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ON THE

G A N G L I A

AND THE OTHER

NERVOUS STRUCTURES OF THE UTERUS.

BY

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LONDON:

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1842.

PREFACE.

THE following Papers and Engravings from the Philosophical Transactions have been printed in a separate form, with the permission of the President and Council of the Royal Society. All the preparations described or referred to in them, are in the author's possession, and it will afford him great pleasure to submit them to the examination of every Member of the Medical Profession.

ON THE
NERVOUS GANGLIA OF THE UTERUS,

READ TO THE ROYAL SOCIETY OF LONDON, JUNE 17, 1841, AND PUBLISHED IN THE PHILOSOPHICAL TRANSACTIONS.

IN a communication to this Society which was read on the 12th December, 1839, I described four great plexuses under the peritoneum of the gravid uterus, which had an extensive connection with the hypogastric and spermatic nerves. From their form, colour and general distribution, and their resemblance to ganglionic plexuses of nerves, and from their branches actually coalescing with those of the hypogastric and spermatic nerves, I was induced to believe, on first discovering them, that they were nervous ganglionic plexuses, and constituted the special nervous system of the uterus.

Subsequent dissections of the unimpregnated uterus, and of the gravid uterus in the third, fourth, sixth, seventh, and ninth months of pregnancy, have enabled me not only to confirm the accuracy of my former observations, but to discover the important fact, that there are many large ganglia on the uterine nerves, and on those of the vagina and bladder, which enlarge with the coats, blood-vessels, nerves, and absorbents of the uterus during pregnancy, and which return after parturition to their original condition before conception takes place.

The uterus and its appendages are wholly supplied with nerves from the great sympathetic and sacral nerves. At the bifurcation of the aorta, the right and left cords of the great sympathetic nerve unite upon the anterior part of the aorta, and form the aortic plexus. This plexus divides into the right and left hypogastric nerves, which soon subdivide into a number of branches to form the right and left hypogastric plexus. Each of these plexuses, having the trunk of the hypogastric nerve continued through its centre, after giving off branches to the ureter, peritoneum, rectum, and trunks of the uterine blood-vessels, descends to the side of the cervix, and there terminates in a great ganglion, which, from its situation and relations, may be called the hypogastric ganglion, or utero-cervical ganglion.

This ganglion is situated by the side of the neck of the uterus, behind the ureter, where it is passing to the bladder. In the unimpregnated state it is usually of an

irregular, triangular, or oblong shape, with several lobes or processes projecting from it where the nerves enter, or are given off from it. In the long diameter it usually measures from half an inch to three-quarters of an inch, varying in dimensions with the size of the nerves with which it is connected. The hypogastric ganglion always consists of cineritious and white matter like other ganglia, and gray and white nerves issue from it, which proceed to the rectum, bladder, uterus, and vagina. It is covered with the trunks of the vaginal and vesical arteries and veins, and the ganglion has an artery of considerable size, which enters it near the centre, and divides into branches which accompany the nerves given off from its inner surface, and from its anterior and inferior borders. The hypogastric nerve, after separating into a plexus, enters its upper edge, and branches from the third and other sacral nerves its posterior border, and the whole of its outer surface. None of the branches of the sacral nerves pass over the ganglion to the bladder, though some of them enter its anterior edge where the vesical nerves are given off.

From the inner and posterior surface of each hypogastric ganglion, numerous large nerves are given off, which go backward to anastomose with the hæmorrhoidal nerves, which accompany the arteries to the rectum, and pass with them between the muscular fasciculi of the organ. An extensive connection is thus established between the two hypogastric ganglia and the nerves of the rectum, and many large broad nerves pass off from the posterior and inferior part of these ganglia to ramify on the sides of the vagina, and between the vagina and rectum.

From the inferior border of each hypogastric ganglion several fasciculi of small nerves are sent off, which pass down on the sides of the vagina, and enter several large flat ganglia about midway between the os uteri and ostium vaginæ. From these vaginal ganglia, innumerable filaments of nerves, on which small ganglia are formed, extend downwards to the sphincter, where they are lost in a white dense membranous expansion, from which they cannot be separated without laceration. From this great web of ganglia and nerves on the sides of the vagina, by which it is completely covered, numerous branches are sent to the sides of the bladder, which enter it around the ureter. All these nerves of the vagina are accompanied with arteries, and they often form complete rings of nerve around the trunks of the great veins.

From the anterior margin of each hypogastric ganglion, large white and gray nerves are sent off, some of which pass on the outside, and others on the inside of the ureter, and these branches meet in front of the ureter in a ganglion, which may be termed the *middle* vesical ganglion. There are other two ganglia formed on these nerves, one between the uterus and ureter, and the other between the ureter and vagina. These may be called the internal and external vesical ganglia. The ureter is thus inclosed within a great ring of nerve, which resembles the œsophageal ganglion in some of the Invertebrata. The trunks of the uterine artery and vein are likewise encircled by a great collar of nervous matter, between which and the hypogastric ganglion, several large and some small branches pass.

The internal vesical ganglion, which usually has a flattened or long bulbous shape, is formed entirely upon the nerves which pass from the hypogastric plexus and ganglion, and run between the uterus and the ureter. It has an artery which passes through its centre. It first gives off a large branch to the ring of nerve or ganglion which surrounds the uterine blood-vessels; it then sends branches to the anterior part of the cervix uteri, and afterwards a great number of small filaments to the muscular coat of the bladder behind, where it is in contact with the uterus. The internal vesical ganglion then sends forward a large branch which terminates in the middle vesical ganglion.

This ganglion sends off a great number of large nerves to the bladder. Some of these accompany the arteries, and can be seen ramifying with them upon the whole of the superior part of the organ, even to the fundus. Filaments of these nerves, scarcely visible to the naked eye, are seen ramifying upon the bundles of muscular fibres, occasionally forming loops, and inclosing them, or passing down between them to the strata of fibres below. Some of the smaller branches of the middle vesical ganglion do not accompany the arteries, but are distributed at once to the parts of the bladder around the ureter.

The external vesical ganglion is formed entirely upon the nerves which proceed from the hypogastric ganglion, and pass on the outside of the ureter. This is a small thin ganglion, the branches of which are sent immediately into the muscular coat of the bladder. It usually sends down a long branch to anastomose with the nerves and ganglia situated on the side of the vagina.

From the inner surface of each hypogastric ganglion numerous small, white, soft nerves pass to the uterus, some of which ramify upon the muscular coat about the cervix, and others spread out under the peritoneum, to coalesce with the great ganglia and plexuses situated on the posterior and anterior surfaces of the organ. Large branches also go off from the inner surface of the hypogastric ganglion to the nerves surrounding the blood-vessels of the uterus, which they accompany in all their ramifications throughout its muscular coat. Other branches of nerves pass down from the ganglion between the vagina and bladder. Soon after conception the blood-vessels of the nervous ganglia and plexuses now described enlarge, and the ganglia and plexuses themselves expand with the uterus. The long diameter of the hypogastric ganglion at the end of the ninth month measures about an inch and a half.

I have published a full description, with illustrations of the great ganglionic nerves surrounding and accompanying the blood-vessels, and of the ganglia and plexuses, situated on the body of the uterus*. The appearances presented in the fourth month of pregnancy by the hypogastric ganglia, and the ganglia and nerves of the rectum, bladder, vagina and uterus, and also the great plexuses of nerves situated on the anterior surface of the uterus, are seen in the Plates which accompany this paper.

From an examination with the microscope of portions of the plexuses under the

* The Anatomy of the Nerves of the Uterus. London, 1841. Fol.

peritoneum of a gravid uterus of nine months, which had long been immersed in rectified spirit, Professor OWEN and Mr. KIERNAN were led to conclude that they were not nervous plexuses, but bands of elastic tissue.

"The tissue of the broad, white, reticularly inter-communicating bands of fibrous matter resembling nerves of the uterus," observes Professor OWEN, "consisted of minute fibres, which were solid, smooth, equal-sized, cylindrical and nearly transparent, irregularly interblended in their course; their diameter does not exceed $\frac{1}{10,000}$ th of a line. These bands correspond in structure with the fibrous modification of cellular tissue. The component fibres did not form tubes, nor were their interspaces filled with the primitive granules or cells of the nervous tissue.

"In the nerves of the spinal system, the primitive fibres of the neurilema, which closely resemble those of the ordinary cellular and fibrous tissues, are arranged in the form of tubes, and can be distinguished into cylinder and contents. The same structure, on a minute scale, exists, according to VALENTIN*, in the sympathetic nerves; but according to the observations of REMAK and SCHWANN†, the component fibres form solid bands, and are of a more transparent character than in the spinal nerves, but marked occasionally with swellings, and having granules in the interspaces.

"I consider that the difference between the nerves of the sympathetic and the fibrous cellular tissue to consist, as regards their microscopic character, in the greater proportion of the granules or cells in the interspaces of the fine reticularly interwoven, component fibres of the nervous band; and this difference I believe to exist between the two nerves of the sympathetic system and the white bands of fibrous matter which connect the peritoneum with the muscular substance of the womb, and which resemble a plexus of nerves."

The tubular structure of the ganglionic plexuses on the body of the uterus has since been observed by Mr. DALRYMPLE, and the perfect resemblance of the uterine nerves to those of the stomach and intestines demonstrated. The following letter contains an account of Mr. DALRYMPLE's microscopical examination of the uterine nerves.

6 Holles Street, April 21, 1841.

MY DEAR SIR,

After having seen and very carefully examined, some weeks since, your very beautiful preparations of the nerves of the impregnated uterus, and after having felt convinced by their continuity, colour, texture, and mode of distribution, that they really were nerves, I was a good deal surprised to hear from you, and others, that their identity had been doubted. I was aware that it would have been worse than useless to have asked you for a portion of such suspected cords to submit to the microscope, knowing that they had been very many months immersed in strong alcohol. It would neither have been fair to you, nor satisfactory to me, to have made such an attempt at solving the question.

* Repertorium, iii. p. 76.

† Mikroskopische Untersuch., p. 179.

Being anxious, however, to satisfy myself upon the subject, I obtained an uterus (unimpregnated), and while it was quite recent, I traced several nerves, which I recognised, from their situation round the ureter, and upon the body of the uterus, to be similar to some you had previously pointed out to me. These filaments I submitted to the microscope, and used a very beautiful eighth-of-an-inch object-glass made by Ross. I found that it was impossible, with the most careful dissection, to detach any filament of nerve without including a quantity of cellular and elastic tissue; so that although the tubular portion, indicating the nerve, was distinct, yet it was surrounded by innumerable extremely minute threads, coiled and contorted, such as one finds the component of elastic tissue, and the ultimate element of cellular membrane.

Under slight pressure, however, the tube was plainly discernible, containing granular matter, not uniformly distributed, but collected in minute masses, at intervals. Small blood-vessels were also seen here and there, with blood-discs within them, which served to indicate the difference between the nervous and vascular tubes, and thus to avoid the possibility of error.

Being, however, aware that some of the most distinguished foreign microscopical anatomists had differed as to what was the real characteristic of nerves of the sympathetic system, I should not have troubled you with this communication had I stopped here.

Feeling, from this discordance of opinion, that there was no absolute test, or at least one which was not open to cavil, I thought to try a comparison of the uterine nerves with those that undeniably belonged to the ganglionic system. I traced, therefore, some nerves upon the surface of the stomach, up to the great ganglion that gave them origin; and I selected some also from the small intestine. These I submitted to the same microscopical power, and under the same circumstances of light, and pressure, and medium.

In all of these I observed the tubular part filled with granular matter, and similarly collected in minute masses.

I also observed that each tube was surrounded by the minute serpentine threads before described. In fact so closely did they agree, in every particular, with the appearances presented by the uterine nerves, that it would have been impossible to distinguish the one from the other.

Thus by comparing the unknown with the known, despite the want of any absolute test, I feel perfectly satisfied of the true nervous character of the very beautiful plexuses you have so patiently and with so much labour developed.

Admitting then this intricate structure to be really nervous, it is a matter of no marvel that they increase in size during pregnancy. It would indeed be wonderful if the nerves alone remained stationary, while the muscular and cellular, the serous and mucous, and the vascular tissues increased, as it is notorious those structures of the uterus do, during the period of child-bearing.

If, as is also indisputable, nerves shrink and atrophy when the function of an organ they supplied is lost or destroyed, is it singular that the uterine nerves should increase, when that organ rouses itself from inaction, to one of the most extraordinary exemplifications of temporary functional vigour that the animal œconomy can anywhere exhibit? Pardon me this prolixity, and believe me,

My dear Sir,

Yours very faithfully,

JOHN DALRYMPLE.

Dr. Robert Lee, F.R.S.

EXPLANATION OF THE PLATES.

PLATE XXVI.

Exhibits a posterior and lateral view of the gravid uterus in the fourth month of pregnancy, of the vagina, rectum and bladder, with their ganglia and nerves.

A. The fundus and body of the uterus covered with peritoneum.

B. The vagina.

C. The bladder.

D. The rectum.

E, F. The ovaria.

G. The great sympathetic nerve where it divides into the two hypogastric nerves and plexuses. The arteries and veins of the great sympathetic are all injected in the preparation from which the drawing has been made. A little above the bifurcation of the great sympathetic nerve, there is a deposit of cineritious matter in its substance, and the nerve itself is enlarged as high as the kidneys.

H. The right and left hypogastric nerves and plexuses. The artery of the right is injected, and accompanies the nerve to the great ganglion at the cervix in which it terminates.

I. The left hypogastric or great utero-cervical ganglion, with an artery passing into it near the centre.

J. The third and other sacral nerves, sending numerous large branches into the posterior border of the ganglion, and the whole of its outer surface.

K. The hæmorrhoidal nerves accompanying the arteries to the rectum, and sending numerous branches to anastomose with nerves sent off from the posterior edge of the ganglion.

L. Branches of nerves with ganglia sent off from the left hypogastric nerve, which pass down on the inside of the ureter to the trunks of the uterine artery and veins, and enter ganglia which surround these blood-vessels.

M. The left ureter, with a nerve accompanying it, which passes into the vesical ganglion, situated on the anterior part of the ureter.

N. Rings of nerve, surrounding the uterine blood-vessels.

O. The middle vesical ganglion, into which large nerves enter, which are sent off from the anterior border of the left hypogastric ganglion, and pass on the outside of the ureter.

P. Broad, flat ganglia formed on the great plexus of nerves which covers the upper part of the vagina.

Q. The orifices of the divided veins of the vagina, which are completely encircled with ganglionic plexuses of nerves.

R. Filaments of vaginal nerves passing under the sphincter.

S. Large nerves covering the posterior wall of the vagina, and anastomosing with the hæmorrhoidal nerves.

PLATE XXVII.

Exhibits an anterior and lateral view of the gravid uterus in the fourth month, and of the vagina and bladder.

A. The right hypogastric nerve.

B. The sacral nerves.

C. The right hypogastric ganglion.

D. Nerves from the hypogastric nerve to the ganglia on the blood-vessels of the uterus.

E. Ganglia surrounding the uterine artery and veins.

F. Ganglionic plexus, under the peritoneum on the fore-part of the uterus.

G. Filaments from this plexus passing out with the round ligament.

H. The round ligament.

I. The right ureter and trunk of the vaginal and vesical veins surrounded with nerves.

J. Ganglia and nerves of the vagina.

K. Nerves passing between the vagina and rectum.

L. Ganglia and nerves of the bladder.

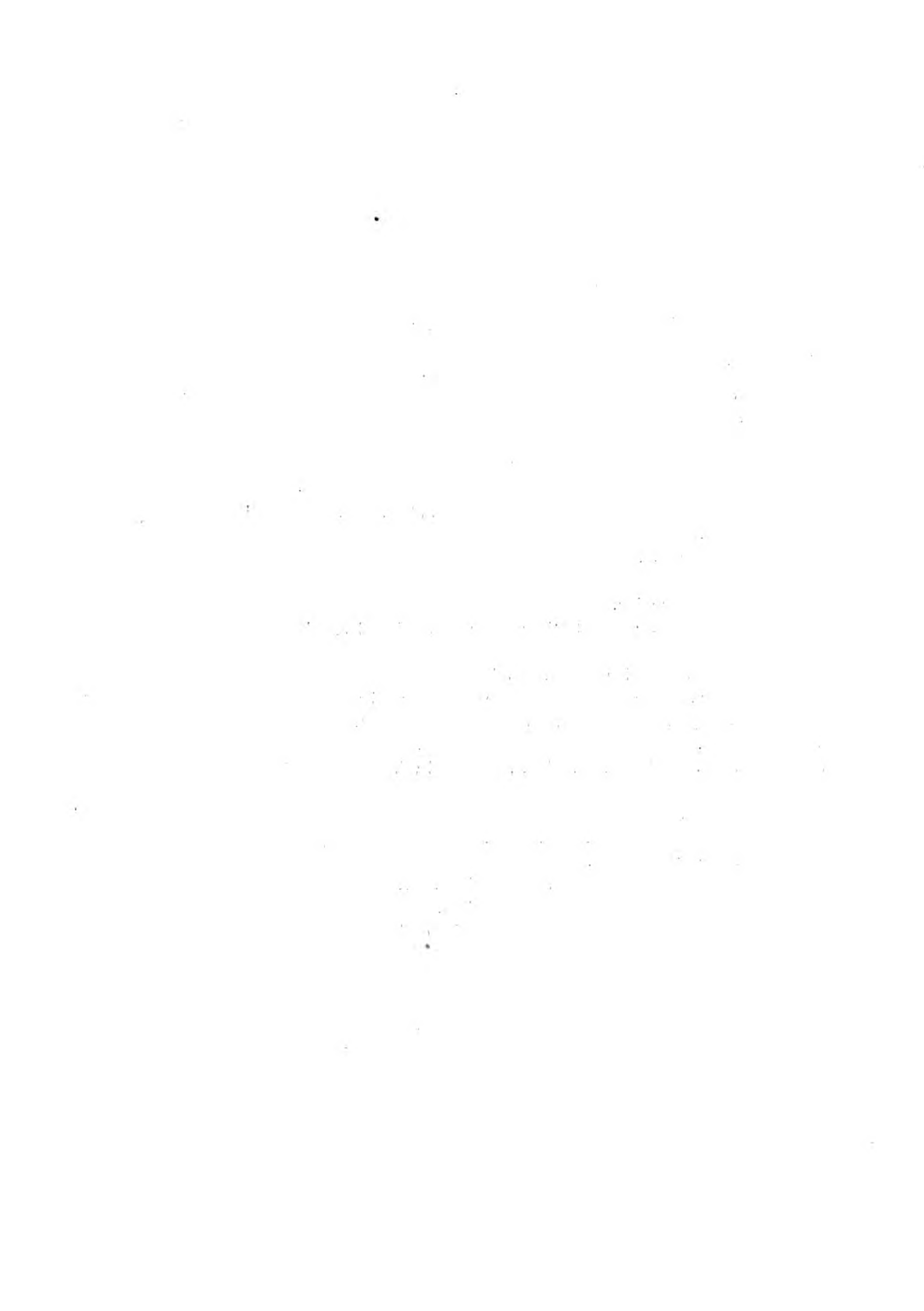
M. Vaginal nerves passing into the bladder around the ureter.

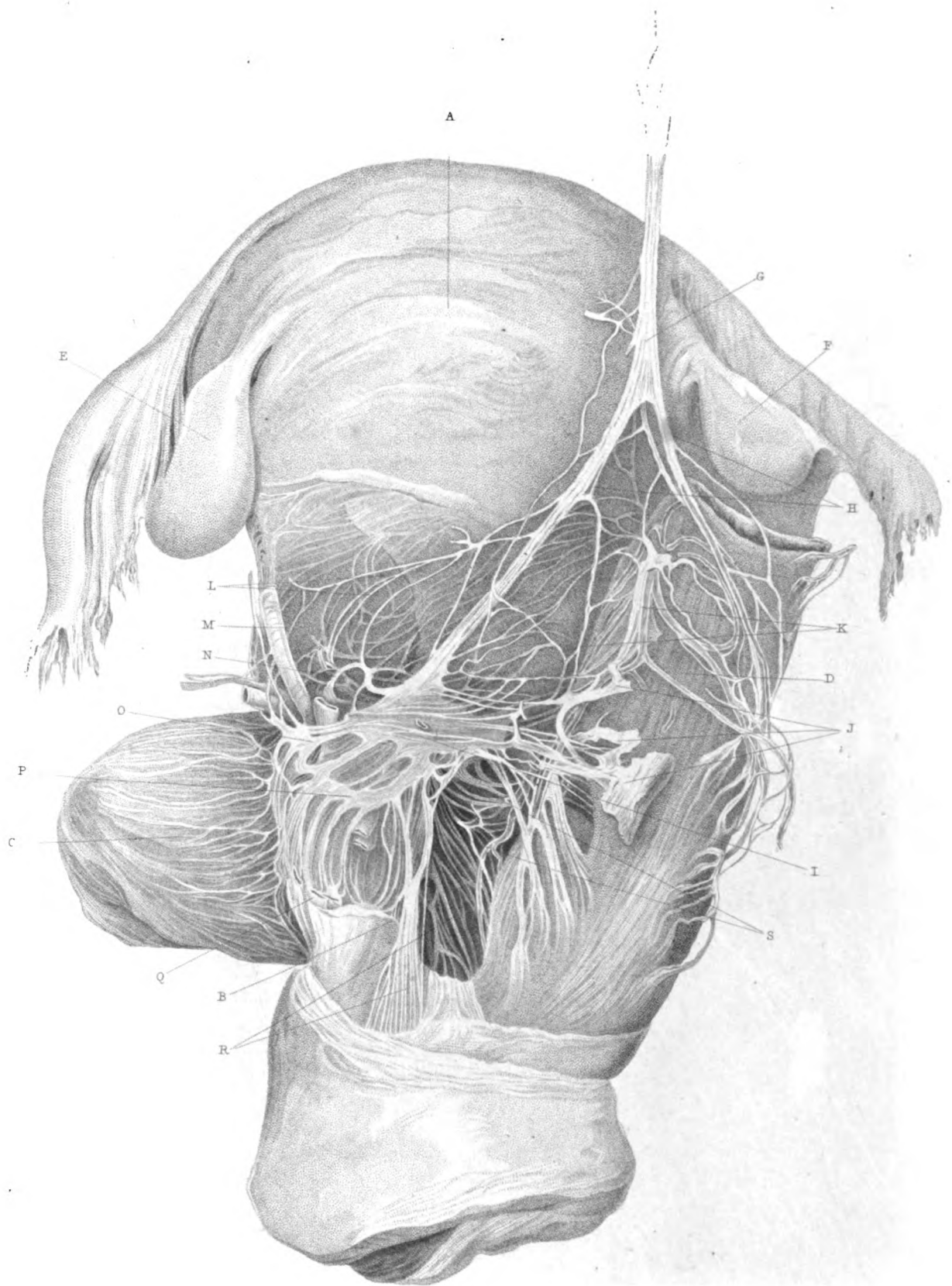
N. Blood-vessels and nerves of upper part of the bladder.

O. Plexus of nerves under the peritoneum on the left side of the uterus, the blood-vessels of which have not been injected.

P. Filaments from this plexus passing out with the round ligaments.

Q. The peritoneum of the anterior part of the body and cervix of the uterus reflected upwards, to expose the ganglionic plexuses situated below.







AN

APPENDIX TO A PAPER ON THE

NERVOUS GANGLIA OF THE UTERUS,

WITH A FURTHER ACCOUNT OF THE

NERVOUS STRUCTURES OF THAT ORGAN.

BY

ROBERT LEE, M.D., F.R.S.,

Coll. Reg. Med. Socius.

From the PHILOSOPHICAL TRANSACTIONS.—PART II. FOR 1842.

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1842.

XI. *An Appendix to a Paper on the Nervous Ganglia of the Uterus, with a further Account of the Nervous Structures of that Organ.* By ROBERT LEE, M.D., F.R.S., Coll. Reg. Med. Socius.

Received June 16,—Read June 16, 1842.

FROM the functions of the human uterus, GALEN inferred that it must be supplied with nerves, but there is no evidence to prove that GALEN, or any of the celebrated anatomists who flourished before the middle of the eighteenth century, ever traced the great sympathetic and sacral nerves into the uterus, or discovered that its nerves enlarge during pregnancy. This was first done by Dr. W. HUNTER, who describes the hypogastric nerve on each side as passing to the gravid uterus, behind the hypogastric vessels, and spreading out in branches like the portio dura of the seventh pair, or like the sticks of a fan, with many communications over the whole side of the uterus and vagina. As Dr. HUNTER never examined the nerves of the unimpregnated uterus, and saw the nerves of the gravid uterus dissected only in one subject, he did not certainly know that they increased after conception. "I cannot," he observes, "take upon me to say what change happens to the system of uterine nerves from utero-gestation, but I suspect them to be enlarged in proportion as the vessels*."

Mr. JOHN HUNTER denied that the nerves of the uterus ever enlarged during pregnancy. "The uterus in the time of pregnancy," he says, "increases in substance and size, probably fifty times beyond what it naturally is, and yet we find that the nerves of this part are not in the smallest degree increased. This shows that the brain and nerves have nothing to do with the actions of a part, while the vessels which are evident increase in proportion to the increased size; if the same had taken place with the nerves, we should have reasoned from analogy†." Dr. WILLIAM HUNTER left no preparations of the nerves of the uterus, nor did Mr. J. HUNTER, in support of their conflicting statements, and at the beginning of the year 1838 I believe there were no preparations in this country, showing the nerves of the uterus dissected, either in the unimpregnated or gravid state. Sir ASTLEY COOPER then maintained, that it was impossible for the nerves of the uterus, or the nerves of any other organ, to increase under any circumstances.

In 1822 Professor TIEDEMANN published a description of the nerves of the uterus with two engravings. In the first, the spermatic nerves are represented on both sides accompanying the spermatic arteries to the ovaria. The spermatic veins, and the

* An Anatomical Description of the Human Gravid Uterus. Lond. 1794, p. 21.

† The works of J. HUNTER, vol. iii. p. 117. A.D. 1837.

nerves which followed them, are not seen. A few small branches of nerves from the hypogastric plexus are seen ramifying on the posterior and inferior surface of the uterus with the uterine arteries. The whole of the superior part of the uterus is covered with peritoneum. In the second Plate some small branches from the left hypogastric nerve, before it enters the great ganglion at the cervix, are seen accompanying the left uterine artery on the left side of the lower part of the uterus. From Professor TIEDEMANN'S work it might justly be inferred, that the human gravid uterus is more sparingly supplied with nerves than any other organ in the body*.

In 1823 Professor LOBSTEIN stated that the uterus before and after conception had a very scanty supply of nerves, "*Rarissime in uteri substantiam tum vacui tum gravidi sese immittere videntur nervorum surculi*†."

In 1829 Professor OSIANDER affirmed that the nerves of the human uterus had never been seen, either by himself or by any other anatomist, and that he had been deceived by the authority of scientific persons, when he stated that nerves were spread over the whole uterus.

On the 8th of April, 1838, while dissecting a gravid uterus of seven months, I accidentally observed the trunk of a large nerve proceeding upward from the cervix to the body of the uterus along with the right uterine vein, and sending off branches in its course to the posterior surface of the uterus, some of which accompanied the ramifications of the vein, and others were inserted into the peritoneum. A broad band, resembling a plexus of nerves, was seen extending across the posterior surface of the uterus, and covering the nerve midway between the fundus and the cervix. On the left side the same appearances were seen, and several branches of the nerves accompanying the uterine vein were distinctly continuous with branches of the great plexus crossing the body of the uterus. The preparation was placed in the museum of St. George's Hospital on the 1st of October, 1838. Several eminent anatomists, to whom I showed the preparation, thought that I had been misled by appearances, and that they were absorbent vessels accompanying the veins and tendinous fibres, spread across the posterior surface of the uterus. They all acknowledged that they had never seen nor dissected the nerves of the uterus, either in the human subject or in any of the lower animals. I resolved, when another opportunity should present, to follow the sympathetic into the gravid uterus, with the utmost care, that I might discover, if possible, the nature of the great plexuses covering its surface.

On the 18th of December, 1838, a woman in the sixth month of pregnancy died in St. George's Hospital, a few hours after the fœtus and its appendages had been expelled; the uterus was removed with all its blood-vessels and nerves remaining connected with it, and the great sympathetic and sacral nerves were traced to the different parts of the uterus, while the preparation was under alcohol.

In a communication to this Society, which was read on the 12th of December, 1839,

* *Tabulæ Nervorum Uteri*, fol. Heidelbergæ, 1822.

† *De Nervi Sympathetica Humani Fabrica*, &c. Paris, 1823, p. 31.

I described the appearances displayed in these dissections, and represented by figures the spermatic, hypogastric, and sacral nerves passing into four great plexuses under the peritoneum of the body of the uterus. From the form, colour, vascularity, and general distribution of these plexuses, and from their branches actually coalescing with those of the great sympathetic, I inferred that they were true nervous ganglionic plexuses, and formed the nervous system of the uterus. Some anatomists of reputation formed a different opinion, and concluded that they were nothing but bands of elastic tissue, gelatinous tissue, or cellular membrane connecting the peritoneum with the muscular coat of the uterus. All who examined the dissections admitted that the plexuses were accompanied with arteries, and were continuous with the spermatic and hypogastric nerves. None attempted to show in any other part of the body, bands of elastic tissue assuming a similar plexiform appearance, accompanied with arteries or continuous with nerves. The communication was withdrawn from the Royal Society.

I continued the investigation of this subject during the whole of 1840 and 1841, and discovered the great nervous ganglia at the neck of the uterus, a description of which is contained in the last volume of the *Philosophical Transactions*. But these ganglia, which exceed in size the semilunar ganglia of the great sympathetic, constitute only a small portion of the nervous system of the human uterus. I propose now briefly to describe other nervous structures of far greater size, as displayed in the dissection of a gravid uterus at the end of the ninth month of pregnancy.

In this preparation the great sympathetic nerve sends numerous branches from both its cords to the trunk of the inferior mesenteric artery, which form a great plexus around it. These nerves accompany all the ramifications of the artery, but the greater number proceed with the hemorrhoidal artery to the rectum. The two cords of the great sympathetic, after giving off these branches to the inferior mesenteric artery, pass down before the aorta nearly two inches below its bifurcation, where they are united by several fine nervous filaments. But the cords continue distinct, and soon separating, each passes down behind the hypogastric blood-vessels to the side of the neck of the uterus, and there terminates in the corresponding hypogastric or utero-cervical ganglion. The left cord of the great sympathetic, or as it is usually called, the hypogastric nerve, enlarges greatly as it approaches the hypogastric ganglion. This ganglion is nearly two inches in breadth, and covers a great part of the cervix uteri. It appears to consist of six or seven smaller ganglia, which are united together by nervous cords. Each of these ganglia is a thick solid nervous mass, of an orange white colour inclined to brown. Arteries which have been injected pass through these smaller ganglia and accompany the various nervous filaments which proceed from them. Into the whole outer surface of the left hypogastric ganglion, numerous branches from the third sacral nerve enter; and behind there is a great connection formed between the ganglion and the branches of the left hemorrhoidal nerve. The vaginal nerves arise from the inferior margin of the ganglion, and the vesical from its anterior border. Some of these nerves pass on the outside of the

ureter to enter the middle vesical ganglion, and others pass on the inner surface of the ureter to the anterior part of the neck of the uterus.

From the superior and anterior part of the left hypogastric ganglion, a plexus of nerves accompanied by an injected tortuous artery, proceeds upward along the whole body of the uterus, near the left side, to the trunk of the left spermatic vein, and there terminates in a dense, reddish brown coloured mass, consisting of fibres firmly interlaced together, and which has all the characters of a true nervous ganglion. From its vicinity to the principal spermatic artery and vein which it partly surrounds, and the ligament of the ovary, it may be called the *left spermatic ganglion*. Between this ganglion and the left hypogastric ganglion, an artery extends which is closely embraced by a plexus of nerves, and a direct nervous communication is thus established between these remote ganglia. The nerves adhered so firmly to the artery through its whole course, that before they were separated they presented the appearance of two white lines on its sides, with filaments crossing over the vessel. From these nerves extending between the left hypogastric and spermatic ganglion, branches with arteries are given off in their whole course to the *subperitoneal ganglia* and *plexuses* on the posterior surface of the uterus, and also branches to the plexuses on the anterior surface. On approaching the spermatic ganglion, these nerves with their artery pass under or between the branches of the *left subperitoneal plexuses* and frequently communicate with them by fine nervous filaments. The artery can be readily traced through the substance of the spermatic ganglion, but the nerves which accompany it from the hypogastric ganglion, immediately disappear on entering the mass. Numerous large branches of nerves from the left subperitoneal plexus likewise terminate in the left spermatic ganglion, but some of them pass under it, and proceed to the round ligament; and others are continued upward, gradually diminishing in size as they approach the renal plexus along the spermatic blood-vessels. From the upper border of this ganglion, large flat nerves proceed to ramify on the fundus uteri, and pass with the vessels into the muscular coat. The trunk of the spermatic vein and artery is almost completely surrounded with this ganglion, as the trunks of the uterine, and vaginal arteries and veins are inclosed within rings of nerve connected with the hypogastric ganglion.

In this dissection there are nervous structures displayed on the anterior and posterior surfaces of the uterus of still greater magnitude. These, from their situation, may be called the *subperitoneal ganglia* and *plexuses* of the uterus.

Over the middle of the lower part of the body of the uterus behind, immediately beneath the peritoneum, is situated the posterior subperitoneal ganglion, which is considerably larger than the left hypogastric ganglion. It presents the appearance of a layer of dense structure composed of fibres strongly interlaced together, having a yellowish brown colour. It adheres firmly to the peritoneum, but between its lower surface and the muscular coat of the uterus, there is interposed a thick soft layer of cellular substance, through which filaments of nerves and branches of con-

siderable size pass to the muscular coat of the uterus. The middle part of the ganglion is more than two lines in thickness, but it becomes everywhere thinner towards the circumference, and particularly at the inferior border, where it sends off many nerves to the back part of the vagina. From its left lower and lateral part, it sends off two layers of broad nerves, one of which adheres to the peritoneum, and the other closely invests the muscular coat and blood-vessels of the uterus. Between these layers there is placed a very thick mass of soft cellular membrane, through which innumerable branches of nerves pass between these layers, the hypogastric ganglion, and the plexus of nerves with the injected artery extending between the hypogastric and spermatic ganglia. Many of the superficial nerves pass down under the peritoneum, and terminate in the upper border of the left hypogastric ganglion, and upon these superficial nerves there is formed another ganglion of considerable size, between which and the hypogastric nerve numerous branches of soft nerves extend. This ganglion formed on the nerves under the peritoneum near the edge of the uterus, is thick and solid, and consists of a yellowish brown substance, with white nervous filaments interlaced, and arteries of considerable size passing through it. From its lower border large nerves extend to the upper edge of the hypogastric ganglion, and innumerable soft nerves enter the whole inner surface of the hypogastric ganglion, which take their origin from the lower part of the great subperitoneal ganglion. The upper part of this ganglion becomes firmly adherent both to the peritoneum and muscular coat of the uterus, which it covers as high as the fundus. Large broad nervous plexuses, superficial and deep, extend from the upper portion of the subperitoneal ganglion across the body of the uterus to the spermatic ganglion, and blood-vessels, and the round ligament, around which they form a sheath of nerves.

In an elaborate drawing by Mr. JOSEPH PERRY, all the ganglia and plexuses on the left side of the uterus now described, have been represented with the greatest fidelity.

As the arteries and veins on the right side of the uterus are only partially injected, the nerves extending between the hypogastric and spermatic ganglia have not been so minutely traced. But that there is a similar nervous chain connecting these great ganglia of the fundus and cervix and the subperitoneal ganglia and plexuses, does not admit of doubt, and has been clearly demonstrated by other dissections at an earlier period of pregnancy.

Over the middle of the anterior and lower part of the body of the uterus, there is situated a nervous and vascular mass, of great extent, and similar in structure to the subperitoneal ganglia described on the posterior surface. It adheres to the peritoneum firmly, but on being divided longitudinally, it is also observed to be separated from the muscular coat of the uterus by a soft stratum of cellular membrane. From the lower part of this *anterior subperitoneal ganglion* nerves are sent down to the cervix uteri and vagina, and numerous branches pass off on both sides to the hypogastric ganglia. Superficial and deep plexuses of nerves are likewise sent off from its superior lateral borders, which proceed across the uterus, sending branches into

the muscular coat, and uniting with all the ganglionic plexuses on the posterior surface. The appearances presented by the anterior subperitoneal ganglia and plexuses in the fourth month of pregnancy, have been displayed in the second engraving which illustrated the paper on the nervous ganglia of the uterus. At that period the ganglion seemed nothing but a thin nervous and vascular membrane, imbedded in soft cellular substance, through which the delicate nervous filaments accompanied with arteries proceeded to the superior angles of the uterus. On comparing this dissection with that now described, it is impossible to avoid being struck with the enormous development of these nervous structures during the four latter months of pregnancy, or to resist the conclusion that these are formed for the purpose of supplying the uterus with that nervous power which it requires during labour.

These dissections prove that the human uterus possesses a great system of nerves, which enlarges with the coats, blood-vessels and absorbents during pregnancy, and which returns after parturition to its original condition before conception takes place. 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 these nerves of the uterus could not be demonstrated, its physiology and pathology would be completely inexplicable.

EXPLANATION OF THE PLATE.

PLATE XIV.

Exhibits the ganglia and nerves on the posterior and left side of the gravid uterus at the end of the ninth month of pregnancy.

- A. The fundus and body of the uterus, having the peritoneum dissected off from the left side.
- B. The vagina covered with nerves proceeding from the inferior border of the left hypogastric ganglion.
- C. The rectum.
- D. The left ovarium and Fallopian tube.
- E. The trunk of the left spermatic vein and artery surrounded by the left spermatic ganglion.
- F. The aorta divided a little above the origin of the right spermatic artery, and about three inches above its division into the two common iliac arteries.
- G. The vena cava.
- H. Trunk of the right spermatic vein entering the vena cava.
- I. Right ureter.
- K. The two cords of the great sympathetic nerve passing down along the front of the aorta.

- L. Trunk of the inferior mesenteric artery passing off from the aorta, and covered with a great plexus of nerves sent off from the left and right cords of the great sympathetic.
- M. M. The two cords of the great sympathetic passing down below the bifurcation of the aorta to the point where they separate into the right and left hypogastric nerves.
- N. The right hypogastric nerve with its artery injected proceeding to the neck of the uterus, to terminate in the right hypogastric ganglion.
- O. The left hypogastric nerve where it is entering the left hypogastric ganglion and giving off branches to the left subperitoneal ganglion.
- P. Hemorrhoidal nerves accompanying the hemorrhoidal artery and proceeding from the great plexus which surrounded the inferior mesenteric artery.
- Q. The sacral nerves entering the whole outer surface of the hypogastric ganglion.
- R. The left hypogastric ganglion with its arteries injected.
- S. The nerves of the vagina.
- T. Nerves with an injected artery proceeding from the upper part of the left hypogastric ganglion along the body of the uterus, and terminating in the left spermatic ganglion.
- U. Continuation of these nerves and the branches which they give off to the subperitoneal plexuses.
- V. The same nerves passing upward beneath the subperitoneal plexuses, and anastomosing freely with them.
- W. The left spermatic ganglion, in which the nerves and artery from the hypogastric ganglion, and the branches of the left subperitoneal plexuses terminate, and from which the nerves of the fundus uteri are supplied.
- X. The left subperitoneal plexuses covering the body of the uterus.
- Y. The left subperitoneal ganglion with numerous branches of nerves extending between it and the left hypogastric nerve and ganglion.
- Z. The left common iliac artery cut across and turned aside, that the left hypogastric nerve and ganglion might be traced and exposed.

