of the sympathetic.

4. A portion of the left semilunar ganglion.

5.5. Nervous branches which pass between the two semilunar ganglia. I am inclined to think that a crossing of fibres between the two ganglia takes place in this situation.

6.6.6.6.6. Branches of the sympathetic, which pass out with the cœliac axis (*b*), and are distributed to the liver, pancreas, small intestines, stomach, &c. The branches of the sympathetic, of sufficient size to be seen by the unassisted eye, are composed of many gelatinous fibres associated with some tubular fibres; but in the fine divisions of these nerves, small branches are found entirely composed of gelatinous fibres; and if these small branches be further traced, single gelatinous fibres are seen to pass from them, and to enter the cellular coat of small arteries; and finally, to pass along by the side of the artery, taking a slightly winding course round the

vessel, and lying upon the middle coat. The origin and subsequent interlacing of the tubular and gelatinous fibres is better seen in the small branches which pass from the posterior part of the thoracic ganglia. These branches, from their small size, can be examined by the compound microscope without any previous manipulation. At their origin from the ganglion, the tubular and gelatinous fibres are in distinct and separate bundles; and after proceeding a short distance, the fibres composing the two bundles gradually spread out and become interlaced with each other. In some instances, where the small branch bifurcates soon after it leaves the ganglion, the tubular fibres, composing the tubular bundle, divide into two portions, which pass out in the two minute branches in which the small parent branch divides; the gelatinous fibres, composing the gelatinous bundle, likewise divide into two portions, which also pass out in the two minute branches and become mixed with the tubular fibres. The crossing of the gelatinous and tubular fibres in the parent trunk to gain their ultimate destination, is exceedingly well-marked. If the fibres composing these small branches be followed towards the so-called trunk of the sympathetic, we find that the gelatinous fibres take their origin at the corpuscles of the ganglion, and that the tubular fibres are traced through the ganglion to the white cord connecting the spinal and sympathetic nerves. In this case, as in the preceding one, the tubular fibres do not arise from the ganglion, but can be shown to be emanations from the spinal nerves. The origin of these small branches by distinct bundles of gelatinous and tubular fibres, and their subsequent interlacing, bear a striking resemblance to the origin of the spinal nerves, by distinct bundles of motor and sensitive tubules, and their subsequent interlacing.

7.7. Branches of the sympathetic distributed to the supra-renal capsule from the semilunar ganglion.

8. Small ganglion on these nerves.

9.9. The renal plexus surrounding the renal artery.

10. Branches from the renal plexus which accompany a branch of the renal artery to the upper part of the kidney.

11.11.11.11. Ganglia in the course of the renal plexus. Besides these ganglia, there are many much smaller which could not be shown in this drawing, some of which are so minute as to measure but the $\frac{1}{40}$th of an inch in diameter. The gelatinous fibres of the renal plexus are chiefly derived from the semilunar ganglion (3.3.3), though many arise from the ganglia in the plexus (11.11, &c.). The tubular fibres are derived from the lower intercostal nerves through the medium of the lesser splanchnic nerves (2.2).

12.12.12. The ganglia of the abdominal sympathetic of the right side.

13.13. The so-called trunk of the sympathetic of the right side.

14.14.14.14. Branches which pass from the lumbar nerves and trunk of the sympathetic, and enter the superior aortic plexus (21.21.21, &c.).

15.15.15. Three ganglia of the abdominal sympathetic of the left side.

16.16.16. The so-called trunk of the abdominal sympathetic of the left side.

17.17. Two of the so-called gray roots of the sympathetic, which, in consequence of lying loose in the preparation, have been turned in the wrong direction by the artist. These branches, which have often been erroneously considered roots of the sympathetic, pass from the posterior part of the lumbar ganglia, and sending some branches to the vessels in the immediate neighbourhood, join the lumbar nerves. The composition of these branches, as shown by the compound microscope, is analogous to the usual branches of the sympathetic, being formed of many gelatinous fibres, mixed with some tubular fibres. The gelatinous fibres are derived partly from the ganglion from which a branch passes, and partly from the ganglion next above, which latter portion turns down in the cord communicating between the ganglia and then passes out in the branch. The tubular fibres are derived in a similar manner, *i. e.* from the white cord connecting the spinal and sympathetic nerves, which is on the level of the ganglion from which a branch arises, and from the white cord next above. The latter portion turns down in the cord communicating between the ganglia, and passes through the upper part of the ganglion to reach the branch; the former portion leaves the white cord immediately it reaches the ganglion, and turning backwards enters the branch. In this instance, as in the preceding ones, the tubular fibres can be shown to be emanations from the spinal nerves, although they pass through the ganglia in the course of their distribution. The process of tracing these tubular fibres is exceedingly tedious and difficult, yet it can be done; and I have best succeeded by employing the solution of bay salt and arsenite of soda, which, whilst it gives sufficient firmness to the nervous tubules, alters their natural appearance much less than spirit and water. After giving some branches to the lumbar arteries, a portion of the branch joins the lumbar nerves and divides into two parts, one of which passes backwards in the direction of the spinal cord, and the other becomes associated with the gelatinous fibres arising from the ganglion on the sensitive root of the nerve, and passes out in the distributions of the lumbar nerve.

18.18. Two of the white cords connecting the spinal and sympathetic nerves, which have been often erroneously considered roots of the sympathetic. By following the tubular fibres which compose these cords back towards the spinal cord, we find them to be derived from the motor and sensitive roots of the nerve, in apparently equal proportions. And by following the same tubular fibres in the direction of the sympathetic ganglion, we find that on arriving at the ganglion they take several directions. 1. Some turn backwards and enter the gray branch, previously noticed, which passes from the posterior part of the ganglion. 2. Some penetrate the ganglion and enter into the small branches which proceed from the under surface of this body. 3. Some turn down in the so-called trunk of the sympathetic, and supply the tubular fibres found in the different branches which proceed from it; and 4, some, and these by far the most numerous, pass inwards and join the lower part of the superior aortic plexus (21.21, &c.). The last set of tubular fibres becomes apparently attached to

the ganglion on passing over it; but this is caused by gelatinous fibres, which arise from the ganglion, becoming associated with the tubular fibres, and passing with them to the lower part of the superior aortic plexus (21.21, &c.). Sometimes the tubular fibres and gelatinous fibres remain distinct from each other in the whole course of these last-named branches, so that we have a nerve whose upper half is white and whose lower half is gray. These branches, moreover, have a precisely similar constitution to that of the splanchnic nerves in the thorax, and might, not inappropriately, be termed abdominal splanchnic nerves. The two communicating branches between the spinal and sympathetic nerves are differently arranged in the thorax, in the abdomen, and in the pelvis. In the thorax, the branches are of nearly equal size through the whole extent of the cavity. In the abdomen, however, the gray branch is much larger than the analogous branch in the thorax, and gradually increases in size to the lower part of the abdomen. The white branch, on the contrary, is smaller than the corresponding branch in the thorax, and decreases in size towards the pelvis. In the pelvis there is no white branch joining the ganglion; and the branches of the sacral nerves, which might be said to represent it, pass over the sacral ganglia without being at all connected with them, and end in the pelvic plexus. The gray branch, on the contrary, is still further increased in size in the sacral region, and after giving some small branches to the vessels near its course, joins the sacral nerves. The tubular fibres found in this portion of the sympathetic, and in the branches which arise from it, are derived from the tubular fibres of the white branch from the lumbar nerves, which fibres turn down in the trunk of the sympathetic, and becoming associated with the gelatinous fibres form the usual sympathetic branches. This arrangement in the human subject corresponds with that described by Volkman and Bidder in the Frog*.

19.19.19.19. Branches which pass from the abdominal sympathetic to the superior aortic plexus. They are composed of, part tubular, and part gelatinous fibres, in the same manner as the splanchnic nerves in the thorax (1.1. and 2.2). The tubular fibres are derived from the lumbar nerves, and the gelatinous fibres from the abdominal sympathetic ganglia. The purpose of these branches is, moreover, similar to that of the splanchnic, viz. to furnish the tubular fibres which are found in the branches of the sympathetic.

20.20. Small ganglia formed on these branches.

21.21.21.21.21.21.21.21.21.21.21.21. Ganglia in the superior aortic plexus. The branches proceeding from the semilunar ganglion (3.3.3) to the upper part of this plexus are small, and few in number, and appear merely to preserve the general connexion which exists between different parts of the sympathetic. But the branches at the lower part of the plexus are much larger, and much more numerous, and are formed by the gelatinous fibres which arise from the lumbar ganglia (15.15.15), and from the different ganglia in the plexus (21.21.21, &c.), associated with the tubular fibres,

* Die Selbständigkeit des Sympathischen Nervensystems, tab. 3.

derived from the lumbar nerves, through the medium of, what might be called, the abdominal splanchnic nerves (19.19, &c., and 14.14, &c.). The branches of the lower part of this plexus all converge to one point, viz. the root of the inferior mesenteric artery (*i*), where the association of the gelatinous and tubular fibres occurs, previous to the branches being given off to the large intestines, and to the inferior aortic plexus. From the exact similarity which exists between the semilunar ganglion and the inferior part of the superior aortic plexus, in their formation and constitution, it would not be stretching analogy too far to say, that a second semilunar ganglion exists in this situation, having its elements more apart, and being diffused over a larger space. Indeed these aortic ganglia (21.21, &c.) offer a good demonstration of the formation of the more dense structure of the semilunar ganglion (3.3, &c.). The elements of the semilunar ganglion are, the tubular fibres derived from the intercostal nerves, through the medium of the splanchnic nerves (1.1. and 2.2), and the gelatinous fibres derived from the sympathetic ganglia. And the reason of so large an amount of nervous matter being collected in this situation is, no doubt, from its being a common point whence large and numerous branches pass off to the different viscera. The elements which enter into the formation of the lower part of the superior aortic plexus are exactly similar to those which form the semilunar ganglion; viz. tubular fibres derived from the lumbar nerves through the medium of the abdominal splanchnic nerves (19.19, &c., 14.14, &c.), and gelatinous fibres from the sympathetic ganglia (21.21, &c., 15.15). And the reason why a smaller amount of nervous matter exists here than at the semilunar ganglion is, that the branches which pass from it are much less numerous. However, in estimating the branches which pass from this point, we must take into account not only those which pass out with the inferior mesenteric (*i*) and superior hæmorrhoidal (*k*) arteries, but also the branches which form the inferior aortic plexus (22.22); for this latter plexus is constituted in a manner very different from the superior aortic plexus. Whilst the superior aortic plexus may be said to form a plexus distinct in itself, in which the tubular and gelatinous fibres become associated together to form the branches of the sympathetic, the inferior aortic plexus is merely the continuation downwards of some of these branches, so formed, previous to their dividing to form the two lateral hypogastric plexuses.

22.22.22. Branches of the sympathetic which accompany the inferior mesenteric artery (*i*).

23.23.23. Branches of the sympathetic which accompany the superior hæmorrhoidal artery (*k*, *l*). They proceed from a common point with the preceding branches (22.22), and like them are composed of gelatinous and tubular fibres.

24.24. Branches which accompany the divisions of the superior hæmorrhoidal artery, before the formation of the pelvic plexus (61.61, &c.).

25.25. Branches which pass downwards and join the posterior part of the pelvic plexus (61.61, &c.).

26.26.26.26. The inferior aortic plexus, consisting of branches of the sympathetic

which pass downwards to form the two lateral hypogastric plexuses (29.29). In the middle of this plexus (27) a crossing of the fibres from the opposite sides occurs, by which means the lower part of the plexus, and, as a consequence, the hypogastric plexus of each side, contains nervous fibres derived from both sides of the body; that is to say, if the nervous fibres composing the left hypogastric plexus be followed upwards, a part of them will be traced to the aortic ganglia (21.21, &c.) and lumbar nerves (19.19, &c.) of the left side, and a part to the aortic ganglia (21.21, &c.) and lumbar nerves (14.14, &c.) of the right side.

28. Small ganglion at the termination of the inferior aortic plexus.

29.29. The lateral hypogastric plexus of the left side, which is composed of gelatinous and tubular fibres derived from the lower part of the superior aortic plexus. It supplies the lower half of the uterus, and sends short branches downwards to join the pelvic plexus (61.61, &c.).

30.30.30.30. Fine sympathetic branches which proceed from the inferior aortic plexus and accompany the iliac arteries (*f* and *g*). Three branches chiefly come from the middle of the inferior aortic plexus (27), where the crossing of the fibres from opposite sides occurs.

31. A branch composed of some of the preceding branches (30.30, &c.), which passes in the broad ligament of the uterus to join the lower part of the lateral hypogastric plexus (22.29).

32. A branch composed of some of the preceding branches (30.30, &c.), which also passes down in the broad ligament and joins the nerve (36) distributed to the upper part of the uterus and Fallopian tube. Like the preceding branch (31), it is drawn out of its relative situation by the position of the preparation.

33. Ganglion at the lower part of the lateral hypogastric plexus.

34. The continuation of the lateral hypogastric plexus (29.29) which supplies the lower half of the uterus.

35.35. Nerves distributed to the lower part of the uterus. These nerves are chiefly composed of gelatinous nervous fibres, which fibres form the chief part of the nerves supplied to the uterus. Although some tubular fibres accompany the gelatinous fibres from the hypogastric plexus, and are found in the uterine nerves, yet they are few in number, and appear to be far from forming the essential element of the nerves supplied to this organ. It remains for further inquiry to determine the element of the uterus to which these tubular fibres are distributed, and the function they perform.

36.36.36.36. A branch which proceeds from the lower part of the lateral hypogastric plexus, is joined by a branch (32) from the inferior aortic plexus (26.26), and by two branches (37.37) which come from the nerves between the bladder and uterus. The nerve after the junction of each branch is increased in size, and passes up in the broad ligament to supply the upper part of the uterus (D) and the Fallopian tube (F). It contains both gelatinous and tubular nervous fibres.

38.38.38. A branch of the sympathetic, which proceeds from the inferior aortic plexus (26, &c.), and is distributed to the middle part of the uterus (D), also sending a branch (39) to the ovary (E). The branch passes down by the side of the lateral hypogastric plexus (29.29), but without being at all connected with it in this subject, and then enters the broad ligament passing up to the middle part of the uterus. It is formed of gelatinous and tubular fibres.

39. A branch which is sent to the ovary. Whether any branches come down from the renal plexus, in company with the spermatic artery, or not, I am unable to say, as the preparation was slightly injured in this part; but I am inclined to think that there were branches supplied to the ovary as seen in Plate XV.

40.40.40. Branches which pass from the lower border of the lateral hypogastric plexus to join the pelvic plexus.

41. The lumbo-sacral nerve.

42. Part of the ganglion on the sensitive root of this nerve.

43. The first sacral nerve.

44. The ganglion on this nerve.

45. The second sacral nerve.

46. The ganglion on this nerve.

47. The third sacral nerve.

48. The ganglion on this nerve.

49.49.49. The ends of funiculi which form the fourth sacral nerve.

50.50.50. Portions of the sacral plexus.

51. A branch of the fourth sacral nerve (49.49) distributed to the levator ani (S).

52. Branches from the third sacral nerve (47), which are distributed to the skin of the perinæum and labia majora (N).

53. Some of the same branches, which, being divided, are turned aside.

54.54.54. Branches from the third sacral nerve (47) distributed to the sphincter ani (R) and skin near the anus (P).

55.55. Branches from the fourth sacral nerve (49.49, &c.) distributed to the muscular fibres and skin, at the lower part of the vagina.

56.56. Large branches from the third sacral nerve (47) distributed to the clitoris (T).

57.57. The continuations of the preceding branch (56.56). In consequence of this branch lying across the preparation it became necessary to divide it, and to turn the ends to each side.

58.58. Branches of the sacral plexus which lie loose in the preparation.

59. A branch from the second sacral nerve (45) which joins the pelvic plexus (61.61, &c.).

60.60.60. Branches from the third sacral nerve (47) and from the fourth sacral nerve (49.49), which join the pelvic plexus (61.61, &c.). The branches from the third sacral nerve join the anterior part of the plexus, and are distributed to the bladder and tissues of the anterior part of the vagina, and those from the fourth sacral nerve

join the posterior part of the plexus, and are distributed to the erectile tissue and tissues at the posterior part of the vagina, and also to the rectum.

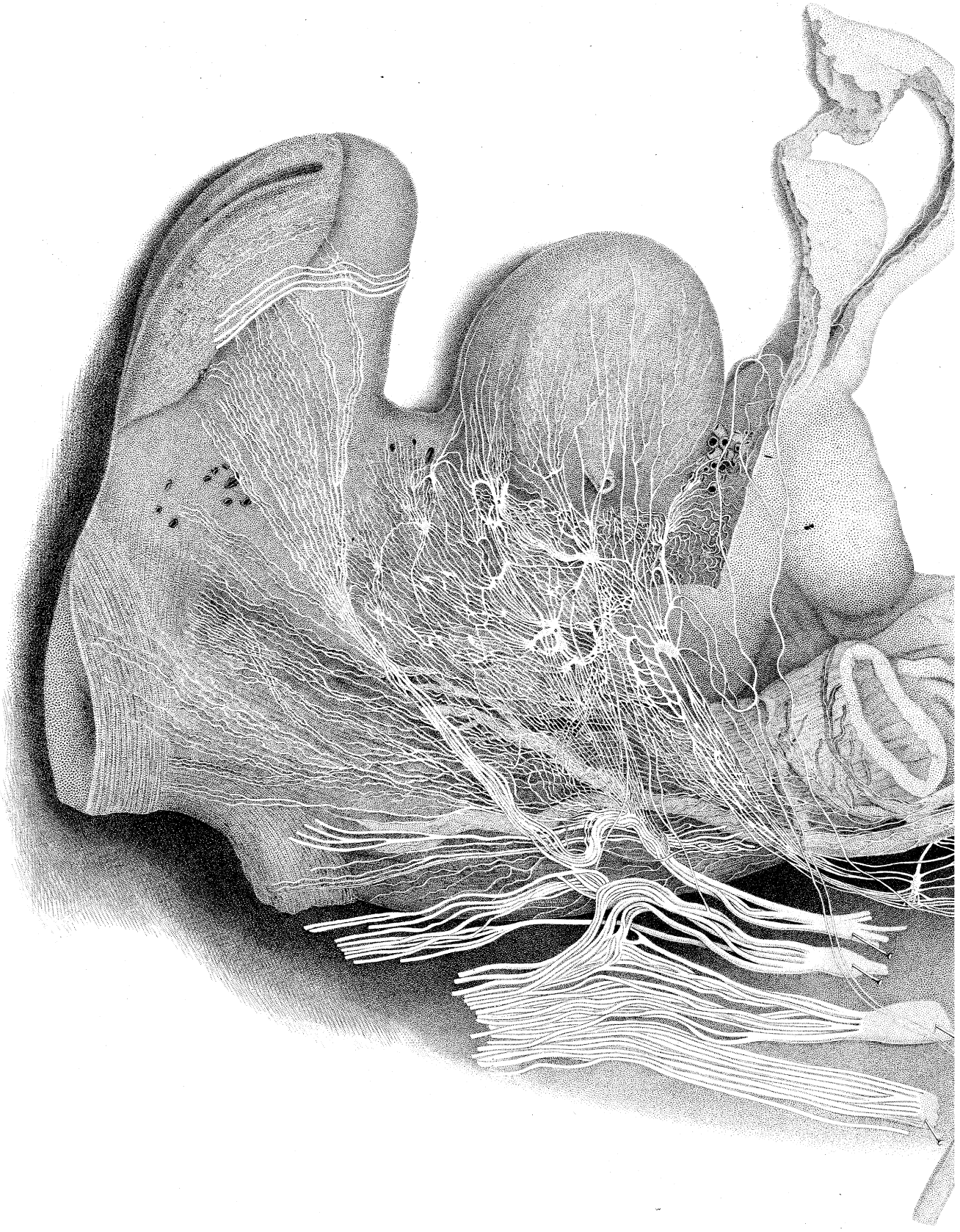
61.61.61.61.61.61. Small ganglia in the pelvic plexus. They are situated at the point of union between the branches from the lateral hypogastric plexus (29.29) and the branches from the sacral nerves (60.60.60). The lower part of the lateral hypogastric plexus forms a continuous plexus with the pelvic plexus, and the only circumstance which marks the division between the two is the existence of these ganglia, and the junction of the branches from the sacral nerves. It appears, however, from the marked difference which exists in their constitution, necessary to make this distinction between the two plexuses. For whilst the lateral hypogastric plexus (29.29) is a continuation of branches from the lower part of the superior aortic plexus (21.21, &c.), the pelvic plexus (61.61, &c.) is a point where a new arrangement of the gelatinous and tubular nervous fibres occurs, previous to the branches being distributed to the bladder, vagina and rectum. In this respect the pelvic plexus is analogous to the semilunar ganglion (3.3, &c.) and to the lower part of the superior aortic plexus (21.21, &c.), from which it differs in the amount of nerves sent from it, and the large amount of tubular fibres which these nerves contain. This analogy is further shown by the branches from the sacral nerves (60.60, &c.) being analogous to the abdominal splanchnic nerves (19.19 and 14.14), and to the thoracic splanchnic nerves (1.1. and 2.2), as being the medium by which the tubular fibres are distributed to the viscera. The sacral branches however differ from the splanchnic nerves in not being associated with any gelatinous fibres. These branches pass over the sacral ganglia of the sympathetic without having any connexion with them. In the branches of the sympathetic proceeding from the semilunar ganglion (6.6, &c.) and from the superior aortic plexus (22.22, &c.), and distributed to the abdominal viscera, the amount of the gelatinous fibre greatly exceeds that of the tubular; but in the branches from the pelvic plexus (61.61, &c.), distributed to the bladder and vagina, the amount of tubular fibre exceeds that of the gelatinous; and in the branches sent to the lower part of the rectum (68.68), the amount of tubular and gelatinous fibre is nearly equal. The gelatinous fibres found in the pelvic plexus are derived from the lateral hypogastric plexus, augmented by the gelatinous fibres which arise from the small ganglia (61.61, &c.). The tubular fibres are derived from the sacral nerves, though some tubular fibres from the lumbar nerves enter the plexus with the gelatinous fibres from the lateral hypogastric plexus.

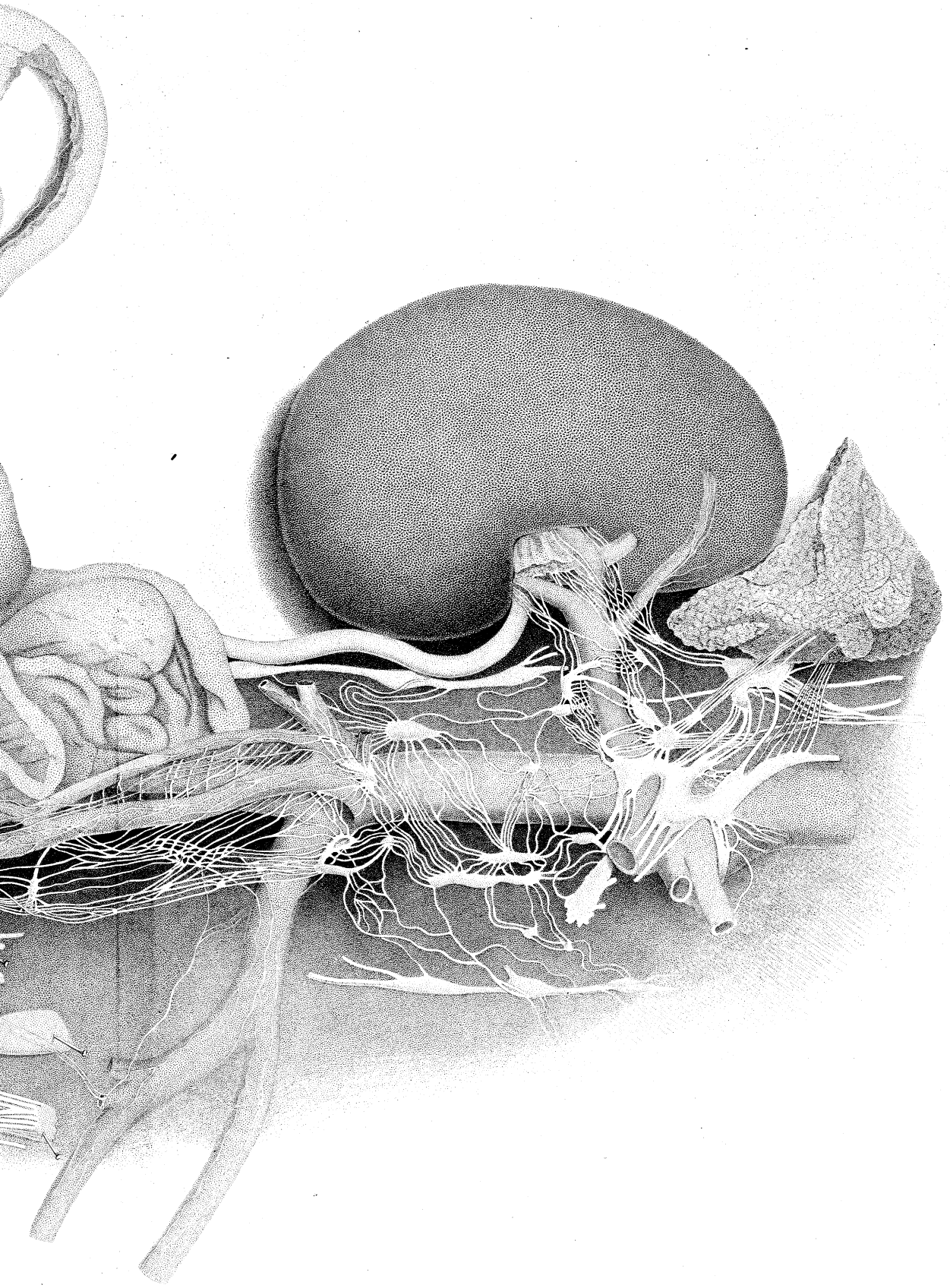
62.62.62.62.62. Small secondary ganglia which are formed in the pelvic plexus, and which assume various and curious forms.

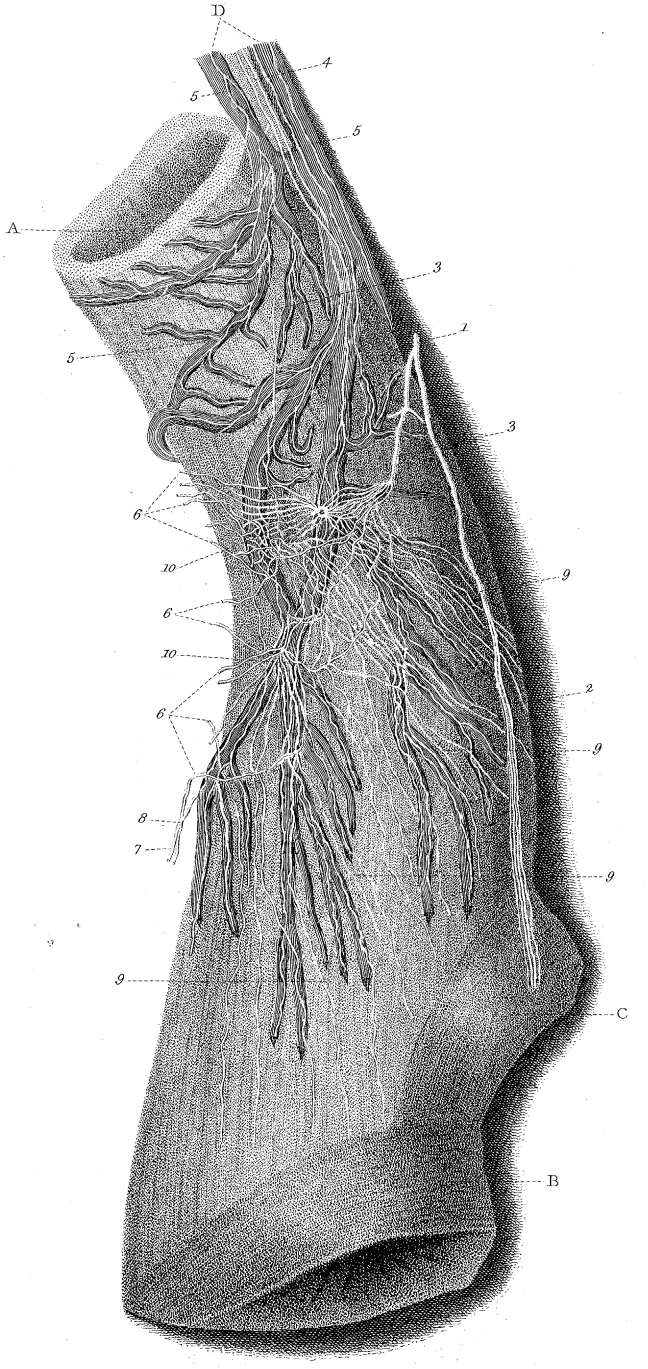
63.63.63.63. Branches from the anterior part of the pelvic plexus, which are distributed to the bladder. They contain a large amount of tubular nervous fibre.

64. Small ganglion on the vesical nerves.

65.65. Branches which come from the fourth sacral nerve, and joining with branches from the lower part of the pelvic plexus, are distributed to the erectile tissue (L).







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These sacral branches pass down by the side of the pelvic plexus, but have no communication with it.

66.66.66.66. Small ganglia formed on the nerves before they enter the erectile tissue.

67.67.67.67. Branches which enter the erectile tissue at the lower and anterior part of the vagina (L).

68.68.68. Branches which come from the posterior part of the pelvic plexus (61.61, &c.), and are distributed to the rectum.

PLATE XII.*.

A finished engraving of the preceding plate.

PLATE XIII.

Showing the posterior part of the pelvic plexus, which lies upon the rectum. This portion of the plexus is concealed in Plate XII. by the sacral nerves (47 and 49.49), and by the branches of the sacral nerves (59 and 60.60) lying upon it.

A. The upper part of the rectum.

B. The sphincter ani.

C. Fibres of the levator ani.

D. The two trunks of the superior hæmorrhoidal artery, as in Plate XII. The artery divides into branches which are distributed over the surface of the rectum.

1. A portion of the fourth sacral nerve.

2. A branch from the fourth sacral nerve sent to the levator ani.

3.3. Branches from the fourth sacral nerve which enter the posterior part of the pelvic plexus.

4. Three branches which come from the lower part of the superior aortic plexus (21.21, Plate XII.), and accompanying the superior hæmorrhoidal artery, end in the posterior part of the pelvic plexus.

5.5. Branches from the superior aortic plexus, which accompany the superior divisions of the hæmorrhoidal artery, before the formation of the pelvic plexus.

6.6.6. The divided ends of branches which enter into the formation of the pelvic plexus.

7. A branch distributed to the vaginal erectile tissue.

8. Small ganglion on this branch.

9.9.9.9. Branches from the pelvic plexus, which are distributed to the rectum. These branches follow the course of the arteries for some way, but leave the vessels in their ultimate distribution to the gut. They consist of gelatinous and tubular fibres in nearly equal proportions.

10.10. Small ganglia on the hæmorrhoidal nerves.

PLATE XIV.

A. The gravid uterus at the ninth month of pregnancy.

B. The right Fallopian tube turned aside.

C. The right ovary.

D. The right kidney, which has been cut at the lower part to show the structures beneath.

E. The right ureter.

F. The bladder.

G. The vagina.

H. The rectum.

I. A portion of the abdominal aorta.

K.K. Two renal arteries.

L. The renal vein.

M. The spermatic artery.

N. The continuation of the spermatic artery to the fundus of the uterus.

O. The division of the spermatic artery which supplies the ovary.

P. The superior hæmorrhoidal artery covered with fat. The nerves which accompany it are not dissected.

R.R. Portions of the superficial layer of muscular fibres which have been dissected out by Dr. Robert Lee, and described by him as nervous ganglia and plexuses. These muscular fibres adhere to the under surface of the peritoneum.

S. The edge of the divided peritoneum.

1.1. Portions of the semilunar ganglion.

2.2. Portions of the renal plexus.

3. The aortic plexuses.

4. The lateral hypogastric plexus.

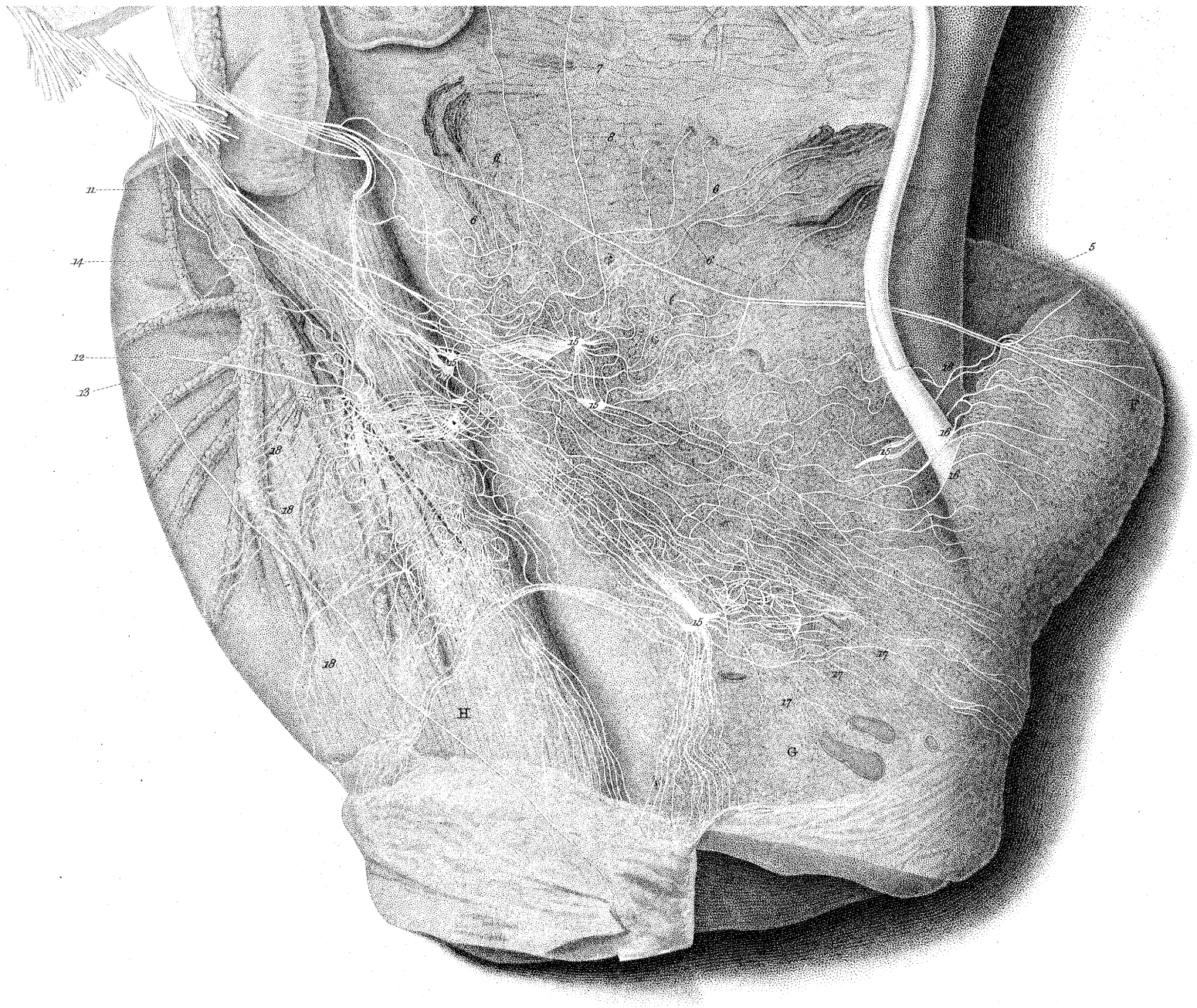
5. A continuation from the lateral hypogastric plexus, which is distributed to the superior part of the bladder.

6.6.6.6. Continuations from the lateral hypogastric plexus distributed to the lower half of the uterus.

7. A nervous branch which supplies the middle part of the uterus. It is inclosed in a tendinous canal, which extends to the bifurcation of the branch, and is apparently analogous to the branch described at 38. Plate XII. The difference which may at first appear to exist between these two branches passes away, when we remember that the lateral hypogastric and inferior aortic plexuses are both emanations from the superior aortic plexus.

8. A portion of the preceding branch, which has been divided in the dissection. It lies loose in the preparation.

9. A branch which accompanies the spermatic artery, but which was divided in removing the preparation from the body.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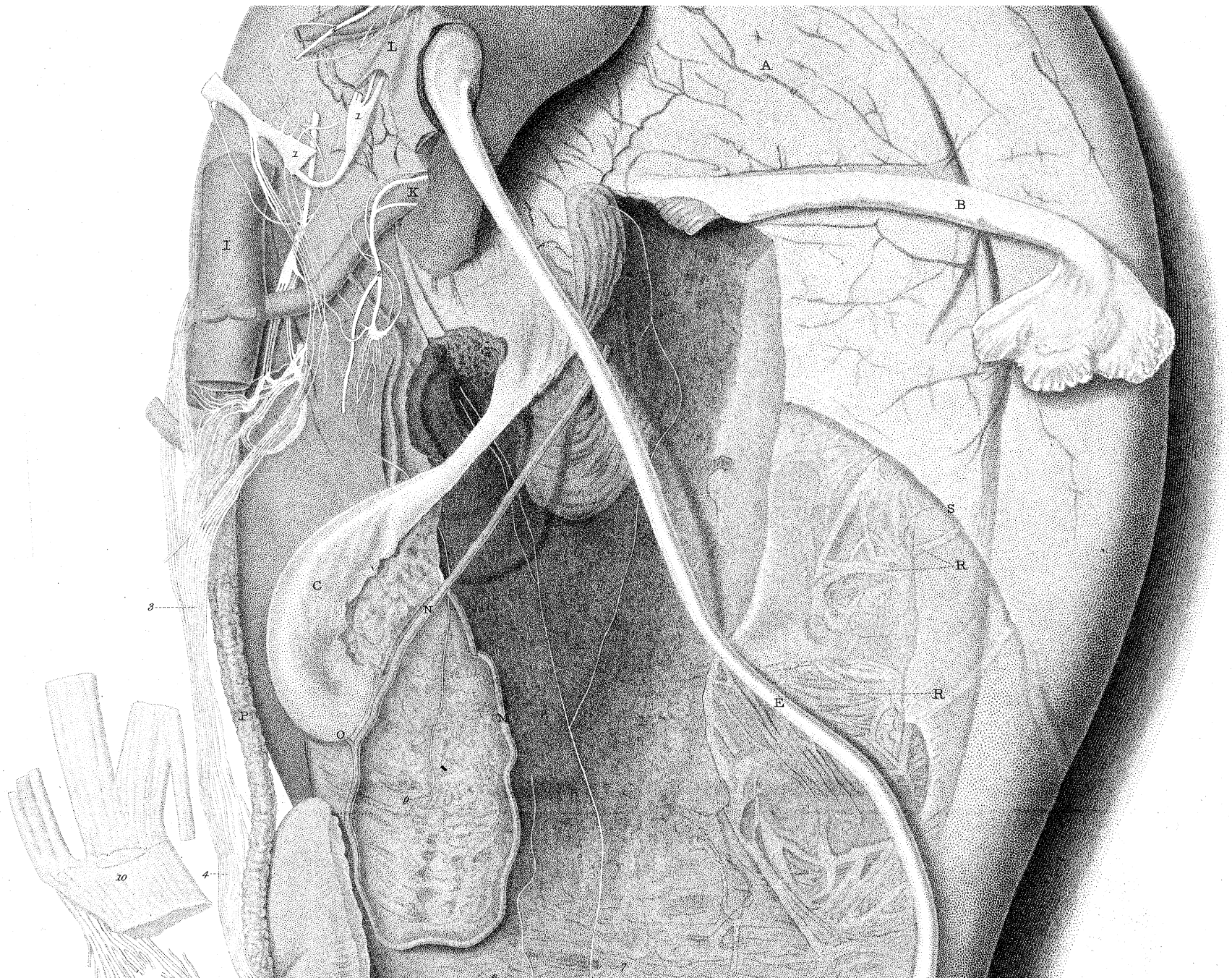
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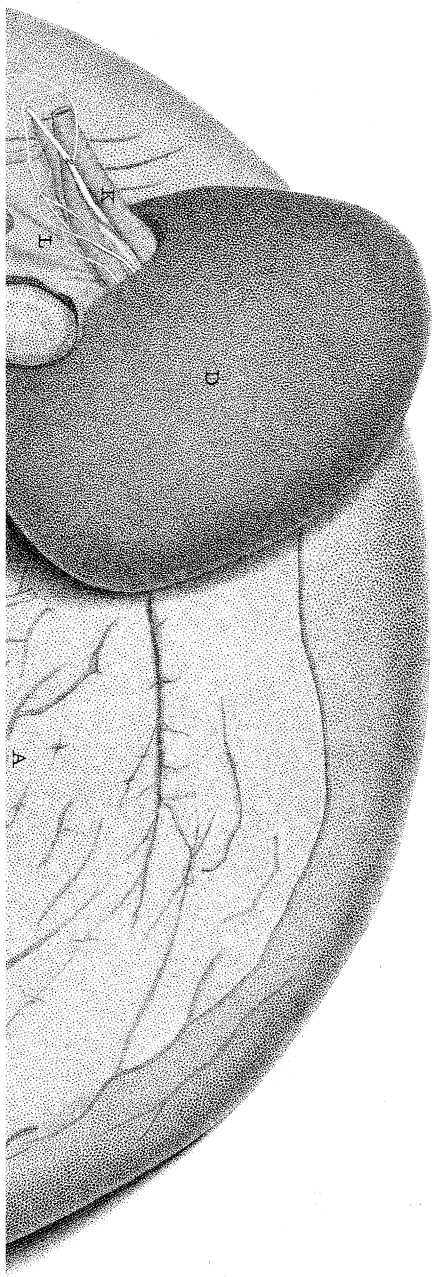

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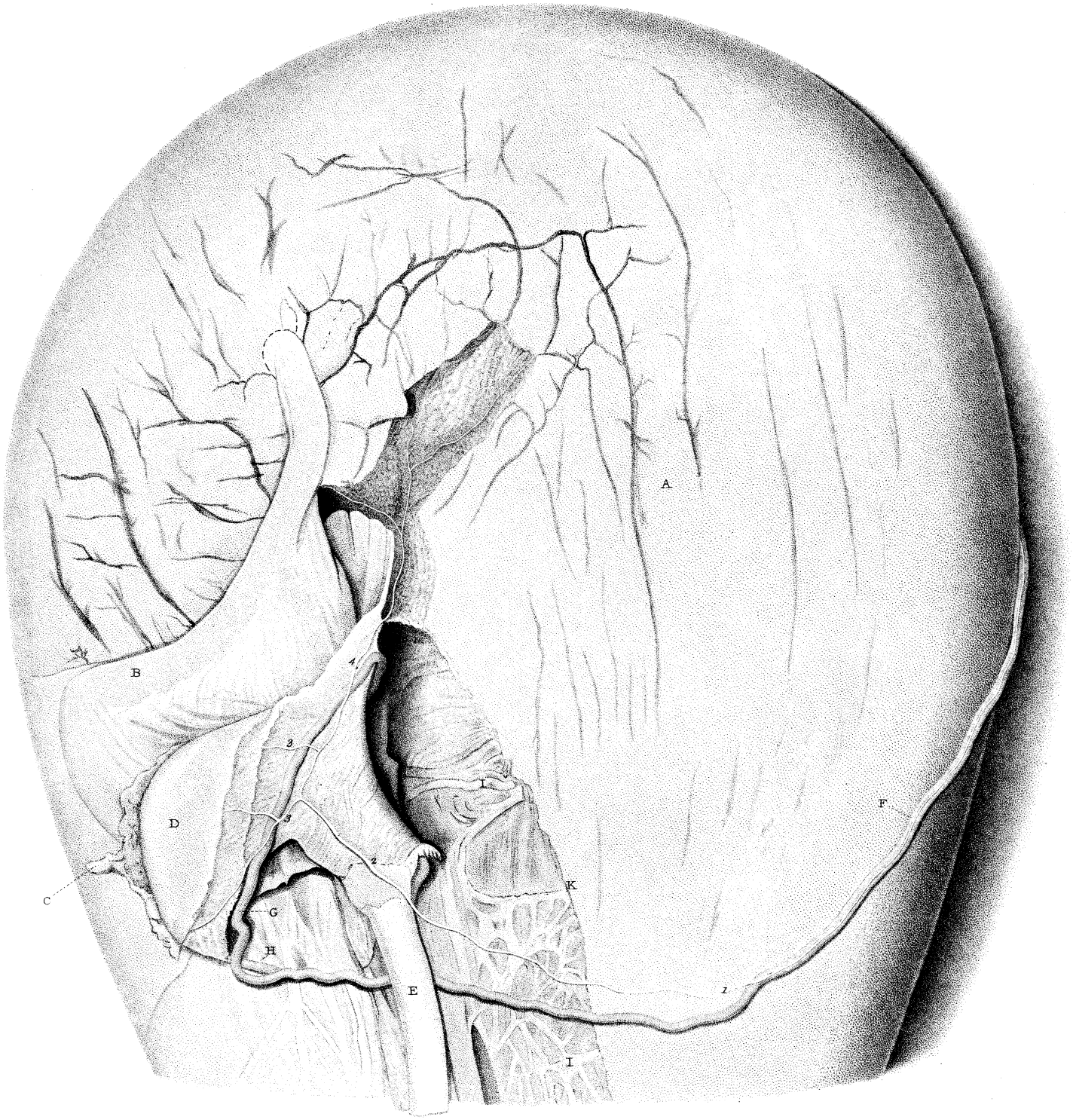

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10. Part of the sacral plexus.

11. Branches which enter the middle and anterior part of the pelvic plexus.

12. A branch which joins the posterior part of the pelvic plexus.

13. A branch from the sacral nerves distributed to the muscular tissues at the lower part of the vagina.

14. Branches which come down with the superior hæmorrhoidal artery and join the posterior part of the pelvic plexus.

15.15.15.15.15. Small ganglia in the pelvic plexus. Several smaller ganglia also exist in this plexus.

16.16.16. Nerves distributed to the bladder from the pelvic plexus.

17.17.17. Branches sent to the erectile tissue at the lower and anterior part of the vagina.

18.18.18. Branches from the posterior part of the pelvic plexus distributed to the rectum.

The formation and composition of the nerves in this dissection are, in all cases, exactly similar to that described in the previous dissection, Plate XII. Some of the branches, however, have been broken in consequence of my beginning the dissection with opinions very different from what I afterwards found to be correct.

PLATE XV.

Showing the distribution of the Nerve to the ovary and fundus of the uterus on the opposite surface of the same gravid uterus figured in Plate XIV.

A. The fundus of the gravid uterus at the ninth month of pregnancy.

B. The left Fallopian tube.

C. The fimbriated extremity of the Fallopian tube.

D. The left ovary.

E. A large vein.

F. The left spermatic artery.

G. The continuation of the spermatic artery to the fundus of the uterus.

H. The branch of the artery distributed to the ovary.

I.I. Another portion of the superficial layer of muscular fibres, which has been described as nervous ganglia and plexuses by Dr. Robert Lee.

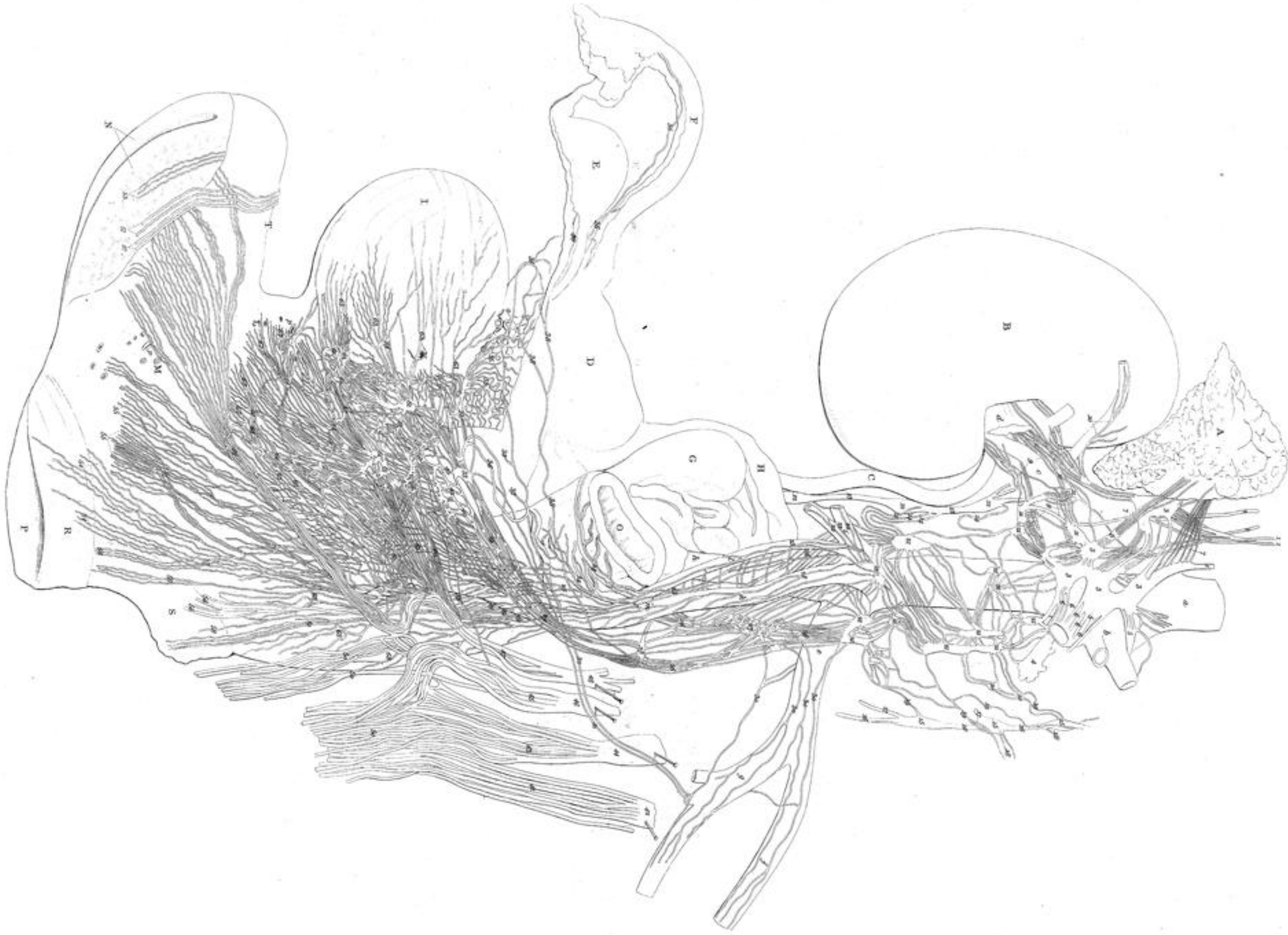
K. The edge of the divided peritoneum.

1. A branch of nerve which proceeds from the renal plexus in company with the spermatic artery, and is distributed to the ovary and fundus uteri.

2. A fusiform enlargement formed on the nerve previous to its distribution.

3.3. Branches sent to the ovary.

4. A branch sent to the fundus of the uterus.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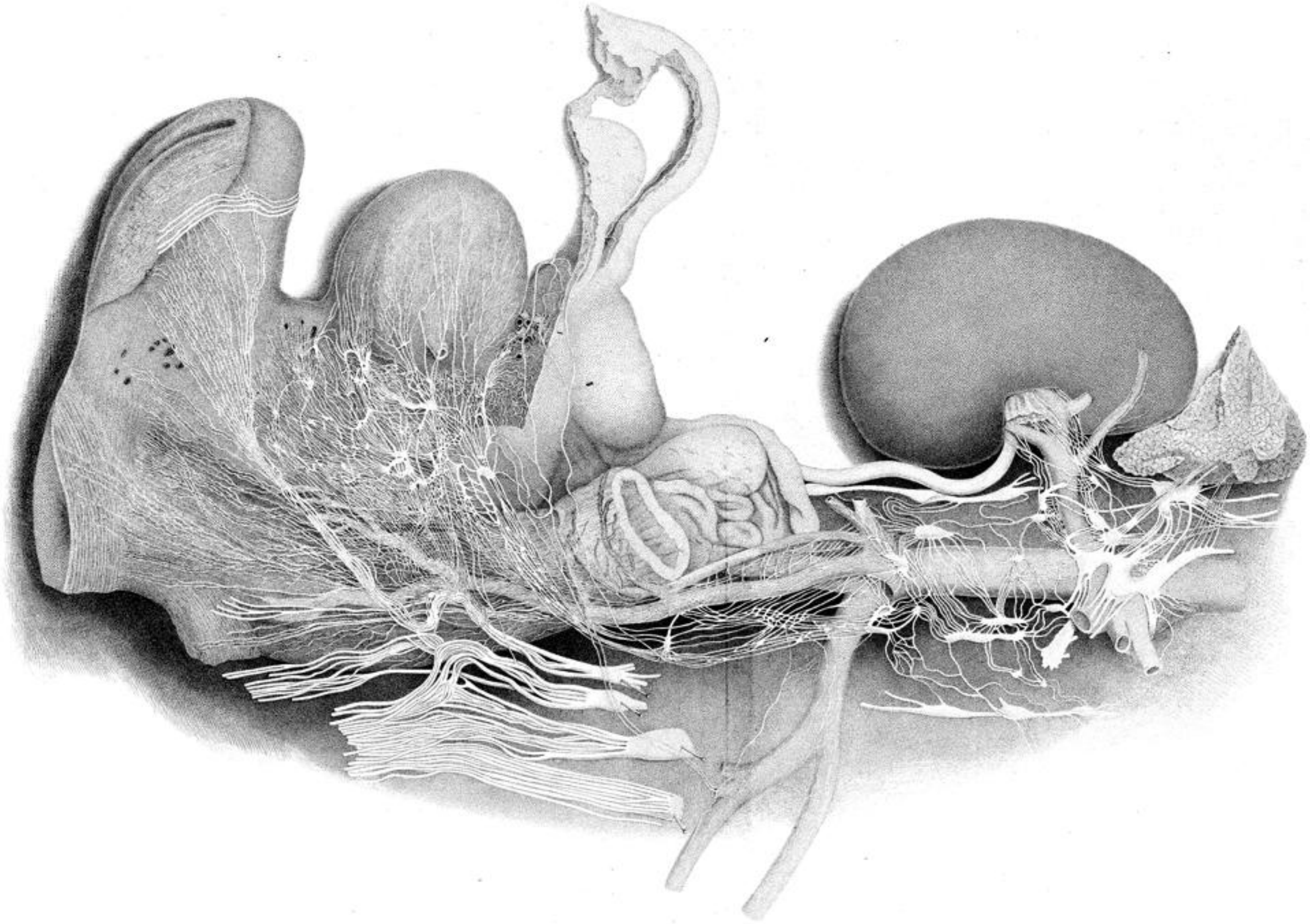

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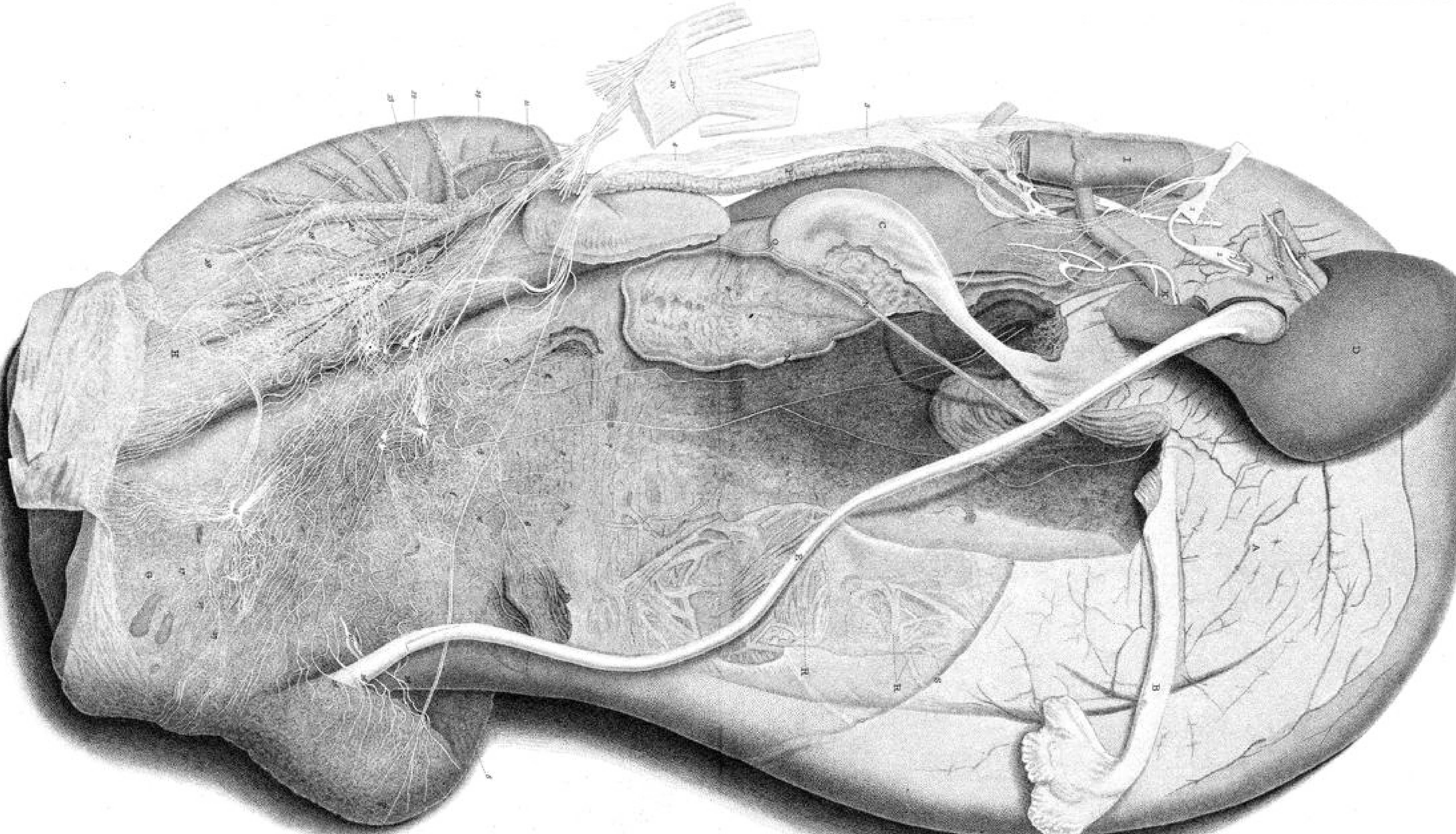

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