Plates of the thoracic and abdominal nerves, reduced from the original ... accompanied by coloured explanations, and a description of the par vagum, great sympathetic and phrenic nerves.

JOHN GOTTLIEB WALTER'S

PLATES

OF THE

THORACIC AND ABDOMINAL

NERVES.

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THE THORACIC AND ABDOMINAL

NERVES,

REDUCED FROM THE ORIGINAL,

AS PUBLISHED BY ORDER OF THE ROYAL ACADEMY OF SCIENCES AT BERLIN;

ACCOMPANIED BY

COLOURED EXPLANATIONS,

AND A

Description

OF THE

PAR VAGUM,

GREAT SYMPATHETIC AND PHRENIC NERVES.

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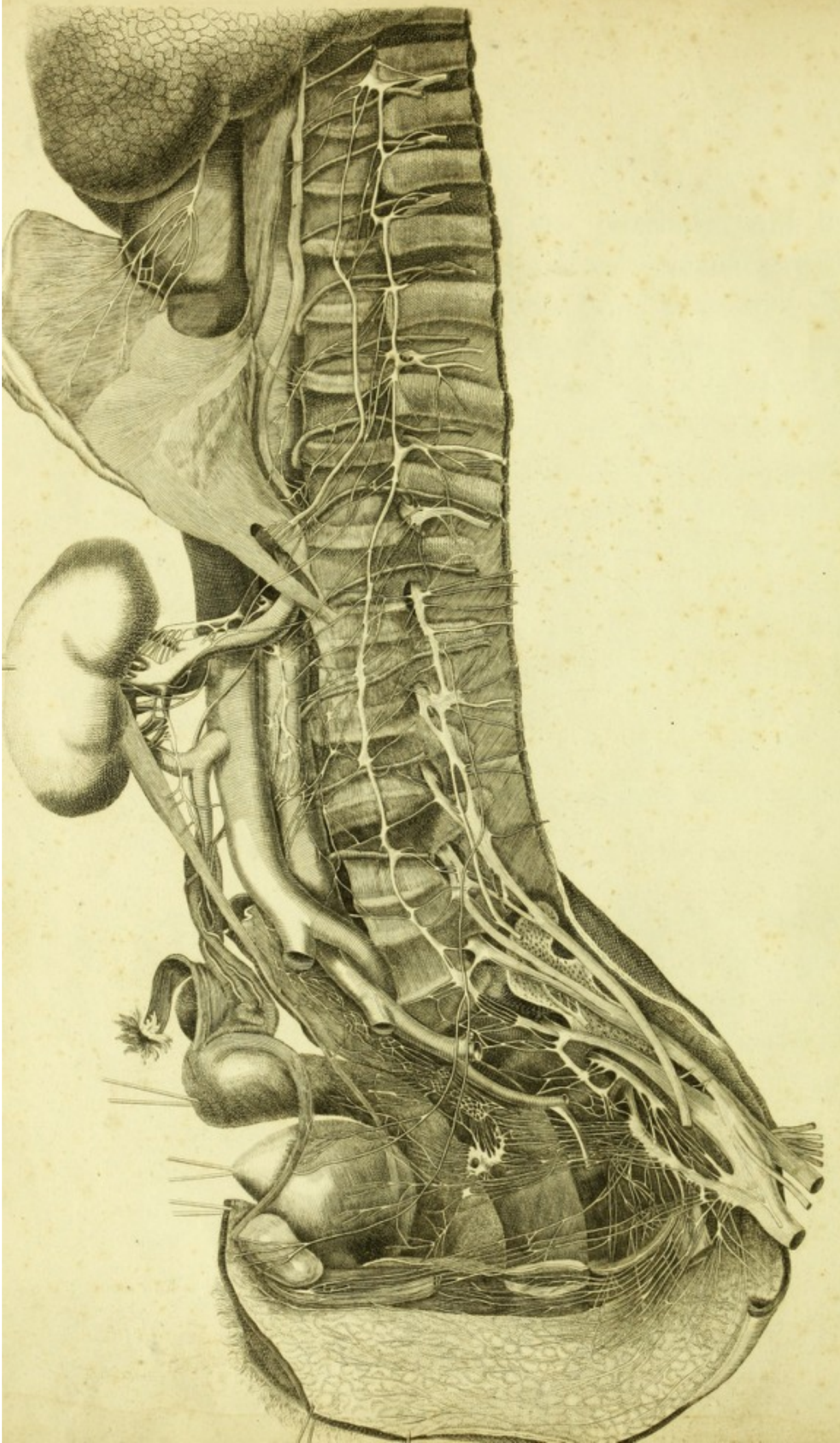
PREFACE.

AMONG the numerous cultivators of human anatomy in the present day, is to be reckoned the justly celebrated JOHN GOTTLIEB WALTER, whose indefatigable zeal, industry, and application, enabled him to unravel the intricate distribution of the thoracic and abdominal nerves; to expose their ganglia, and to trace their ramifications and junctions, with unprecedented exactness.

The interesting labours of this learned anatomist were published some time since by order of the Royal Academy of Sciences of Berlin, with every decoration and advantage which the art of engraving could supply, and it is but truth to confess that the execution is admirable. A work of such superior excellence cannot be too much admired or too generally known:

but the expense attending the purchase, and the difficulty of obtaining a copy, have operated greatly to the detriment of this division of anatomy. To obviate these two inconveniences, the propriety and utility of publishing these Plates, in a diminished form, was suggested, and has been undertaken with every possible care to preserve the grand characters which are so accurately and expressly delineated in the Plates of Walter. With this view also the reference Plates have been coloured, to confine the attention more immediately to the respective divisions, courses, and parts through which the larger nerves pass, so that it is presumed that altogether these Plates, although diminished, will not be found inferior to the original either in elegance of engraving or accuracy of delineation.

This great neurologist not having favoured the public with a description of the par vagum, great sympathetic nerve, nor the phrenic nerve, a short explanatory account of them is added, to render the work more complete.



G. Kurtland fecit et sculp

PLATE I.

THIS Plate exhibits a view of:—

1. The phrenic nerve ramifying on the diaphragm.
2. The distribution of the great sympathetic nerve: it is seen running by the sides of the vertebræ, forming ganglia between the ribs by uniting with branches from the spinal marrow; sending twigs to the spermatic ganglia, the anterior crural nerve, the great ischiatic and obturatory nerves, and to the hypogastric plexuses.
3. The origin of the splanchnic nerve, which with the par vagum forms the cœliac plexuses and ganglia in the abdomen.
4. The origin and distribution of the external spermatic nerve.
5. The origin of the great ischiatic nerve and obturatory nerve.

EXPLANATION

OF

PLATE I.

1. THE PHRENIC NERVE.
2. The branch of the phrenic nerve, which perforates the diaphragm, and anastomoses with the cœliac ganglia.
3. The sixth intercostal nerve.
4. The seventh intercostal nerve.
5. The eighth intercostal nerve.
6. The ninth intercostal nerve.
7. The tenth intercostal nerve.
8. The eleventh intercostal nerve.
9. The twelfth intercostal nerve.

Given off from the spinal marrow between the ribs.

10. Branches from the first lumbar pair of nerves, going to supply the abdominal muscles and glands of the groin.
11. The EXTERNAL SPERMATIC NERVE arising from the first lumbar pair; it is seen bifurcating as it approaches the pubes, where the external branch terminates, while the internal branch goes to the round ligament of the uterus.

12. Nerves from the second lumbar pair and its ganglion, which supply the psoas muscle, the quadratus lumborum, and som other of the abdominal muscles.
13. The Third lumbar nerve.
14. The fourth lumbar nerve.
15. The fifth lumbar nerve.
16. The OBTURATORY NERVE: the origin of this nerve from the second, third, and fourth lumbar, is distinctly seen.
17. The ANTERIOR CRURAL NERVE, formed by the union of the second, third, and fourth lumbar nerves.
18. The anterior branch of the first sacral nerve.
19. The trunk of the GREAT ISCHIATIC NERVE, formed by the union of the fourth and fifth lumbar nerves, with the first, second, and third anterior sacral.
20. The lesser branch of the great ischiatic nerve.
21. The greater branch of the great ischiatic nerve.
22. The third anterior sacral nerve: it sends off ten branches, which proceed upwards to form that beautiful net-work of nerves called the HYPOGASTRIC PLEXUS. This plexus is seen forming a large ganglion A, from which many branches are sent off to the vagina and urinary bladder, and to join the other branches; thereby forming three considerable plexuses C, D, B. The cœliac ganglia send branches from above to unite with these plexuses.

23. The second anterior sacral nerves.

24. The GREAT SYMPATHETIC NERVE. This nerve is here seen proceeding down the thorax into the abdomen, by the sides of the dorsal and lumbar vertebræ, forming ganglia as it extends by uniting with branches from the intercostal, lumbar, and sacral nerves. It sends off in the thorax several branches, which give origin to the splanchnic nerve; it also sends off in the thorax the little splanchnic nerve, and a branch to the renal plexus. In the abdomen it anastomoses with the visceral nerves, receives branches from the lumbar and sacral, and sends twigs to join the anterior crural nerve, the great ischiatic and obturatory; thereby forming a communication with the nerves of the lower extremities.

25. The SPLANCHNIC NERVE. This important nerve is formed in the thorax by the union of three branches sent off from the ganglia of the great sympathetic nerve. Having arrived near the crura of the diaphragm, it divides into four branches which pass between the crura of the diaphragm into the abdomen, where, with branches of the par vagum and phrenic nerve, it forms the cœliac ganglia.

26. The ACCESSORY or LITTLE SPLANCHNIC NERVE, which passes out of the thorax between the crura of the diaphragm, then gives a branch to the great splanchnic nerve and to the renal plexus.

27. The SUPERIOR and POSTERIOR RENAL NERVE arising from the great sympathetic nerve between the ninth and eleventh ribs.
28. The FIRST RENAL GANGLION.
29. The SECOND RENAL GANGLION, which goes to the renal artery, and sends off the superior spermatic nerve
30. The FOURTH RENAL GANGLION.
31. The SUPERIOR SPERMATIC NERVE passing over the emulgent artery and supplying the ureter; it then sends a branch before the vena cava inferior to join the inferior spermatic nerve, after which junction they supply the uterus.
32. The FIRST SPERMATIC GANGLION.
33. The SECOND SPERMATIC GANGLION. The anastomoses of these ganglia with the great sympathetic nerve, lumbar ganglia, and inferior mesenteric plexus, are very considerable.
34. The INFERIOR MESENTERIC PLEXUS.
35. Nerves given off from the great sympathetic to unite with the hypogastric plexuses B, C, D.

A. The HYPOGASTRIC GANGION, seen supplying the lower part of the vagina, rectum, and urinary bladder.

B, C, D. The HYPOGASTRIC PLEXUSES, which send nerves to the intestines, uterus, urinary bladder, &c. &c.


LUNGS
Pericardium
Mediastinum
Aorta
Diaphragm
Ribs
Kidney
Cava
Aorta
Ureter
Uterus
Urinary Bladder
Rectum
Vagina
Pudendum
Adipose membrane
A
B
C
D

G. Kirtland fecit et sculp

PLATE II.

THIS Plate exhibits a view of the following nerves of the right side:—

1. The phrenic nerve assisting in the formation of the cœliac ganglia.
2. The cœlic ganglia, and nerves communicating with and given off from them.
3. The superior mesenteric plexus of nerves.
4. The renal ganglia.
5. The spermatic ganglia.
6. The inferior mesenteric plexus of nerves.

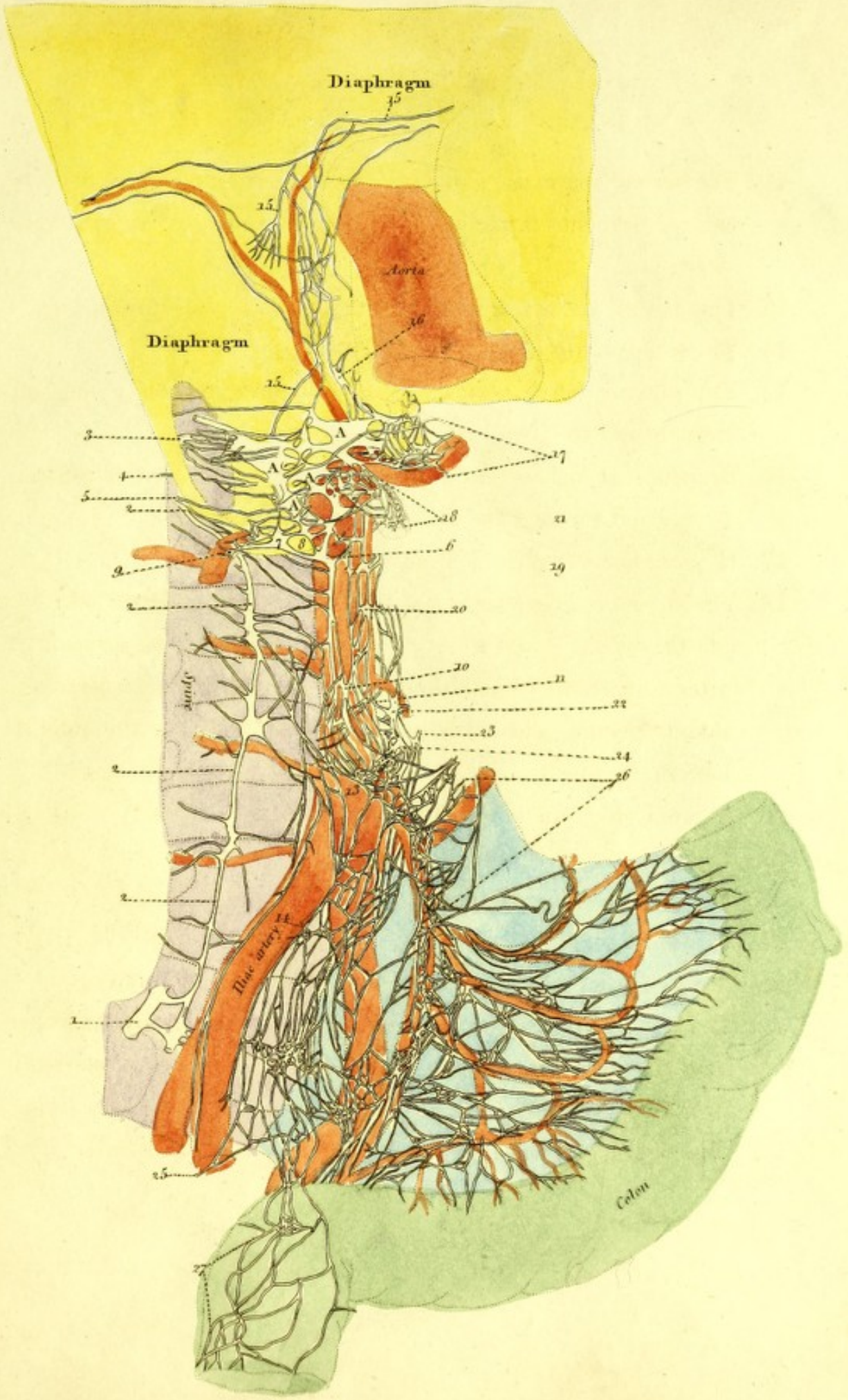
EXPLANATION

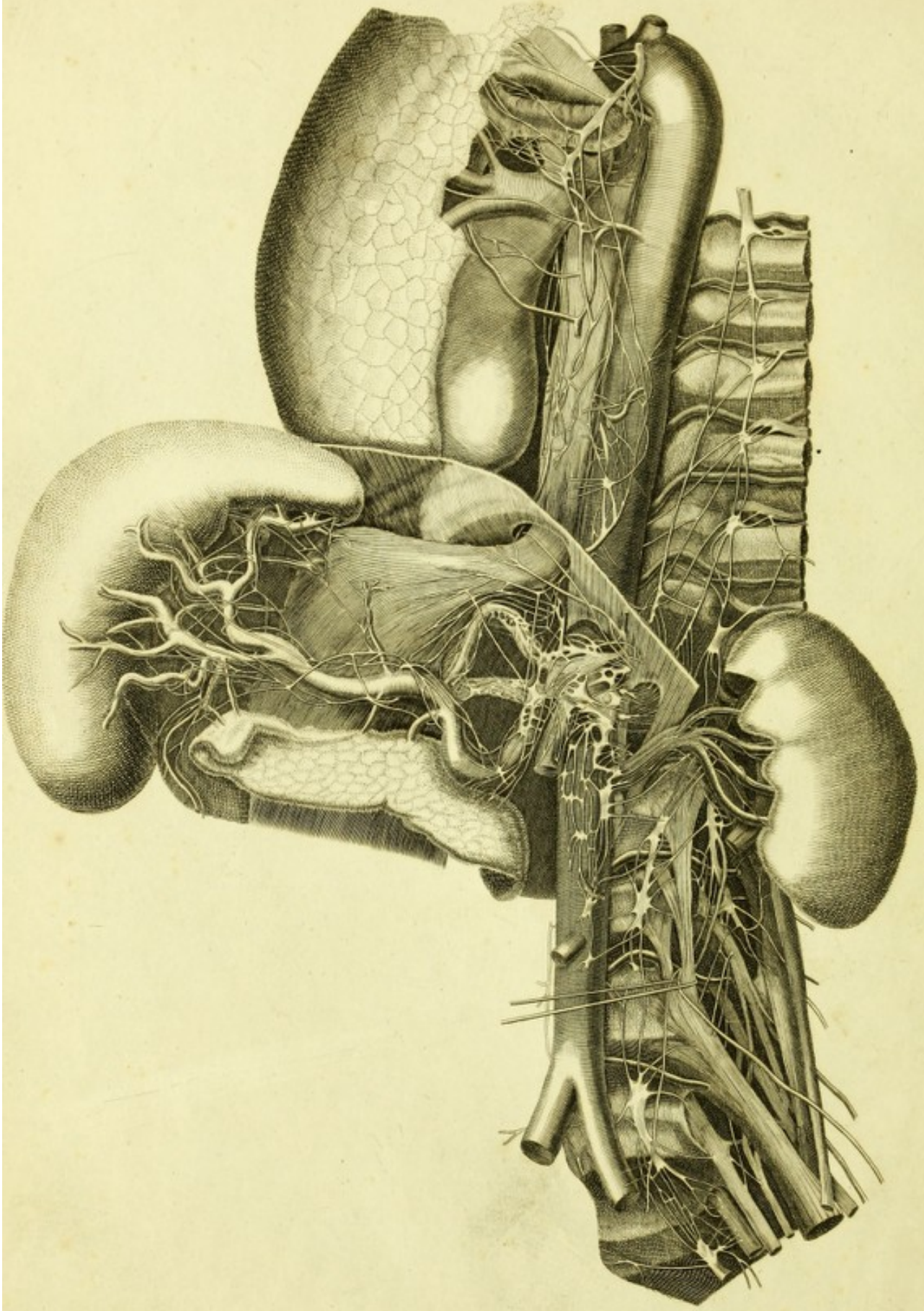
OF

PLATE II.

1. THE anterior lumbar nerve.
2. The GREAT SYMPATHETIC NERVE running down the sides of the vertebræ, and sending branches to the abdominal ganglia A.
3. The SPLANCHNIC NERVE, perforating the diaphragm, and giving off branches to the cœliac ganglia A.
4. The LITTLE SPLANCHNIC NERVE terminating in the cœliac ganglia A.
5. The superior and posterior renal nerve.
6. The first renal ganglion.
7. The second renal ganglion.
8. The third renal ganglion.
9. The fourth renal ganglion: these ganglia anastomosé with each other.
10. The first spermatic ganglion.

11. The second spermatic ganglion: these spermatic ganglia receive several branches from the renal ganglia and great sympathetic nerve.
13. The INFERIOR MESENTERIC PLEXUS surrounds this number.
14. The hypogastric nerve.
15. The phrenic nerve perforating the diaphragm, and giving off branches to the liver, cava hepatica, &c.
16. Branches of nerves from the liver uniting with the phrenic nerve, and forming the phrenico-hepatic ganglia.
17. Hepatic nerves given off from the cœliac ganglia.
18. The SUPERIOR MESENTERIC PLEXUS formed by branches from all the cœlic ganglia: it lies upon the superior mesenteric artery, anastomoses with the renal ganglia, supplies the jejunum, ileum, cæcum, and colon, and sends branches to the inferior mesenteric plexus.
20. A renal ganglion of the left side.
22. The first spermatic ganglion.
23. The second spermatic ganglion.
24. The third spermatic ganglion.
25. A nerve going from the hypogastric plexus to the ureter.
26. The INFERIOR MESENTERIC PLEXUS formed by branches from the spermatic ganglia: it sends off an immense net-work of filaments to the colon.
27. The beginning of the hypogastric plexus. See PLATE I.


Diaphragm
15
15
Aorta
16
Diaphragm
15
3
17
4
5
2
18
21
8
6
9
29
2
20
Kidney
20
21
22
23
24
2
26
25
2
Iliac artery 14
1
25
Colon



G. Kirtland fecit et sculp.

PLATE III.

IN this Plate are represented:

1. The distribution of the par vagum in the posterior mediastinum of the left side, and its junction with the splanchnic nerves to form the cœliac ganglia.
2. The great sympathetic nerve between the sixth rib and sacrum, and its connexion with the cœliac and renal ganglia, independent of the splanchnic nerves which are seen forming them.
3. The renal ganglia.
4. The spermatic ganglia.
5. The hepatic and gastric plexuses.
6. The renal and splenic nerves and plexuses.

EXPLANATAION

OF

PLATE III.

1. THE GREAT SYMPATHETIC NERVE proceeding by the sides of the vertebræ, and giving off the splanchnic nerves, and branches to the cœliac, renal, and spermatic plexuses.
2. The first lumbar nerve.
3. The first lumbar ganglion of the great sympathetic.
4. The second lumbar ganglion.
5. The third lumbar ganglion.
6. The fourth lumbar ganglion
7. The second lumbar nerve.
8. The third lumbar nerve.
9. The EXTERNAL SPERMATIC NRRVE arising from the lumbar: it goes to the round ligaments of the uterus, and through the abdominal ring to the mons veneris.

10. A nerve from the first lumbar, which is lost in the skin of the femur over the tensor vaginæ femoris.
11. The EXTERNAL CUTANEAL NERVE emerging from the second lumbar: it is distributed to the skin about the knee.
12. The OBTURATORY NERVE arising from the second, third, and fourth lumbar.
13. The ANTERIOR CRURAL NERVE, arising also from the second, third, and fourth lumbar.
14. The fourth lumbar nerve.
15. The HEPATIC GANGLION, given off from the phrenic nerve and cœliac ganglia.
16. The supra-renal nerve, which arises from the phrenico-hepatic branches.
17. The gastrico-hepatic nerve given off from the cœliac ganglia; it sends a branch to the diaphragm, and then is distributed on the cardia and liver.

A. The GASTRIC PLEXUS formed by branches from the cœliac ganglia and par vagum.

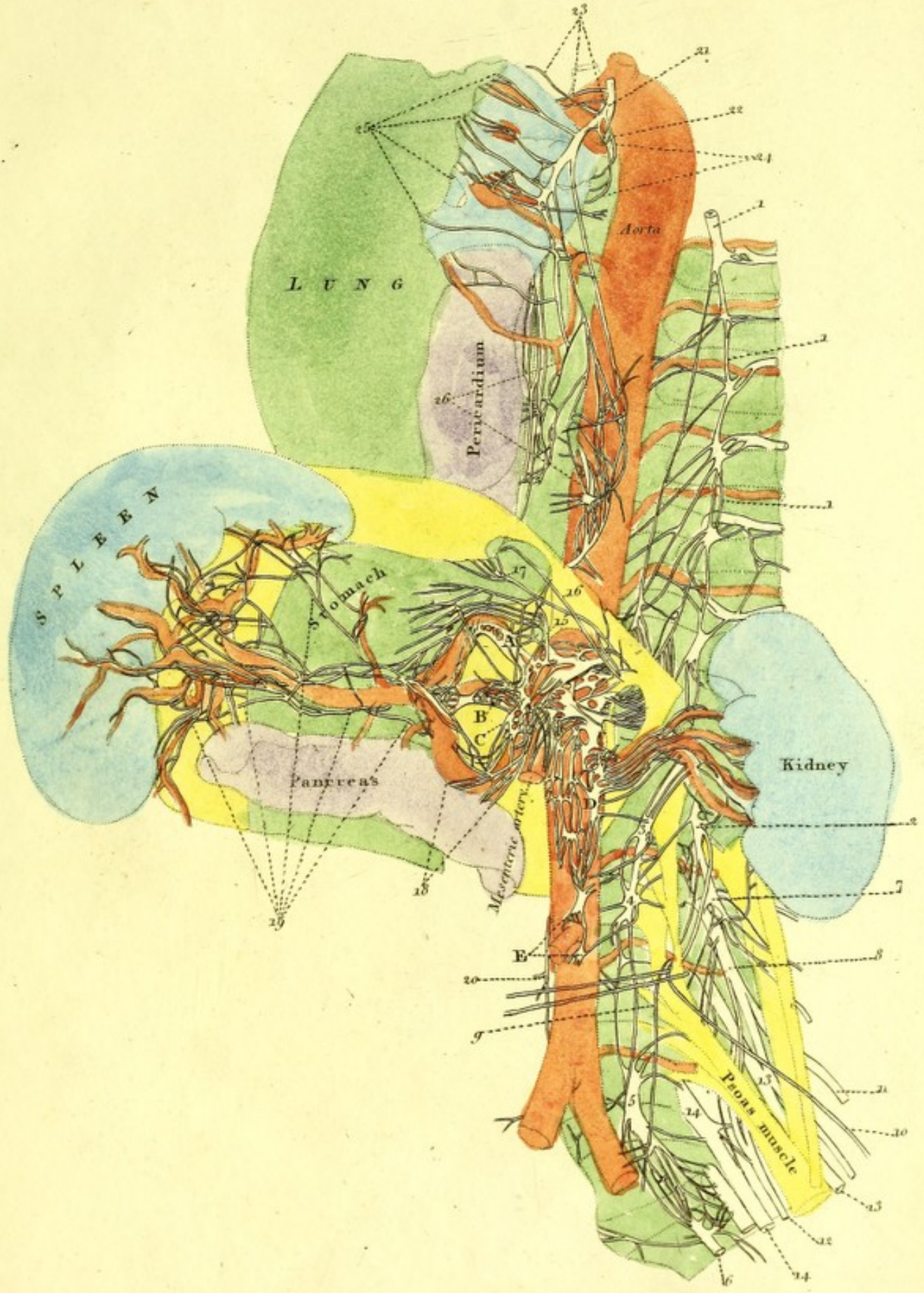
B. The HEPATIC PLEXUS formed by branches from the cœliac ganglia.

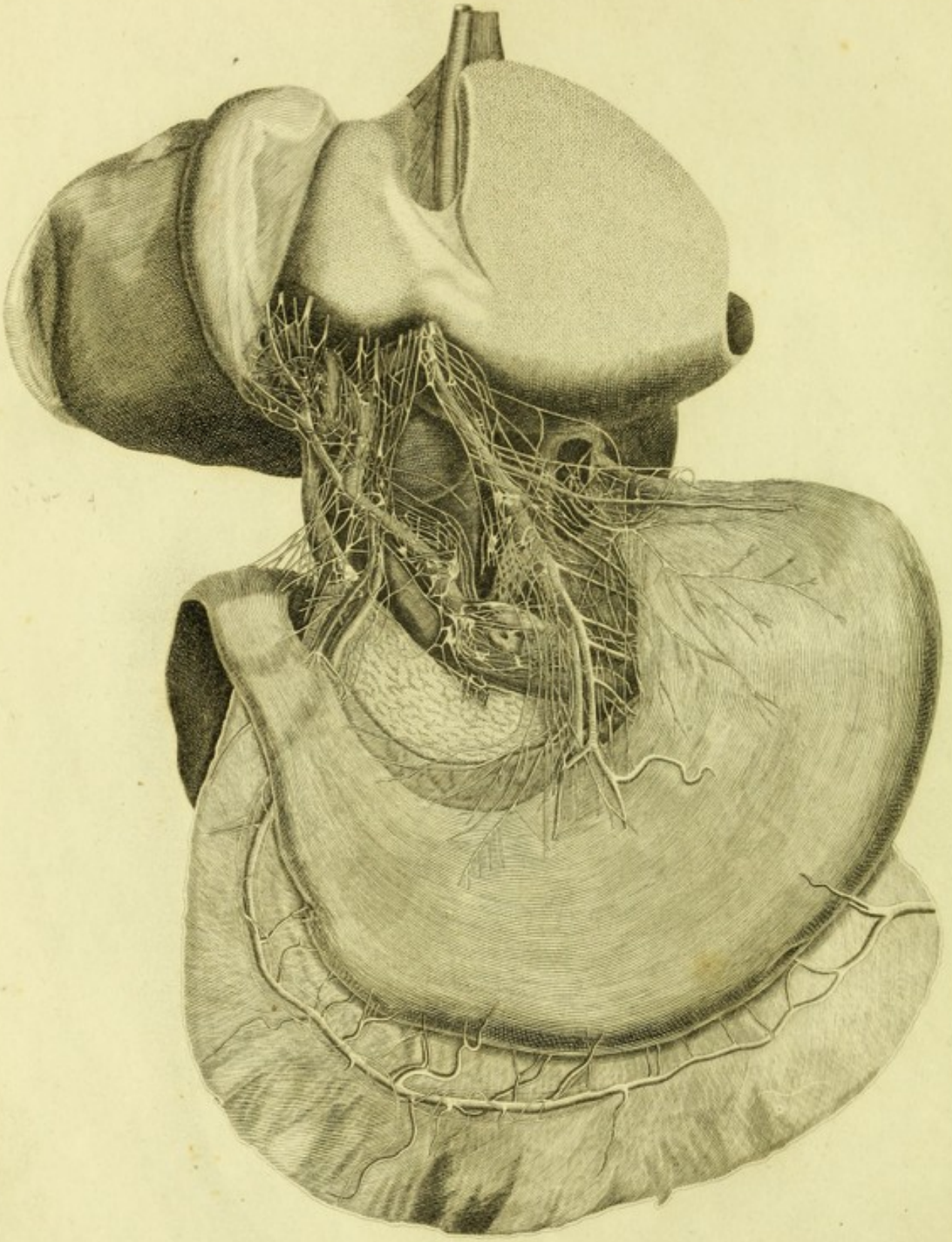
C. The SPLENIC PLEXUS, which supplies the spleen.

D. The RENAL GANGLIA, which are seven in number, and send off the nerves to the kidneys.

E. Two SPERMATIC GANGLIA, which send branches to the inferior mesenteric and hypogastric plexus.

18. Pancreatic nerves arising from the cœliac plexus.
19. The nerves of the spleen accompanying its arteries, and arising from the splenic plexus.
20. The hypogastric nerve receiving branches under the aorta from the second and third lumbar ganglia: it passes down into the pelvis to concur in forming the hypogastric plexus.
21. The trunk of the PAR VAGUM of the left side; it gives off the CARDIAC and PULMONIC PLEXUSES and the recurrent nerve, then forms the ŒSOPHAGEAL PLEXUS, passes into the abdomen, and terminates in the stomachic and hepatic nerves, which send branches to concur in forming the cœliac ganglia.
22. The RECURRENT NERVE of the par vagum.
23. Nerves going to the heart from the par vagum.
24. Œsophageal branches from the par vagum.
25. Nerves going to supply the lungs: they are given off from the par vagum, and form the pulmonic plexus, from which arise several branches.
26. The ŒSOPHAGEAL PLEXUS lying on the œsophagus and aorta: it is formed by the par vagum of each side, and sends off a trunk just above the diaphragm, which goes into the abdomen to supply the heart, liver, and cœliac plexus.


LUNG
Aorta
Pericardium
SPLEEN
Stomach
Pancreas
Kidney
Mesenteric artery
Psoas muscle
A
B
C
D
E



G Kurtland fecit et sculp.

PLATE IV.

THIS Plate exhibits a view of the nerves of the liver and stomach given off from the cœliac ganglia, which could not be seen in the former views.

EXPLANATION

OF

PLATE IV.

A. THIS letter is surrounded by several HEPATIC GANGLIA, uncertain both as to number and formation.

B. The GASTRIC, or cardiac plexus.

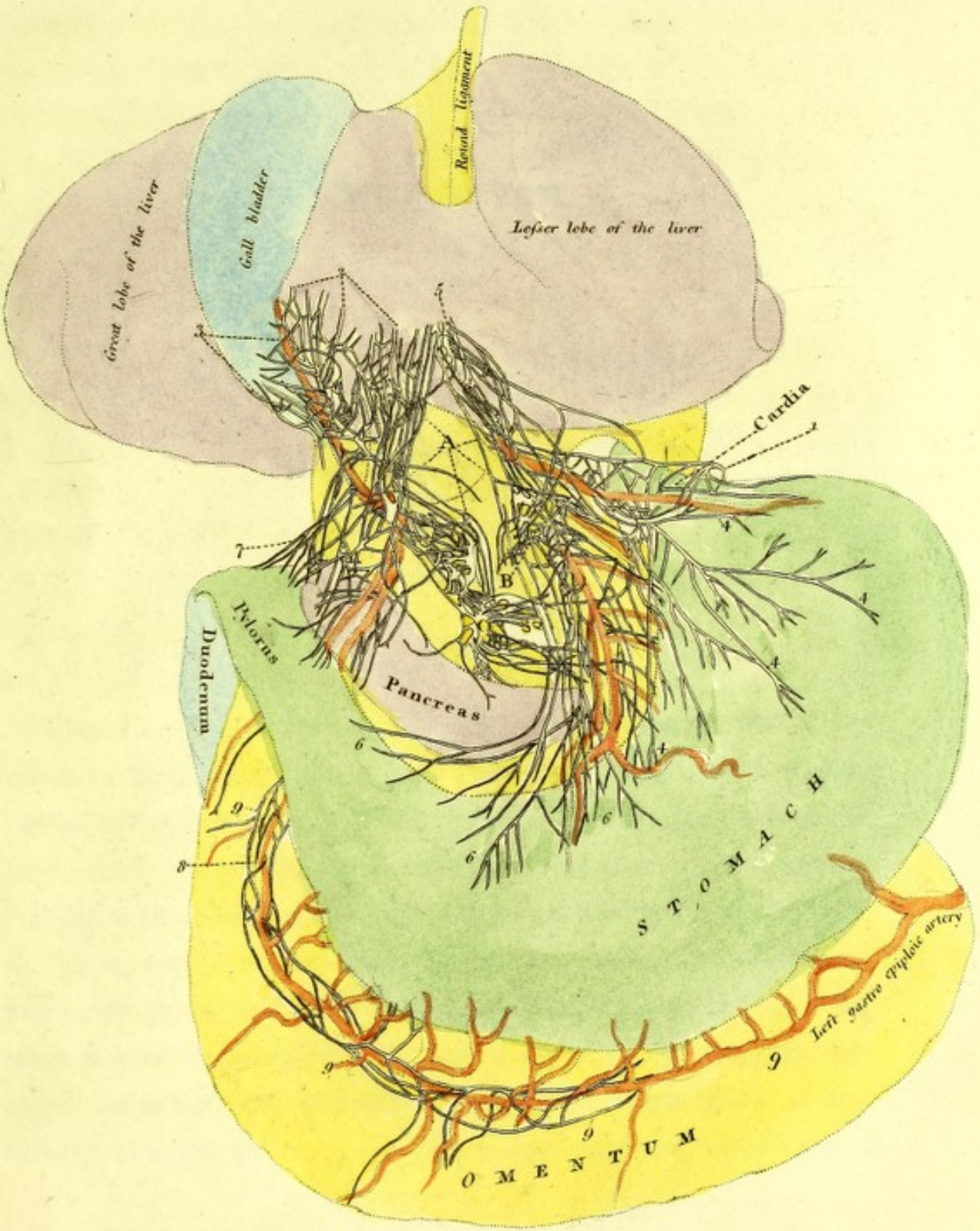
C. The SPLENIC PLEXUS, which sends branches to the spleen.

1. The HEPATICO-GASTRIC nerve: it arises from the splanchnic, forms one of the cœliac ganglia, and then distributes branches to the liver and stomach.

2. Nerves accompanying the arteria hepatica and vena cava to supply the liver.

3. Nerves supplying the gall-bladder,

4. Branches given off from the par vagum of the left side to supply the superior part of the stomach.
5. Branches given off from the par vagum and hepatic ganglia to supply the liver.
6. Nerves penetrating the stomach, and arising principally from the gastric plexus.
7. Branches from the hepatic plexus going to the duodenum.
8. The right gastro-epiploic artery anastomosing with the left.
9. Gastro-epiploic nerves from the hepatic ganglia.


Round ligament
Great lobe of the liver
Gall bladder
Lesser lobe of the liver
Cardia
Pylorus
Duodenum
Pancreas
STOMACH
OMENTUM
Left gastric epiploic artery

Description

OF THE

THORACIC AND ABDOMINAL

NERVES.

OF THE PAR VAGUM.

THE PAR VAGUM, or eighth pair of nerves, arises within the cranium from the medulla oblongata and fourth ventricle, and passes out with the jugular vein through the foramen lacerum in basi cranii. In its exit, it is separated from the internal jugular vein by a thin bony plate; and sometimes two or three fibres of the nerve pass the bone distinct from the others, and afterwards unite into the proper trunk. Deep under the lower jaw and the mastoid process, the glosso-pharyngeal nerve, the par vagum, the spinal accessory, the sympathetic nerve, the portio dura of the seventh, and the upper cervical nerves, are entangled together in a

way that may account for every degree of sympathy between the parts supplied by these nerves. The par vagum, lying behind the internal carotid artery, and as it were escaping from the confusion of the ninth, accessory, and glosso-pharyngeal nerves, descends, and swells into a small ganglion. It then sends off three branches, the first and second pharyngeal nerves, and the internal laryngeal nerve; continues its uninterrupted course betwixt the carotid artery and jugular vein, and is involved in the same sheath with these vessels. In this course down the neck it sometimes sends back a twig which unites with the ninth pair; and, when near the lower part of the neck, it sends forward twigs to unite with those from the sympathetic nerve, which pass down to the great vessels of the heart, to form the SUPERIOR CARDIAC PLEXUS.

The par vagum now penetrates into the thorax by passing before the subclavian artery; it then splits into two. The main nerve passes on by the side of the trachea, and behind the root of the lungs; while the branch on the right side turns round under the subclavian artery on the left, under the arch of the aorta, and ascends behind the trachea to the larynx. This ascending branch of the par vagum is the RECURRENT NERVE.

The par vagum next descends by the side of the trachea. Before it passes behind the vessels and branch of the trachea going to the lungs, it sends minute branches, which form the ANTERIOR PULMONIC PLEXUS. This plexus is entangled in the connexions of

the pericardium, and is dissected with difficulty. The branches of this plexus throw themselves round the pulmonic arteries and veins, and follow them into the lungs. The par vagum, passing on behind the root of the lungs, forms the POSTERIOR PULMONIC PLEXUS. From this also the nerves proceed into the lungs, by attaching themselves to the pulmonic arteries and veins, and bronchial arteries, and the branches of the trachea.

The trunks of the nerve, continuing their course upon each side of the œsophagus, unite and split into branches, and again unite so as to form a net-work upon the œsophagus: these are the ANTERIOR AND POSTERIOR ŒSOPHAGEAL PLEXUSES. The par vagum, thus attached to the œsophagus, pierces the diaphragm with it; the anterior plexus unites again into a considerable trunk, and is attached to the lesser arch of the stomach. It stretches even to the pylorus, and sends its branches to the upper side of the stomach and to the lesser omentum; at the same time it unites with the left hepatic plexus: some of its branches terminate in the cœliac plexus. The posterior œsophageal plexus, likewise uniting again into a considerable cord when it has come into the abdomen, sends branches to encircle the upper orifice of the stomach; it branches also to the inferior side and great arch of the stomach; and it sends branches likewise to the splenic plexus and cœlic ganglia.

Thus we see that the par vagum has a most appropriate name, and that it is nearly as extensive in its connexions as the great sym-

pathetic nerve itself:—It is distributed to the œsophagus, pharynx, and larynx; to the thyroid gland, vessels of the neck and heart; to the lungs, liver, and spleen, stomach, duodenum, and sometimes to the diaphragm. The recollection of this distribution will explain to us many sympathies; for example, the hysterical affection of the throat, when the stomach is distended with flatus, the exciting of vomiting by tickling the throat, the effect which vomiting has in diminishing the sense of suffocation, that state of the stomach which is found upon dissection to accompany hydrophobia, whether spontaneous, or from the bite of a dog.

OF THE GREAT SYMPATHETIC NERVE, OR GREAT INTERCOSTAL.

The sympathetic nerve is in general considered as originally derived from the sixth pair; or we may say, it takes its origin from the sixth, where it passes by the side of the carotid artery, and from the vidian branch of the fifth pair. It appears without the scull sometimes behind and sometimes before the carotid artery, and sometimes it is double in its exit from the base of the scull. Almost immediately after it has escaped from the scull, it forms its first ganglion, by which we distinguish this nerve from the par vagum; it is very large and remarkable, and has the name of the SUPERIOR CERVICAL GANGLION of the sympathetic nerve. It gradually tapers downwards until it terminates in the slender nerve, which in the neck is extremely small. This ganglion has much

variety of shape in different subjects, and may be said in general to receive twigs of nerves upon the back part, and give them out upon the fore part. The superior cervical ganglion of the sympathetic nerve receives nerves from the second, third, and fourth cervical nerves, and even sometimes from the root of the phrenic nerve. It has also connexions with the hypo-glossal, par vagum, and glosso-pharyngeal nerves. It sends out branches to unite with the glosso-pharyngeal, and which follow that nerve in its distribution, to the tongue and pharynx. Many of its branches surrounding the carotid artery form connexions with the internal and external laryngeal nerves, and proceed in meshes, or form plexuses along the branches of the artery.

The continued trunk of the sympathetic, where it emerges from the superior cervical ganglion, is extremely small. It descends behind the carotid artery, and lies near the spine. When opposite to the fifth and sixth cervical vertebræ, the inferior cervical ganglion of the sympathetic is formed. In this course, twigs of communication pass betwixt it and the cervical nerves, or join it with the beginning of the phrenic nerve. But not unfrequently there are three cervical ganglia formed by the sympathetic nerve—a superior, a middle, and an inferior one: or it happens that we find the sympathetic nerve split into two branches in the neck; one of which forms the middle, and the other the lower ganglion. There are received by the MIDDLE CERVICAL GANGLION, or thy-

roid ganglion, branches of nerves from the third, fourth, fifth, and sixth cervical nerves, and also sometimes from the phrenic nerve. The ganglion is by no means constantly found, and it is irregular in its size and shape. When large, and in what may be considered as its more perfect state, it gives off some considerable branches. On the left side of the neck the sympathetic, receiving on the one side branches from the cervical nerves, and on the other giving off branches, which descend behind the carotid artery to the heart, often splits before it forms the middle or thyroid ganglion, and sometimes throws its branches over the thyroid artery, and the ganglion lies upon that artery. Again, from the ganglion there descend two series of numerous lesser filaments, which form meshes upon the thyroid and subclavian arteries to the heart. Others proceed downwards behind the arteries to the lower cervical ganglion. Those branches which descend upon the arteries, entangle the roots of the thyroid, transversalis cervicis, and internal mammary arteries in their plexus; these uniting follow the subclavian artery, and form again a plexus upon the arch of the aorta. This is joined by branches from the par vagum and recurrent. The principal branches of this plexus terminate in the cardiac ganglion under the arch of the aorta.

The LOWER CERVICAL GANGLION is placed upon the limits betwixt the neck and thorax upon the head of the first rib, and by the side of the musculus longus colli; and it is in part covered by

the root of the vertebral artery. The ganglion is of an irregular cushion-like shape. It lies close to the cervical nerves which go to the brachial plexus, and it receives branches from them. Branches likewise pass from this ganglion to the par vagum and recurrent, and pass on to the cardiac and pulmonic plexus. That nerve, which must be considered as the continued sympathetic, throws a ring round the root of the vertebral artery, and sending out branches upon the subclavian, terminates in the first dorsal or thoracic ganglion.

The SUPERIOR THORACIC GANGLION. This ganglion surpasses the other thoracic ganglia in size. It is frequently composed of many branches of the nerve in the neck, coming both before and behind the subclavian artery. It receives also nerves from the three or four lowest cervical nerves and first dorsal nerve. It varies exceedingly in shape, being sometimes round, oval, triangular, or quadrangular. Filaments proceed from this ganglion into the canal of the vertebral artery; to the cellular coat of the subclavian artery; to the cardiac plexus, and also to the pulmonic plexus; or to supply the posterior surface of the lungs.

SYMPATHETIC NERVE IN THE THORAX.

The sympathetic nerve, through all its course in the thorax, has additional branches from the dorsal or intercostal nerves. It forms also, while it is lying on the side of the vertebræ, a division in the thorax, which it will be important to recollect. One nerve is sent more forwards upon the body of the vertebræ, and passes into the abdomen betwixt the crura of the diaphragm; while the trunk of the sympathetic continues in its course by the heads of the ribs, passes under the ligamentum arcuatum, and downwards upon the lumbar vertebræ. This anterior branch of the sympathetic in the thorax is called the SPLANCHNIC NERVE. It is the great nerve of the viscera of the abdomen. It generally has two, three, or four roots from the trunk of the sympathetic nerve, where it is opposite to the sixth, seventh, and eighth intercostal nerves. It is seen lying under the pleura, and passing obliquely over the bodies of the lumbar vertebræ, from the seventh to the tenth; it then passes betwixt the crura of the diaphragm, enters the abdomen, and forms the cœliac ganglia. One or more branches are sent forward from the sympathetic, commonly from the ganglia, opposite to the interstice betwixt the ninth and tenth, or tenth and eleventh ribs. These also pass the diaphragm, and unite with the cœliac ganglia. There is, however, a considerable variety to be observed both in the origins of the splanchnic nerve, and in the number of these sub-

sidiary branches. A large branch going off betwixt the tenth and eleventh ribs is so common, that it has the name of the LESSER SPLANCHNIC NERVE. This nerve as frequently terminates in the renal plexus, as in the cœliac ganglia, or sometimes it sends branches to both.

CŒLIAC GANGLIA AND PLEXUS.

The cœliac ganglia and plexus have no regular shape. They are formed by the splanchnic nerve, and by branches which come from the lumbar nerves, which form a number of ganglia mostly eleven or twelve, and with the branches which proceed from one to another constitute a beautiful plexus around the cœliac artery.

It is this plexus of ganglia which sends off nerves to the higher viscera of the abdomen. The splanchnic nerves are the great, but not the only nerves which form this plexus. The par vagum sends branches down from the stomach, which join it; and even the phrenic nerve, which is the nerve of the diaphragm, sends down twigs to unite to the branches of the great sympathetic nerve, the splanchnic, and par vagum. There are also small nerves which come from near the kidney, and which are derived from the superior lumbar nerves. These pass across the crura of the diaphragm, and enter into the cœliac plexus. In pursuing the nerves of the viscera further, we have it no longer in our power to follow individual branches, but have rather to mark the course, and enumerate

the various sources of the plexus and net-work of nerves, which follow the great vessels. From the cœliac ganglia there pass out,

1. Nerves which accompany the phrenic arteries upon the lower surface of the diaphragm.

2. Nerves to the liver; and of these there are two plexuses, the RIGHT and LEFT HEPATIC PLEXUS; one passes along the vena portæ, biliary ducts, and right hepatic artery, to the right side of the liver, gall-bladder, and ducts; this of course is the right hepatic plexus: the left hepatic plexus passes along the left hepatic artery, and this has connexion with the cardiac nerves, branches of the par vagum.

3. That plexus, which runs upon the lesser curve of the stomach, while it is formed in a great measure by the par vagum, has also connexion with the cœliac plexus.

4. The plexus of nerves which pass to the lower orifice of the stomach and duodenum, is chiefly a division of the right hepatic plexus. These nerves, to the liver, stomach, and duodenum, are attached to the branches of the cœliac artery. Along the great splenic artery, which is also derived from the cœliac artery, there passes out a plexus of nerves to the spleen. From this SPLENIC PLEXUS there pass nerves to the great omentum; and they even unite with those passing out upon the duodenum, and which attach themselves to the right epiploic artery, and take a course upon the great curvature of the stomach. Thus the cœliac plexus is

a great central net-work of nerves, which pass out in divisions to the liver, spleen, pancreas, stomach, duodenum, and omentum.

SUPERIOR MESENTERIC PLEXUS. The place and connexions of the superior mesenteric plexus are at once known, when it is considered that it is formed upon the root of the superior mesenteric artery. It is formed by the cœliac ganglia being continued down upon the aorta, so as to involve the root of the mesenteric artery, and by nerves coming over the side of the vertebræ of the loins from the lumbar nerves. This plexus spreads betwixt the lamina of the mesentery, and extends upon the branches of the artery, and of course is distributed to the small intestines and part of the colon. It consequently supplies the mesenteric glands, and sends nerves also to the pancreas, that join those which it receives from the splenic plexus.

INFERIOR MESENTERIC PLEXUS. The same mesh of nerves, being continued down upon the surface of the aorta, surround the lower mesenteric artery, and follow its branches. This is the lower mesenteric plexus, or mesocolic plexus; and it is formed in a great measure from the branches of the continued trunk of the sympathetic nerve. As this plexus spreads upon the branches of the lower mesenteric artery, it passes to the left side of the colon and rectum, while the lower mesenteric plexus is continued from the upper one. On the side of the lumbar vertebræ it is continuous with the renal and spermatic plexus; and towards

the pelvis, with the hypogastric plexus. Before considering the other lesser plexus of nerves in the abdomen, it is necessary to follow the continued trunk of the sympathetic nerve, which follows closely the lateral part of the dorsal and lumbar vertebræ, whilst the splanchnic nerves pass obliquely over them to the viscera of the upper part of the belly. The continued trunk of the sympathetic nerve, after it has given off the splanchnic nerve in the thorax, sends several small nerves forward over the vertebræ to the mediastinum and sheath of the aorta. It then passses the diaphragm, keeping close to the transverse process of the vertebræ. When, however, it comes lower upon the lumbar vertebræ, it lies more upon the side of their bodies, and the connexions with the lumbar nerves are by small and numerous twigs which stretch over the side of the vertebræ. In this course it is giving off upon the fore part numerous irregular twigs to the several plexuses: where it lies under the vessels which pass to the kidney, it sends up some branches to the renal plexus. The RENAL PLEXUS, however, is not entirely formed of these branches of the continued sympathetic, but is rather a continuation from the cœliac and superior mesenteric plexus; while the lesser splanchnic nerve, which was sent off in the thorax, also terminates in it. This plexus is thrown over the vessels of the kidney, and forms several little ganglia.

From the renal plexus descends the SPERMATIC PLEXUS. This plexus of nerves in women follows the spermatic artery, in its

distribution to the ovaria and uterus. In passing down upon the loins, the sympathetic nerve forms five or six ganglia, with the branches from the lumbar nerves. These are oblong, angular, stellated, irregular in their form, as in their number, situation, size, or the twigs which, in their union with the sympathetic, form them. Betwixt these ganglia, or connexions with the lumbar nerves, the sympathetic is not always one nerve, but is sometimes split into several smaller nerves, which unite again. From the sympathetic nerves of either side we have to observe frequent interchange of branches, which sometimes attach themselves to the lumbar nerves, sometimes creep under the aorta, or unite to the plexus covering the face of the aorta. There are several little ganglia formed by these nerves upon the face of the lumbar vertebræ: they have the name of ganglia accessoria. Before the sympathetic nerve descends into the pelvis it has become extremely delicate: in many subjects it seems to terminate in the last lumbar, or first sacral nerve; but upon more minute dissection, lesser branches will be found to descend amongst the loose cellular substance of the pelvis. When carefully dissected, the sympathetic nerves of each side are seen to descend upon the fore part of the sacrum, and form connexions with the sacral nerves similar to those with the dorsal nerves. As they descend, they of course approach, and finally unite in an acute point on the os coccygis. At the points of union of these extreme branches of the sympathetic nerves with the branches of the sacral

nerves, small ganglia are formed; and there pass out branches from them, which cover the intermediate surface of the sacrum with an extensive plexus. The ultimate ganglion formed by the union of the two sympathetic nerves, is the coxygeal ganglion, and from it there pass three or four nerves to the extremity of the rectum.

Hypogastric plexus. This is a plexus which lies on the side of the pelvis, and involves the hypogastric artery. It consists of the nerves passing to the parts contained in the pelvis; which do not, however, pass in distinct branches, but, like those of the abdomen, are formed into a minute interwoven net-work. The hypogastric plexus takes no determinate origin, but is continuous with, or formed by the extreme branches of the sympathetic nerves, the extremity of the spermatic plexus, the sacral nerves, (and particularly the third sacral nerve,) and by the branches of the accessory ganglia on the sacrum.

PHRENIC NERVE.

The phrenic, or diaphragmatic nerve, arises from the cervical nerves, passes obliquely down the neck, enters the thorax, and is distributed to the diaphragm. This nerve has much variety in its derivation. It comes chiefly from the third cervical nerve, deriving also some twigs from the fourth and second. But sometimes it takes an origin very high in the neck, from the par vagum or ninth nerve; and even the superior cervical ganglion of the sympathetic

is described by some as furnishing a root. Lower in the neck it will be found in some subjects to derive very small additional twigs from the fifth or sixth cervical nerves, or lower ganglion of the sympathetic.

The phrenic nerve, thus formed, descends into the thorax betwixt the subclavian artery and vein. In the chest it proceeds downward and forward, attached to the mediastinum, and before the root of the lungs. It takes its course upon the outside of the pericardium, and from the pericardium slips off to the surface of the diaphragm. From the position of the heart, the left phrenic nerve differs a little in its course from the right; and it passes over the pericardium covering the apex of the heart. The phrenic nerve of the right side, besides supplying the diaphragm, sends down through the diaphragm (to the right side of the vena cava) the ramus anastomoticus, and occasionally gives off some branches which go to the liver between the duplicature of the peritoneum, and penetrate deep into its substance.* The anastomosing branch

* Professor Walter's observations on this connexion, as these:

" Per tot pericula, quæ in ipsis cadaveribus varii sexus et ætatis feci, scio nervum
" thoracicum phrenicum equidem frequenter in dextro corporis latere anastamosin
" habere cum gangliis cœliacis nervi sympathici magni; interim nec desunt ex-
" empla, licet sint rariora, ubi nullum fuit commercium inter nervum phrenicum
" et nervum sympathicum magnum. In sinistro latere res aliter se habet. Quam
" sæpissimè defuit conjunctio nervi phrenici thoracici cum nervo sympathico magno,
" et hic est quasi status naturalis. Neque rarum est nervum phrenicum thoracicum
" sese conjungere in cavo abdominis cum nervo octavi paris. Inter ingentum nume-
" rum observationum quas feci, ne molestus sim lectori, tres tantum adducam.

communicates with the cœliac ganglia, or with the division of the cœliac plexus which passes along the phrenic arteries. From the phrenic artery of the left side there pass down with the œsophagus small nerves, which appearing in the abdomen, unite with the cœliac

" PRIMA OBSERVATIO.

" *Desumta est ex Viro viginti et aliquot Annorum.*

" Decursus nervi phrenici in dextro latere adhuc in cavo abdominis inclusus divi-
" debatur in ramos internos atque externos thoracicos.

" Rami interni ambulabant ad superficiem convexam diaphragmatis supra et ad
" latus internum foraminis quadrilateri, per quod vena cava ex abdomine ad auricu-
" lam dextram ducitur.

" Ramulorum internorum nonnullos terminatos vidi in superficie convexa dia-
" phragmatis; sed satis insignis eorum ramus ad latus externum foraminis quadri-
" lateri venosi perforabat diaphragma, et sic evadit hic ramus, ramus phrenicus
" abdominalis, qui statim divisus fuit in surculos externos et internos. Rami externi
" ad partem lumbarem diaphragmatis migrantes unum ramulum longum mittebant
" ad venam cavam, qui dum se conjicit ad lobulum Spigelii hepatis cum surculo a
" gangliis cœliacis nervi sympathici magni venientis conjunctus fuit.

" Ramorum internorum tres memorabiles vidi ramos. Primus ad latus usque
" arteriæ phrenicæ conficiebat conspicuum ganglion supra renem succenturiatum
" dextrum, ex quo tres surculi nascebantur, quorum unus in rene succenturiati
" dextro consumtus fuit, alter magis externus conjunctus fuit cum ramulis a gan-
" gliis cœliacis dextris nervi sympathici magni ortis. Tertius ramus, datis plusculis
" surculis ad partem lumbarem diapragmatis, tribus insignibus anastomosibus
" copulabatur cum gangliis cœliacis dextri nervi sympathici magni.

" *Decursus Nervi phrenici in sinistro Latere.*

" In thorace adhuc decurrens ramos internos et externos spargebat. Ramulorum
" internorum nonnulli partem in superficie convexa diaphragmatis perforabant, ut in
" facie concava ejusdem consumti fuerint. Ramus externus perforavit eas carnes
" diaphragmatis quæ sphincterem œsophagi constituunt, nunc ambulavit in concava
" facie socia arteria phrenica sinistra et dedit frequenter tres ramos.

ganglia, and both phrenic nerves will be found by some minute branches to unite to the par vagum. These, however, are but minute branches, the great destination of the phrenic nerve is to the diaphragm. The branches strike out from the diaphragm, like

" Primo misit surculos ad partem lumbarem sinistram diaphragmatis euntes.
" Secundo sparsit ramum, qui decurrendo ad renem succenturiatum sinistrum
" cum ramulis a gangliis cœliacis sinistris nervi sympathici magni natis anasta-
" mosin habuit.
" Tertio ramum dedit cum eo ramo nervi sympathici magni anastomoticum, qui
" ante cardiam cum plexu œsophageo anteriori nervi octavi paris conjungitur.

" SECUNDA OBSERVATIO.

" *In Vetula quinquaginta Annorum instituta.*

" Tam in dextro quam in sinistro corporis latere nervus phrenicus eodem modo
" sese habuit quam in viro viginti et aliquot annorum. In dextro latere ganglion
" illud quod nervus phrenicus cavum abdominis ingressus formare solet, etiam in
" hac vetula adfuit sinistro latere, ut in prima observatione nullum fuit, sed simplex
" conjunctio nervi phrenici cum surculis a gangliis cœliacis sinistris ortis facta fuit.

" TERTIA OBSERVATIO.

" *Ex Viro quinquaginta Annorum.*

" *In Latere dextro.*

" Non procul a foramine venæ cavæ nervus phrenicus, datis plusculis ramulis ad
" convexam faciem diaphragmatis, eodem transfosso, in concava superficie diaphrag-
" matis exhibitis plusculis ramulis, parte lumbari duos emisit surculos, qui superato
" spatio unius circiter pollicis inter se confluxerunt et confluxerunt duo ganglia;
" unum erat superius, alterum inferius.
" E ganglio superiori exibant primo ramus externus anastomoticus cum gangliis
" cœliacis dextris.
" Secundo ex ganglio superiori nascebantur surculi, qui partem ad glandulam
" suprarenalem dextram properabant, partem excurrebant versus venam cavam, ubi
" cum surculis a gangliis cœliacis dextrus nervi sympathici magni ad lobum Spigelii

the roots from a centre; they pass some way only covered by the pleura, and then pierce into the substance of the muscle. There are innumerable experiments upon living animals, which shew the connexion of this nerve with the action of the diaphragm.

" venientibus, conjungebantur. Ganglion inferius duos pandebat surculos, exter-
" num anastomoticum cum gangliis cœliacis dextris; internus in plures findebatur
" ramos, qui in renem succenturiatum sinistrum implantatus fuit.

" *In sinistro Latere.*

" Phrenicus nervus, postquam in cavo pectoris sinistro in duos secesserat ramos,
" externum et internum, transfosso diaphragmate, in concava facie ejusdem ita lude-
" bat, ut ramus externus brevior evaserit atque in parte costali diaphragmatis ter-
" minatus fuerit. Ramus internus longior absque ulla facta anastomosi cum gangliis
" cœliacis sinistris descendebat prope ad orificium perquod transit œsophagus, et
" plusculis surculis in parte lumbari diaphragmatis consumtus fuit. Ergo nulla
" fuit in hoc subjecto anastomosis neque cum pari octavo neque cum nervo sym-
" pathico magno."

THE END.

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