

الجهاز الهضمي

علم التشريح

رقم المحاضرة :



الكتاب: مهدي الصبّاغ و ليلي عريقات

المدقق: مالك عابدين و ميس أحمد

الدكتور: محمد المحتسب

Don't worry about the huge number of slides 😱
Most of them are just external pictures that you are free to skip.
the doctor also skipped a lot of slides.

<...> Color code :

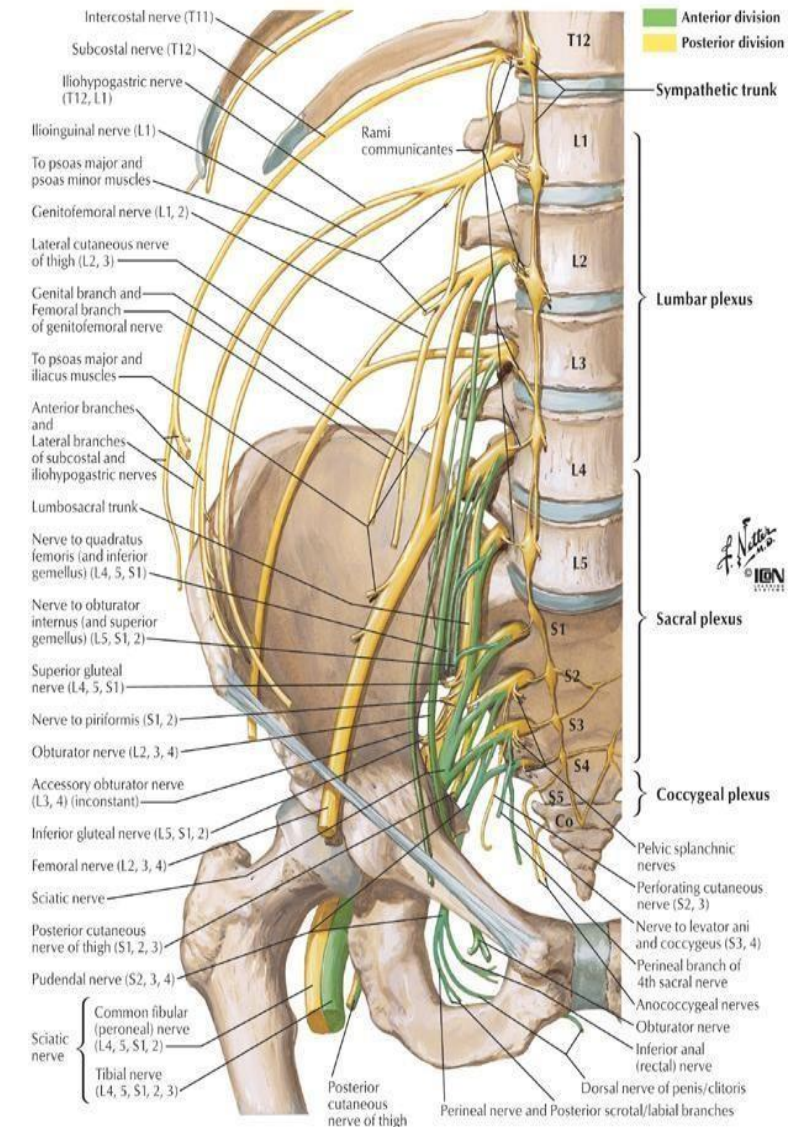
- ~ What doctor said during lecture would appear in **BLUE** .
- ~ What doctor read from the slides would be **UNDERLINED**.
- ~ The slide's explanations would be in **BLACK**.

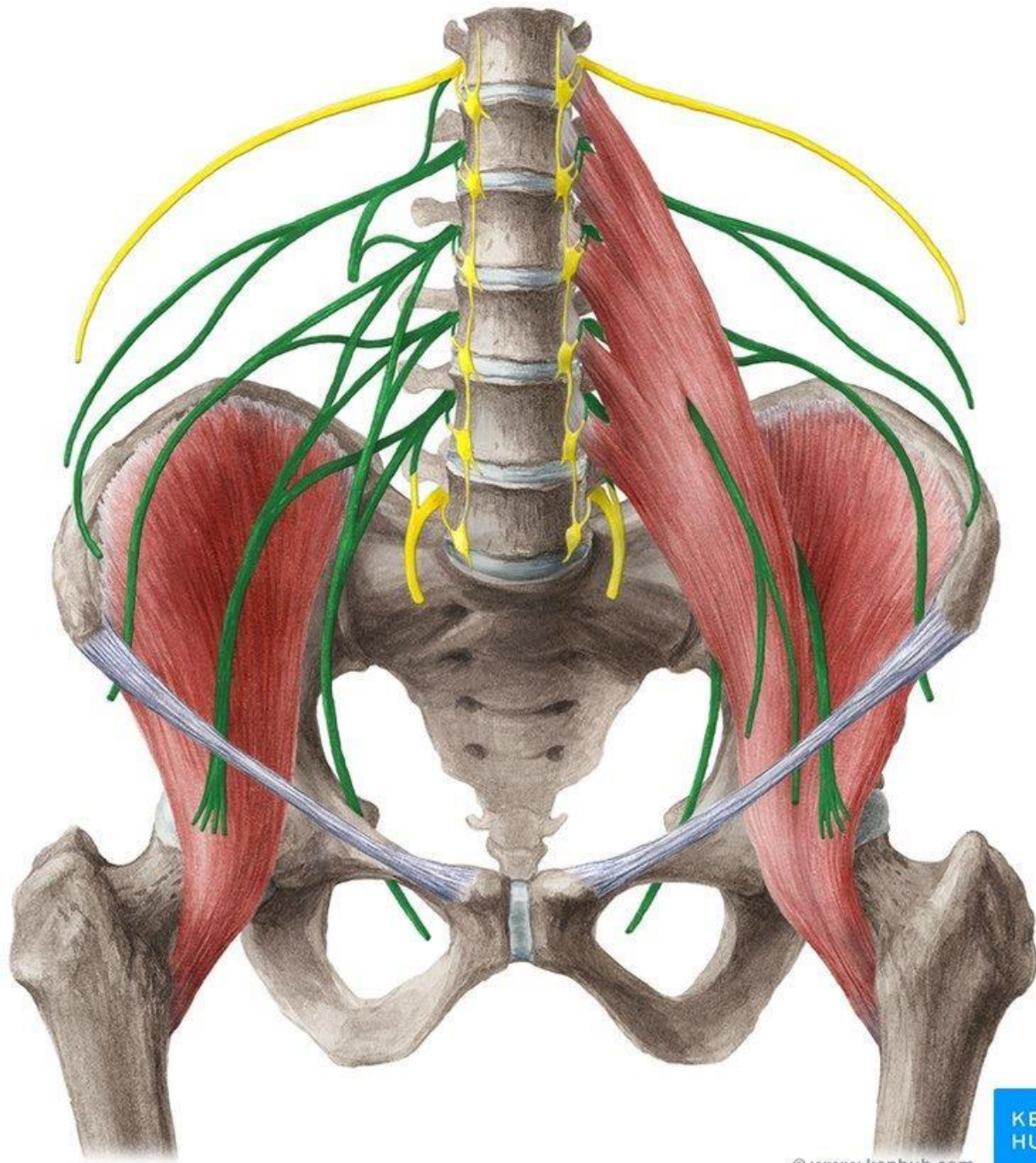
Nerves on the Posterior Abdominal Wall

Lumbar Plexus from L1,L2,L3,L4 anterior rami , also note that L4 and L5 give the lumbosacral trunk which then gives the lumbosacral plexus.

We are mostly concerned with the lumbar plexus

- The lumbar plexus, which is one of the main nervous pathways supplying the lower limb, is formed in the psoas muscle from the anterior rami of the upper four lumbar nerve. Some nerves arise from the lateral side of psoas major , others from the medial side and some from the substance of psoas major
- The anterior rami receive gray rami communicates from the sympathetic trunk,
- The upper two only give off white rami communicates to the sympathetic trunk.
- The branches of the plexus emerge from the lateral and medial borders of the muscle and from its anterior surface.
- The iliohypogastric nerve, ilioinguinal nerve, lateral cutaneous nerve of the thigh, and femoral nerve emerge from the lateral border of the psoas, in that order from above downward.
- The iliohypogastric and ilioinguinal nerves (L1) enter the lateral and anterior abdominal walls



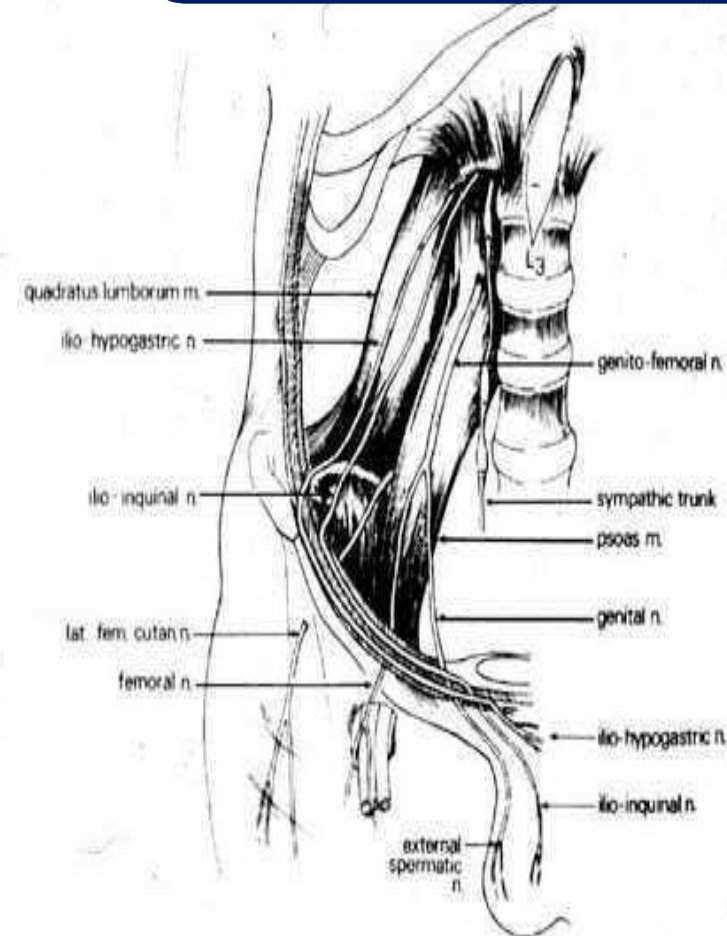


Lumbar plexus

Nerves on the Posterior Abdominal Wall

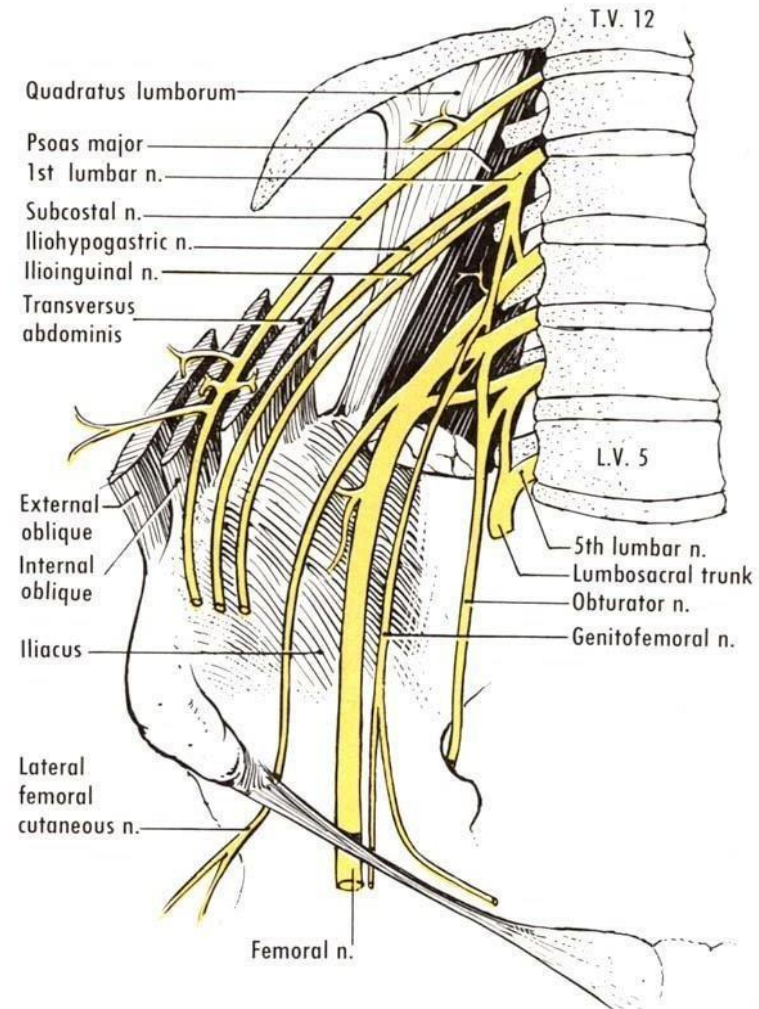
Both iliohypogastric and ilioinguinal nerves are derived from L1 from the **lateral** side of psoas major muscle.

- **The iliohypogastric nerve**
 - supplies the skin of the lower part of the anterior abdominal wall,
- **The ilioinguinal nerve**
 - passes through the inguinal canal to supply the skin of the groin and the scrotum or labium majus.
- **The lateral cutaneous nerve of the thigh**
 - Crosses the iliac fossa in front of the iliacus muscle and enters the thigh behind the lateral end of the inguinal ligament.
 - It supplies the skin over the lateral surface of the thigh.

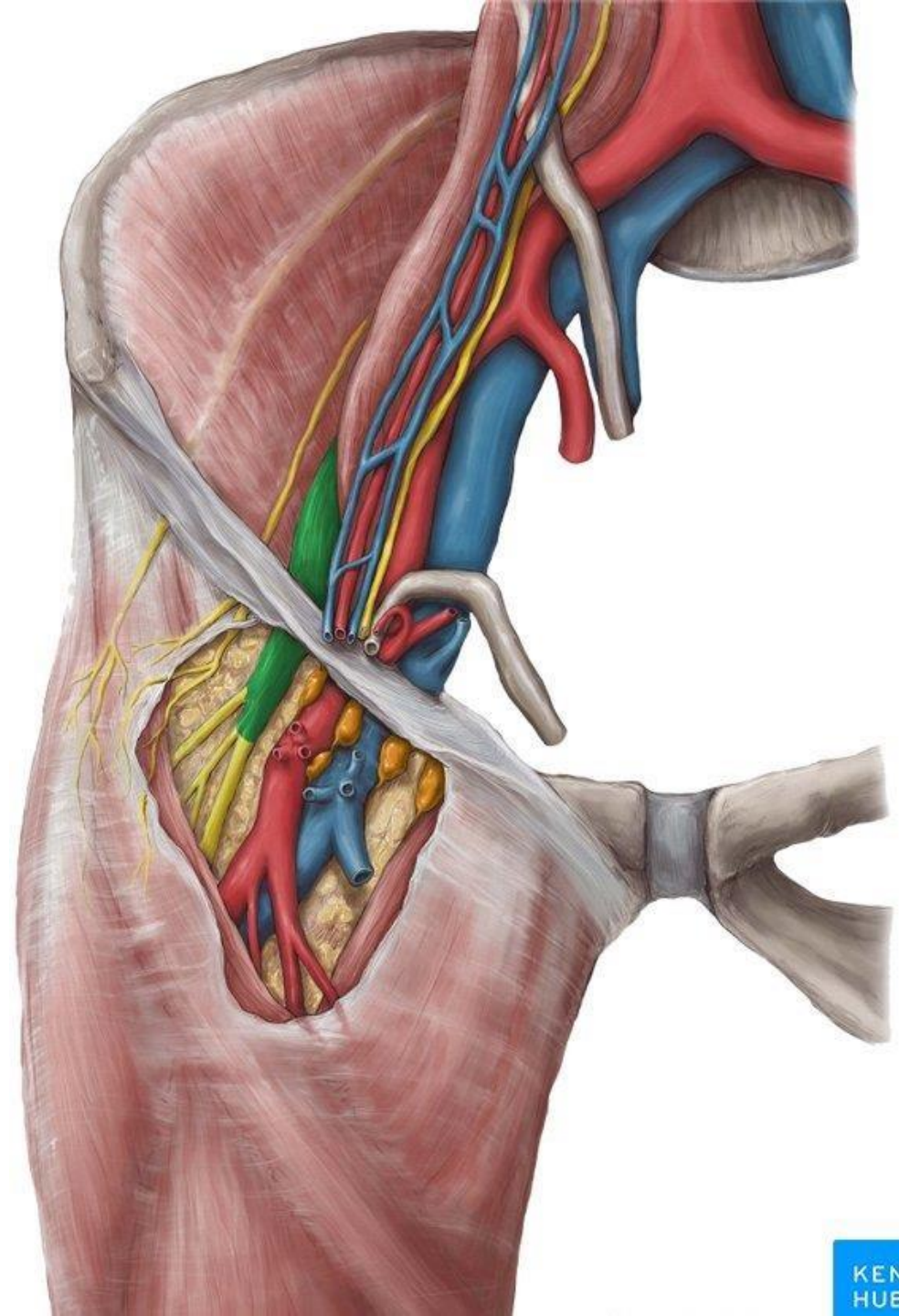


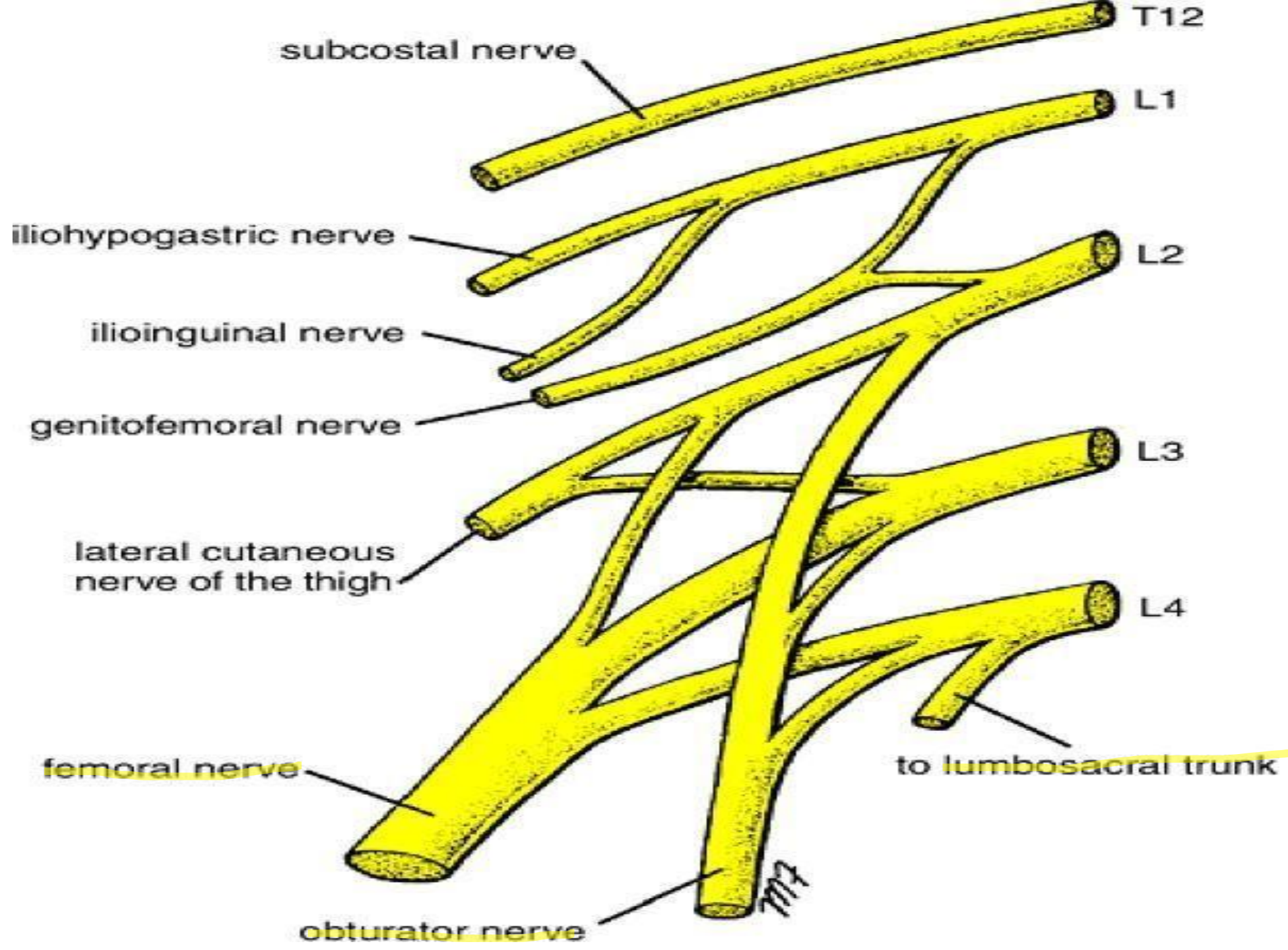
Lumber plexus.....cont

- The femoral nerve (L2, 3, and 4) on the lateral side of psoas
 - It is the largest branch of the lumbar plexus.
 - Goes to the lower limb
 - It runs downward and laterally between the psoas and the iliacus muscles and enters the thigh behind the inguinal ligament and lateral to the femoral vessels and the femoral sheath.
 - In the abdomen it supplies the iliacus muscle.



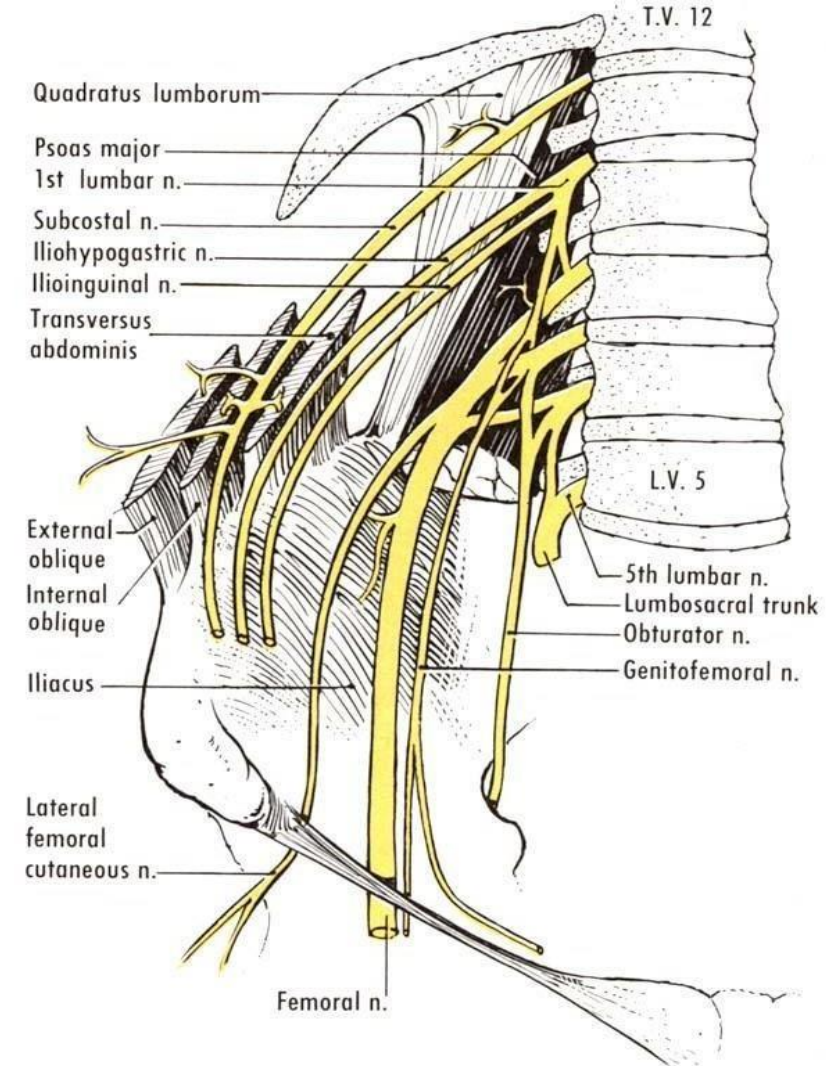
Femoral nerve





Lumber plexus.....cont

- The Obturator nerve and the fourth lumbar root of the lumbosacral trunk
 - Emerge from the medial border of the psoas at the brim of the pelvis.
- The Obturator nerve (L2, 3, and 4) crosses the pelvic brim in front of the sacroiliac joint and behind the common iliac vessels.
 - Note: both femoral and obturator nerves arise from anterior primary rami of L2,L3,L4 but femoral nerve is a posterior branch while obturator is an anterior branch
 - It leaves the pelvis by passing through the Obturator foramen into the thigh.
 - obturator nerve goes to the medial compartment of the thigh.
 - The fourth lumbar root of the lumbosacral trunk takes part in the formation of the sacral plexus . It descends anterior to the ala of the sacrum and joins the first sacral nerve.



Lumber plexus.....cont

- **The genitofemoral nerve** (L1 and 2)
 - Emerges on the anterior surface of the psoas. **from the substance of psoas**
 - It runs downward in front of the muscle and divides into :
 - 1 **A genital branch**, which enters the spermatic cord and supplies the Cremasteric muscle, **it pierces the inguinal canal and goes to cremasteric muscle in the scrotum**
 - 2 **A femoral branch**, which supplies a small area of the skin of the thigh.

Cremasteric reflex: itching in the upper medial side of the thigh that will be detected by sensory nerve endings in the skin , now this sensation will be carried by femoral branch to L1 and L2 , now the femoral branch splits into smaller branches giving rise to the genital branch while supplies the cremasteric muscle , when the genital branch senses the sensation , it causes the contraction of the cremasteric muscle which propels the testicle upwards

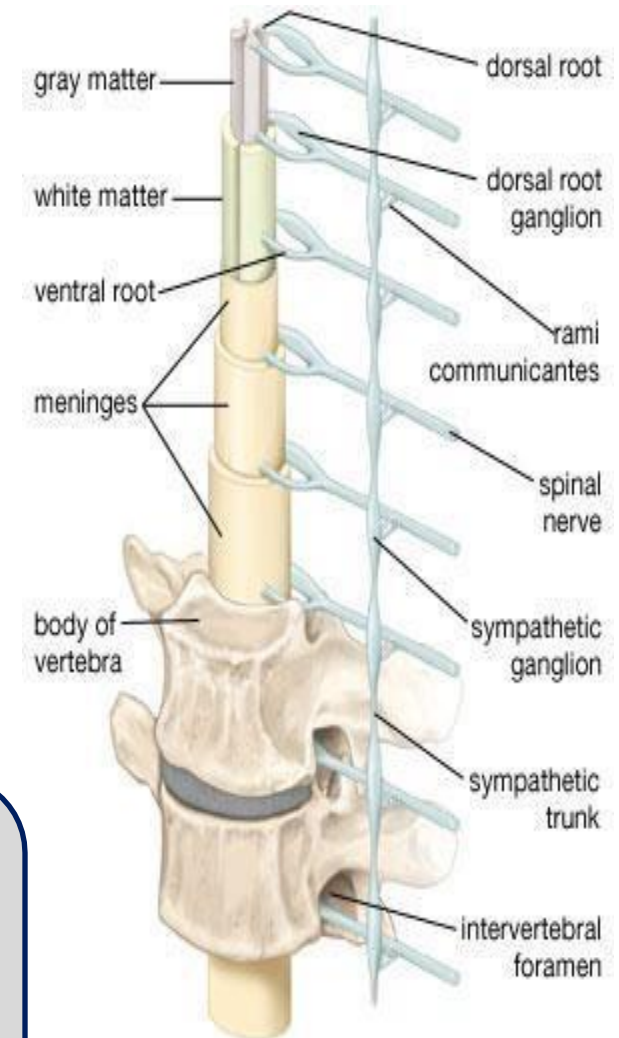
- It is the nervous pathway , in which stimulation of the skin of the thigh in the male results in reflex contraction of the cremaster muscle and the drawing upward of the testis within the scrotum. **This reflex occurs mostly in winter**
- Cremasteric reflex may be absent with: testicular torsion, upper and lower motor neuron disorders, as well as a spine injury of L1-L2. It can also occur if the ilioinguinal nerve is accidentally cut during a hernia repair

Sympathetic Trunk (Abdominal Part)

- The abdominal part of the sympathetic trunk is continuous above with the thoracic and below with the pelvic parts of the sympathetic trunk.
- It runs downward along the medial border of the psoas muscle on the bodies of the lumbar vertebrae.
- It enters the abdomen from behind the medial arcuate ligament and gains entrance to the pelvis below by passing behind the common iliac vessels.
- The right sympathetic trunk lies behind the right border of the inferior vena cava; the left sympathetic trunk lies close to the left border of the aorta.
- The sympathetic trunk possesses four or five segmentally arranged ganglia, the first and second often being fused together.

Sympathetic chain is a chain of ganglia connected together, it starts from the neck where we have 3 ganglia (superior, middle and inferior) and then it descends to the chest where we have 12 ganglia, then goes to s4 and s5 sacral vertebra and coccyx 1, synapses may also occur in this chain.

Note : the origin of the sympathetic fibers is the sympathetic nuclei located in thoracolumbar, meaning that all 12 thoracic vertebrae + L1 and L2 contain sympathetic nuclei from which sympathetic fibers arise



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Nerves arising from these nuclei are called **preganglionic sympathetic nerves** or fibers , and these nerves will now go to the sympathetic ganglia and have one of the following four fates :

1) synapse

2) move upwards towards cervical vertebra

3) move downwards towards lumbar vertebra

4) pass the sympathetic ganglia without synapse and will now move to prevertebral (or preaortic) ganglia .

Prevertebral ganglia include :

a) Celiac ganglia (around celiac trunk)

b) Superior mesenteric ganglia (around superior mesenteric artery)

c) Inferior mesenteric ganglia (around inferior mesenteric artery)

Sympathetic trunk...Abdominal part

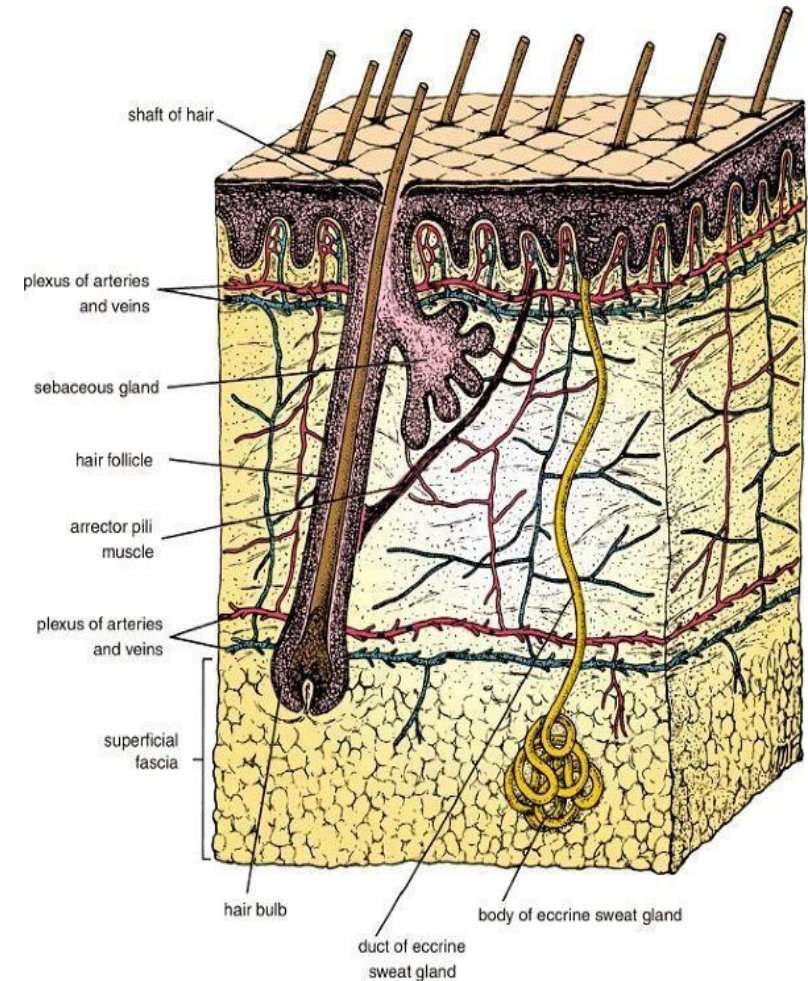
- **Branches**
- **White rami are preganglionic sympathetic fibers which arise from the nucleus and 14 in number (from the 14 sympathetic nuclei, 12 thoracic and 2 lumbar).**
 - communicantes join the first two ganglia to the first two lumbar spinal nerves.
 - A white ramus contains Preganglionic nerve fibers and afferent sensory nerve fibers.
- **Gray rami results from the synapse of the preganglionic sympathetic fibers to form the postganglionic sympathetic fibers which then goes to spinal nerves (that are 31 in number), so now each spinal nerve contains a post ganglionic sympathetic fiber resulting in having 31 of them .**
 - communicantes join each ganglion to a corresponding lumbar spinal nerve.
 - A gray ramus contains postganglionic nerve fibers distributed to blood vessels, sweat gland and skin

Sympathetic.....Abdominal part

Goes to skin → to arrector pili muscle

Postganglionic fibers.....cont

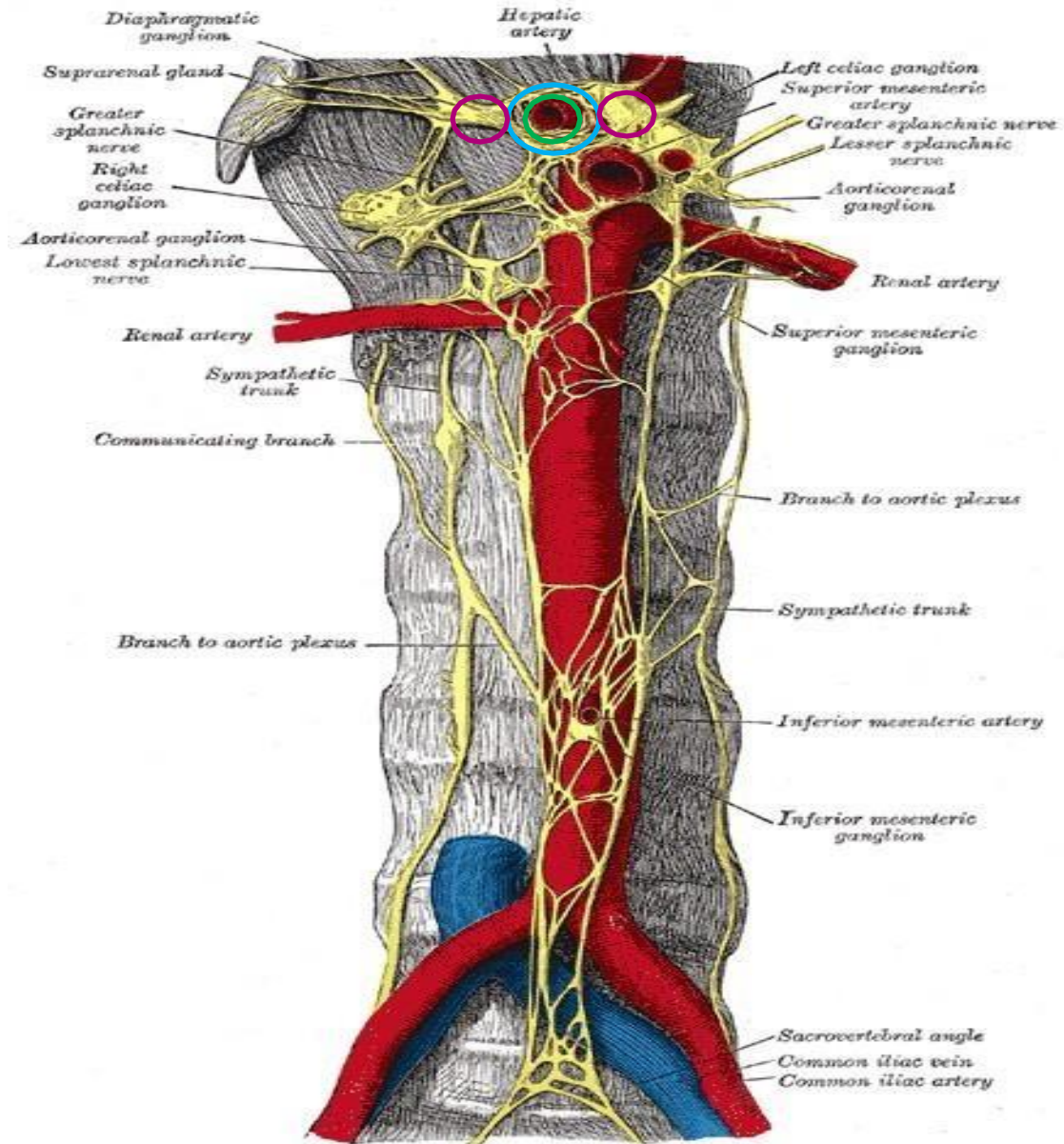
- Distributed through the branches of the spinal nerves to the blood vessels, sweat glands, and arrector pili muscles of the skin.
- Fibers pass medially to the sympathetic plexuses on the abdominal aorta and its branches. (These plexuses also receive fibers from splanchnic nerves and the vagus.)
- Fibers pass downward and medially in front of the common iliac vessels into the pelvis, where, together with branches from sympathetic nerves in front of the aorta, they form a large bundle of fibers called the superior hypogastric plexus.



Aortic Plexuses

- Preganglionic and postganglionic sympathetic fibers
- Preganglionic parasympathetic fibers, and visceral afferent fibers form a plexus of Nerves, the aortic plexus, around the abdominal part of the aorta .
- Regional concentrations of this plexus around the origins of the celiac, renal arteries
- Superior mesenteric → celiac plexus
- Inferior mesenteric plexus → Renal plexus
- **1- The celiac plexus** consists mainly of two celiac ganglia connected together by a large network of fibers that surrounds the origin of the celiac artery.
- The ganglia receive the greater and lesser + lowest splanchnic nerves (Preganglionic sympathetic fibers) comes from the chest+ there's also L1 and L2 derives splanchnic nerves
- Postganglionic branches accompany the branches of the celiac artery and follow them to their distribution.
- Parasympathetic vagal fibers also accompany the branches of the artery.
- **2- The renal plexuses(right to supra renal gland and are sympathetic),** are smaller than the celiac plexus. They are distributed along the branches of the corresponding arteries. The inferior mesenteric plexus is similar but receives parasympathetic fibers from the sacral parasympathetic.

- ❖ **Plexus of nerves " sympathetic and parasympathetic " in front of the aorta , can also be referred to as the celiac plexus cause its around the celiac trunk.**
- ❖ **We have sympathetic ganglia present preaortic around celiac trunk, superior mesenteric and inferior mesenteric , sympathetic fibers synapse in this ganglia so now preganglionic sympathetic fibers become postganglionic and form a plexus along with parasympathetic fibers that are derived from vagus .**



Green circle : celiac trunk
 Blue circle : celiac plexus
 Pink circles : sympathetic

medial arcuate ligament

aorta

aorta opening in diaphragm

Sympathetic Ganglia

sympathetic trunk

celiac ganglia

celiac plexus

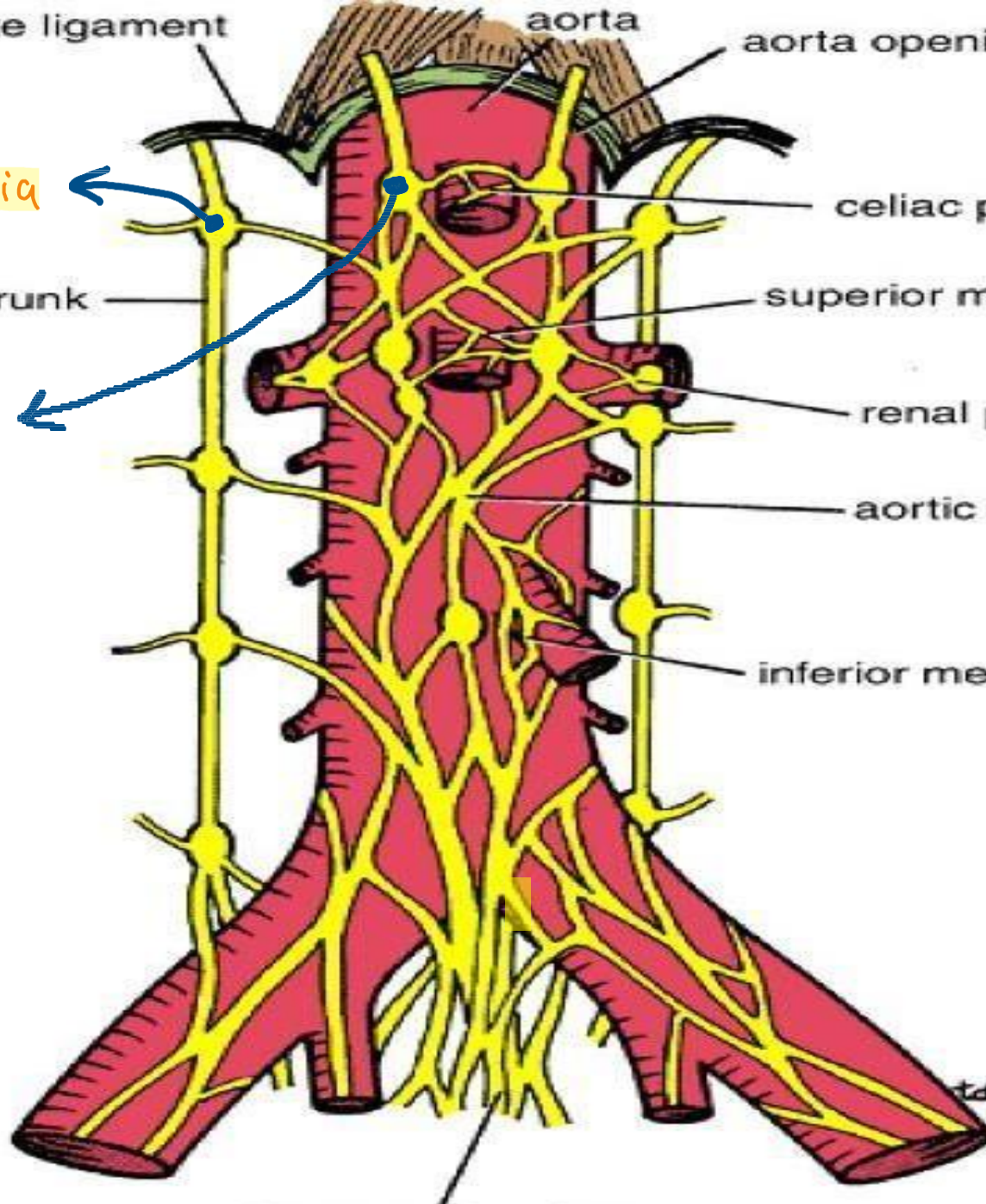
superior mesenteric plexus

renal plexus

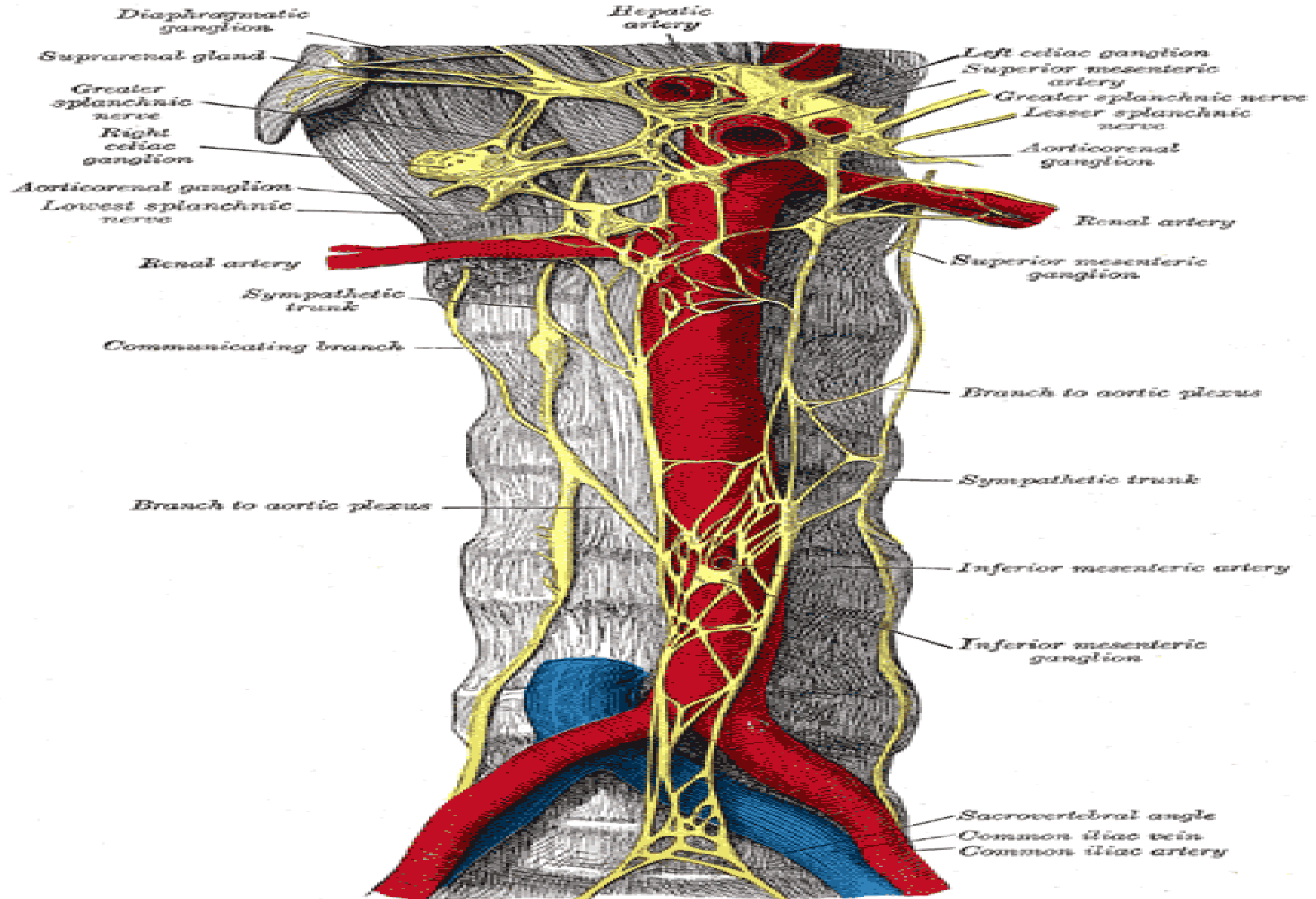
aortic plexus

inferior mesenteric plexus

hypogastric plexus



Sympathetic chain

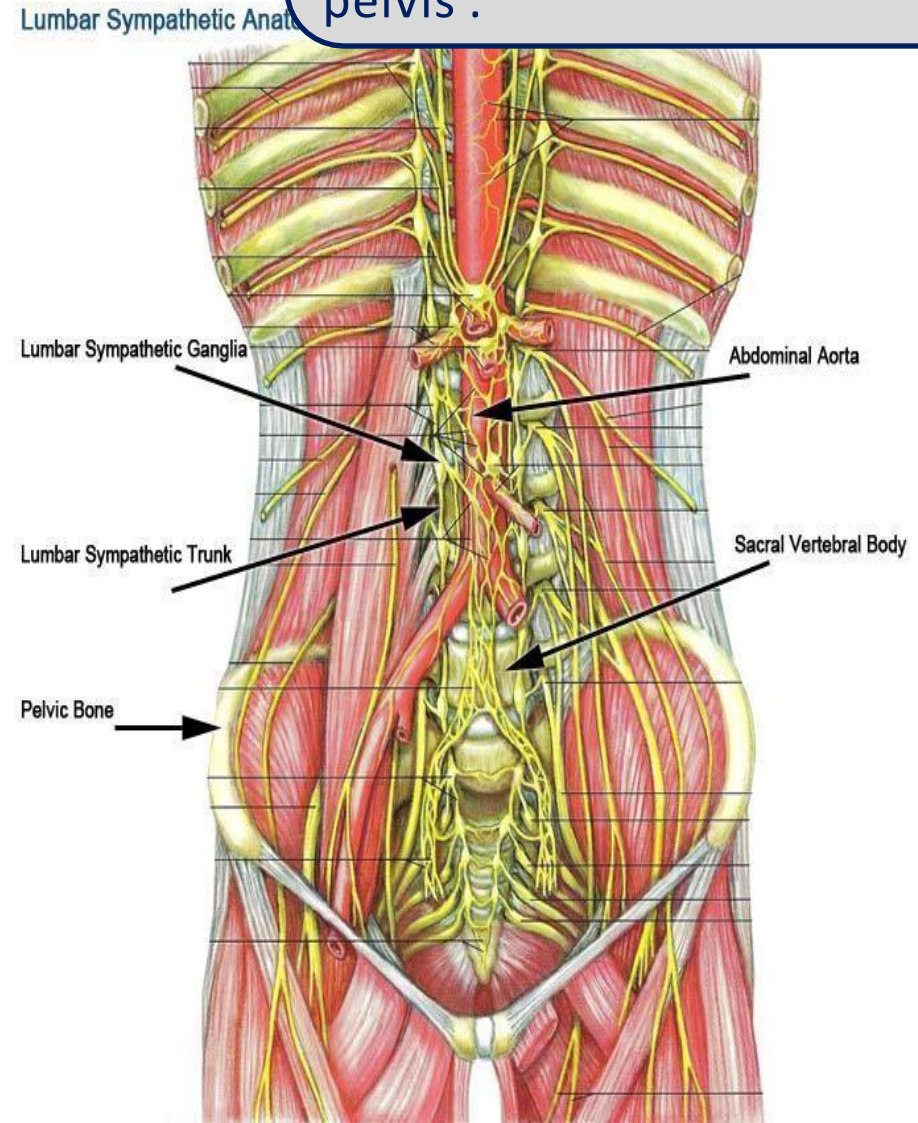


Sympathetic chain

Sympathetic chain

- 2 chains extend from level of atlas till coccyx
- Number of ganglia (in pairs)
 - C = 3
 - Th. = 10 -12 (11)
 - L = 4
 - S = 4
 - Coccygeal =
1(ganglion impar)

Sympathetic chain pierces the diaphragm then goes to the abdomen and passes in front of the common iliac vessels then to the pelvis .

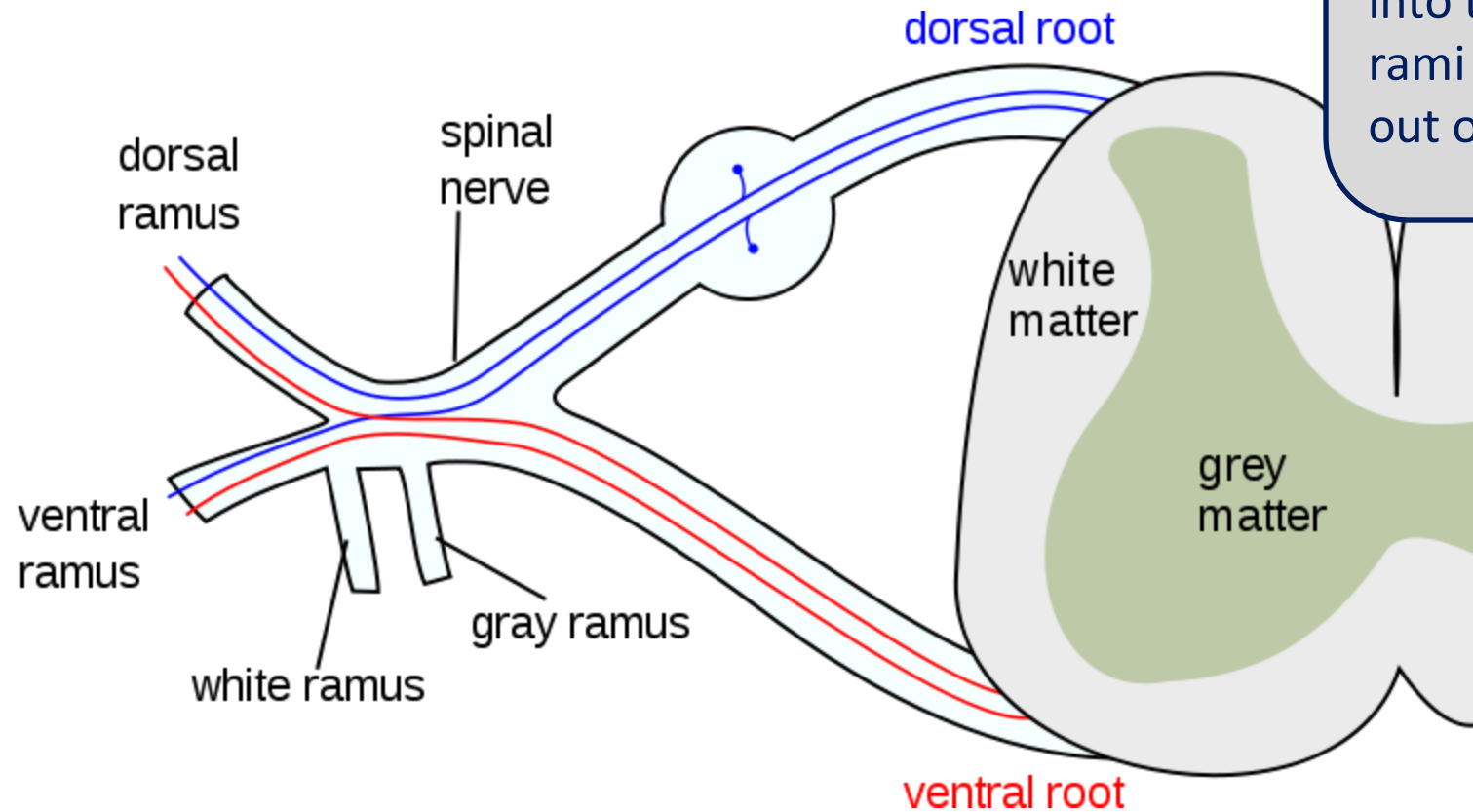


Sympathetic chain....cont

Preganglionic fibers: also called white rami , 14 in number

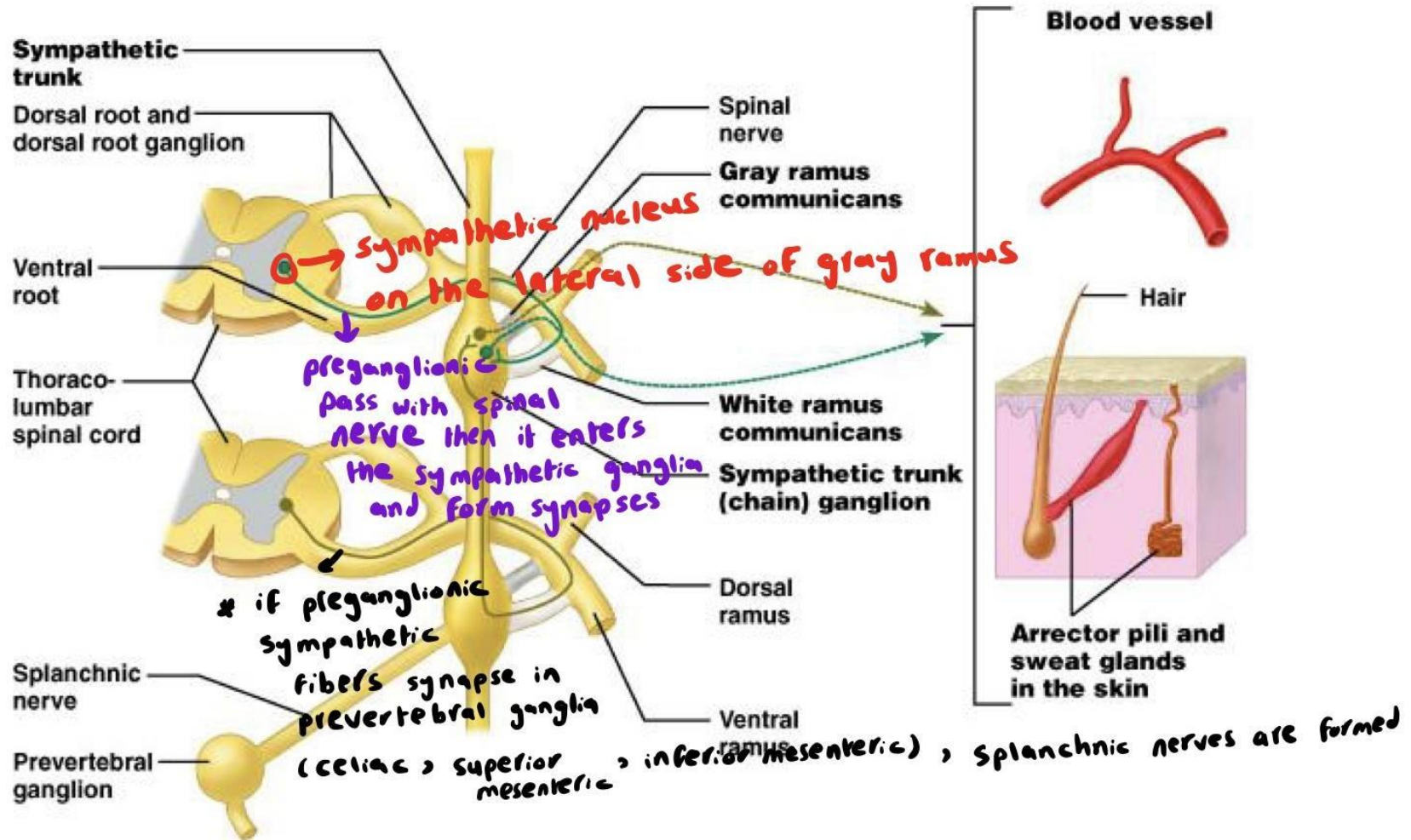
- **Origin:** sympathetic nucleus present in lat. Horn cell of thoracic and upper 2 lumbar region of spinal cord = 14
- Leave the spinal cord through the ant. Root and then leave the spinal nerve as white rami to join the symp.chain (14 white rami)
- **Preganglionic fibers when it enters the sympathetic chain may :**
 - 1- Synapse with cells in the ganglia it enters (e.g. middle.Th.. Segm)
 - 2 Pass up to synapse in higher ganglia (upper Th. Segm → 3 cerv. Segm)
 - 3 Pass down to synapse in lower ganglia (lower Th & upper 2 lumbar go to lumbar & sacral ganglia)
 - 4 May not synapse in sympathetic chain & continue as preganglionic fibers to form (splanchnic nerves)

Sympathetic chain

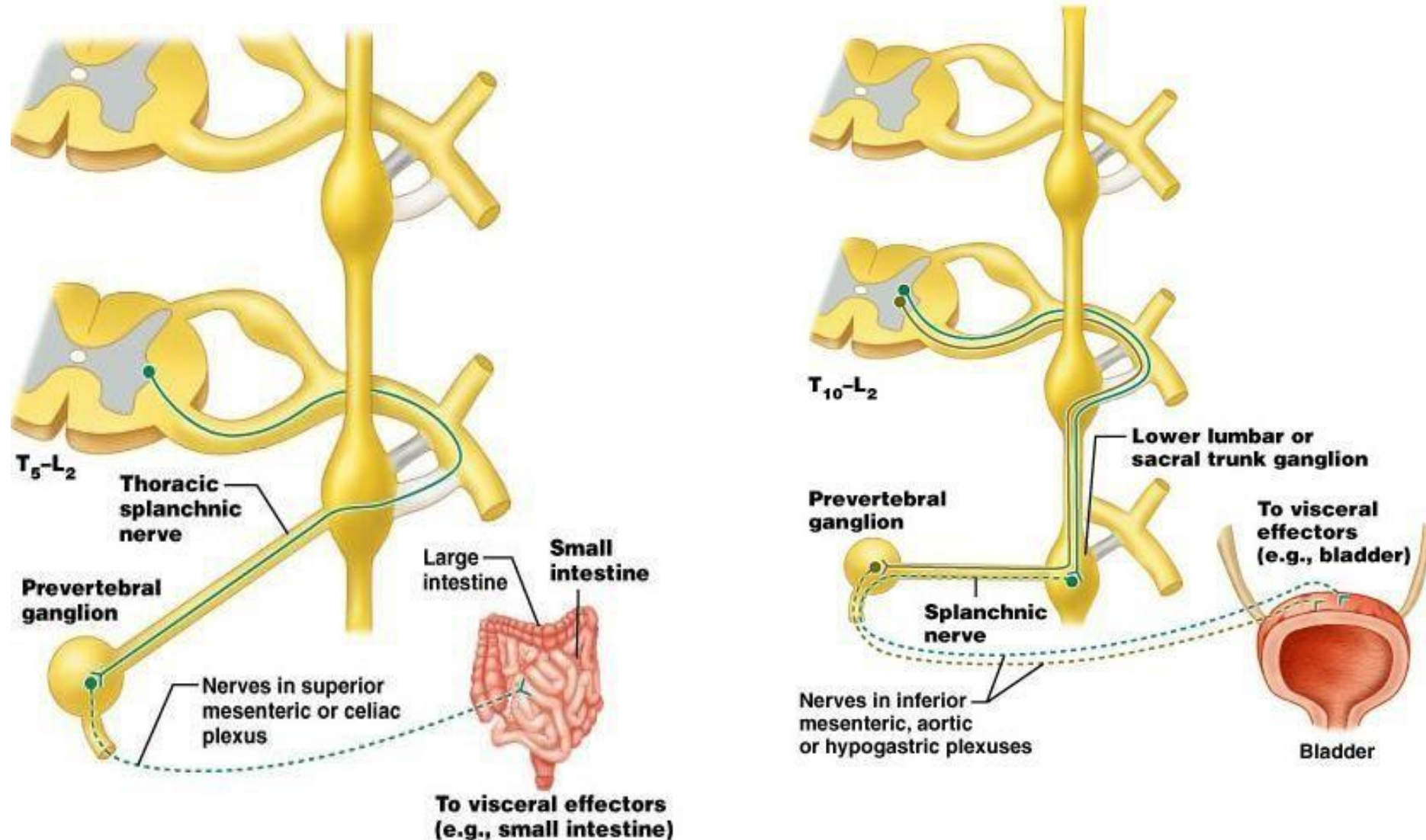


This picture shows spinal nerve + white ramus (fibers are moving into the ganglia) + gray rami (fibers are moving out of the ganglia).

Synapse in chain ganglia at same level or different level



Pass through ganglia and synapse in prevertebral ganglion



Sympathetic chain....cont

- Nerves which leave the sympathetic chain:

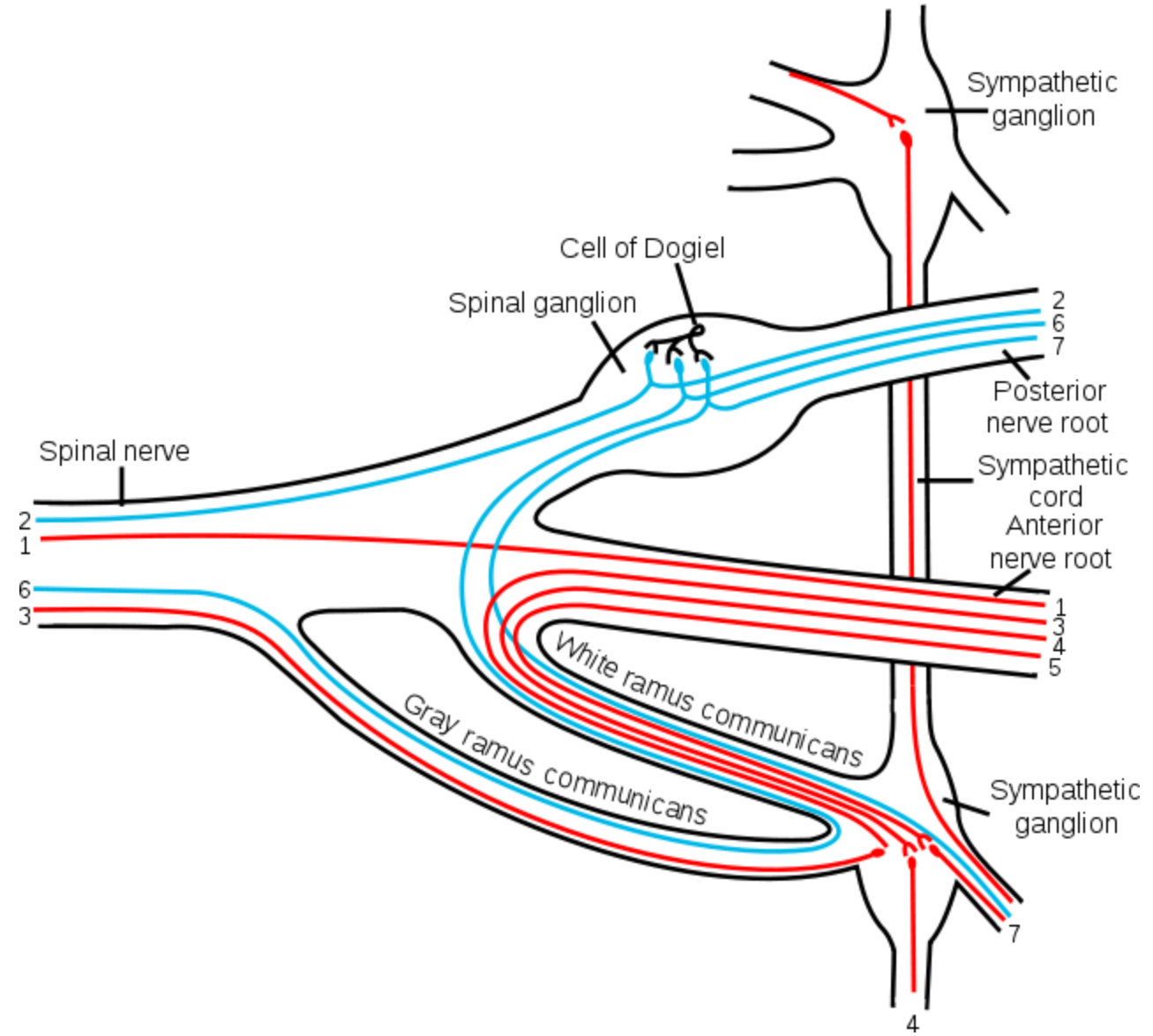
A- gray rami (31 post ganglionic fibers join spinal nerves to reach sweat glands, errectore papillae & blood vessels

- S.C.S.G → lower 4 cranial nerves + upper 4 cervical
- M.C.S.G → 5th , 6th cervical nerves
- I.C.S.G → 7th , 8th cervical nerves
- Thoracic , lumber, sacral ganglia to corresponding nerves

B- visceral nerves

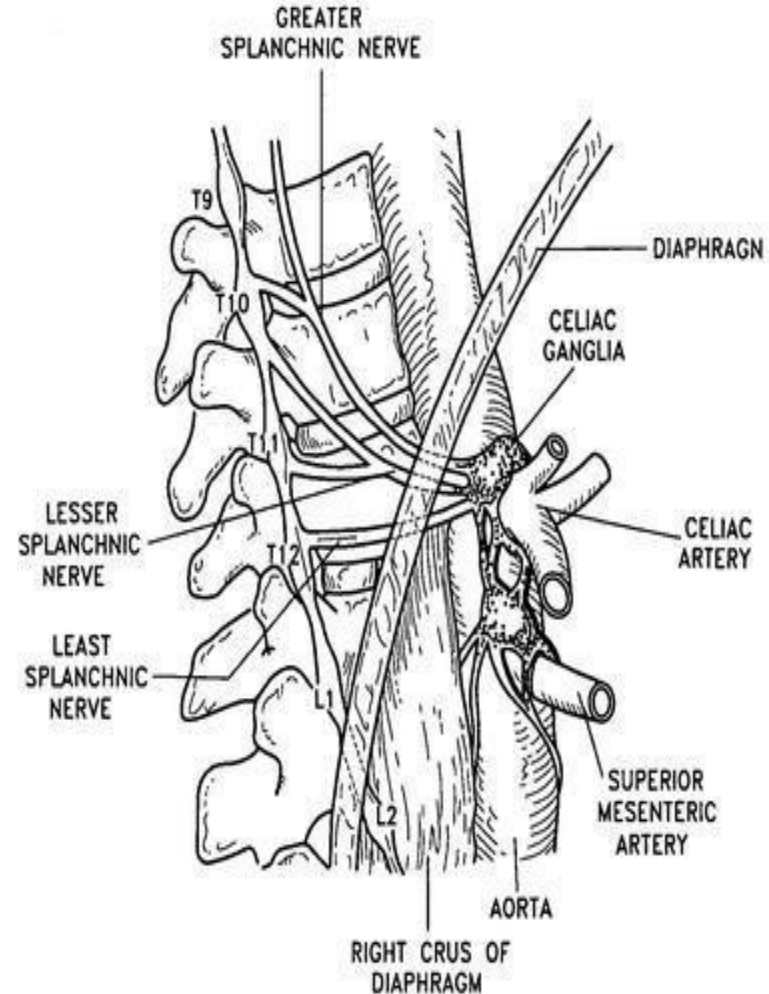
- 1 Int, & Ext. carotid nerves from S.C.S.G to corresponding arteries
- 2 pharyngeal branch : from S.C.S.G to pharyngeal plexus
- 3 pulmonary nerves : 2nd , 3rd& 4th thoracic ganglia
- 4 cardiac nerves : 2nd , 3rd& 4th thoracic ganglia + 3 cervical ganglia
- 5- splanchnic nerves : greater, lesser and lowest splanchnic nerves

Sympathetic chain



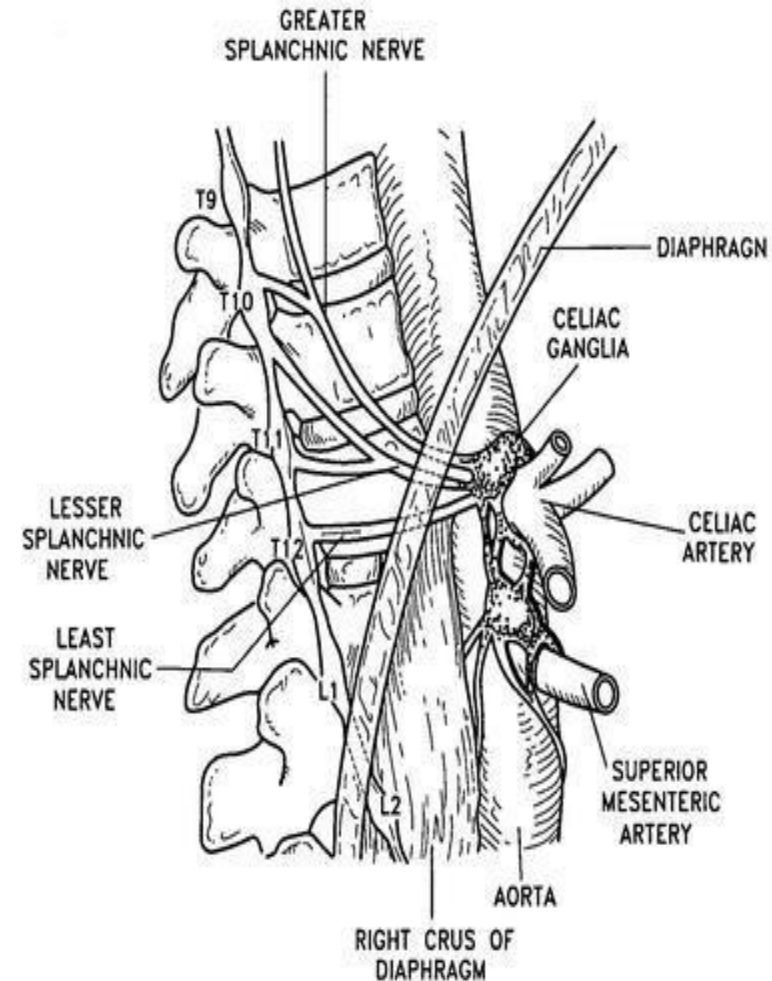
Greater splanchnic nerves:

- Arise from ganglia (5-9th) or 10th
- Pierce the cruss of the diaphragm
- End in the coeliac ganglia
- Post. ganglia fibers follow the branches of coeliac artery to reach the smooth muscle , gland of stomach



Lesser splanchnic nerves:

- Arise from the 9th & 10th Th.ganglia
- Pierces the cruss of diaphragm
- End in the sup. Mesenteric ganglia
- Post. Ganglia fibers supply the smooth muscles, glands of small intestine, ascending and transverse parts of colon



Lowest splanchnic nerves:

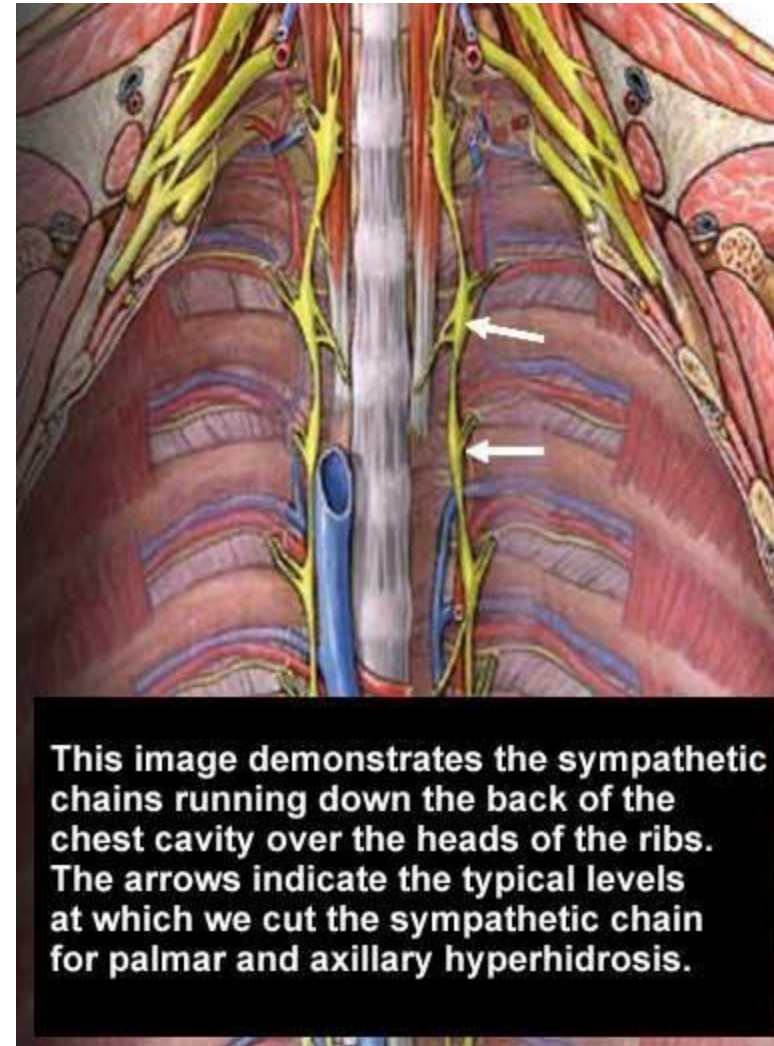
- May be absent, if present arises from the last one or two th.ganglia
- Pierces the diaphragm to end in renal plexus

Lumber splanchnic branch

- Arise from L1& L2 ganglia
- Ends in inferior mesenteric ganglia
- Post. Ganglionic fibers go to sigmoid and pelvic colon, other post. Ganglionic fibers form the descending hypogastric plexus to supply bladder, rectum and genitalia
- **Branches from sacral part of the chain go to pelvic viscera**

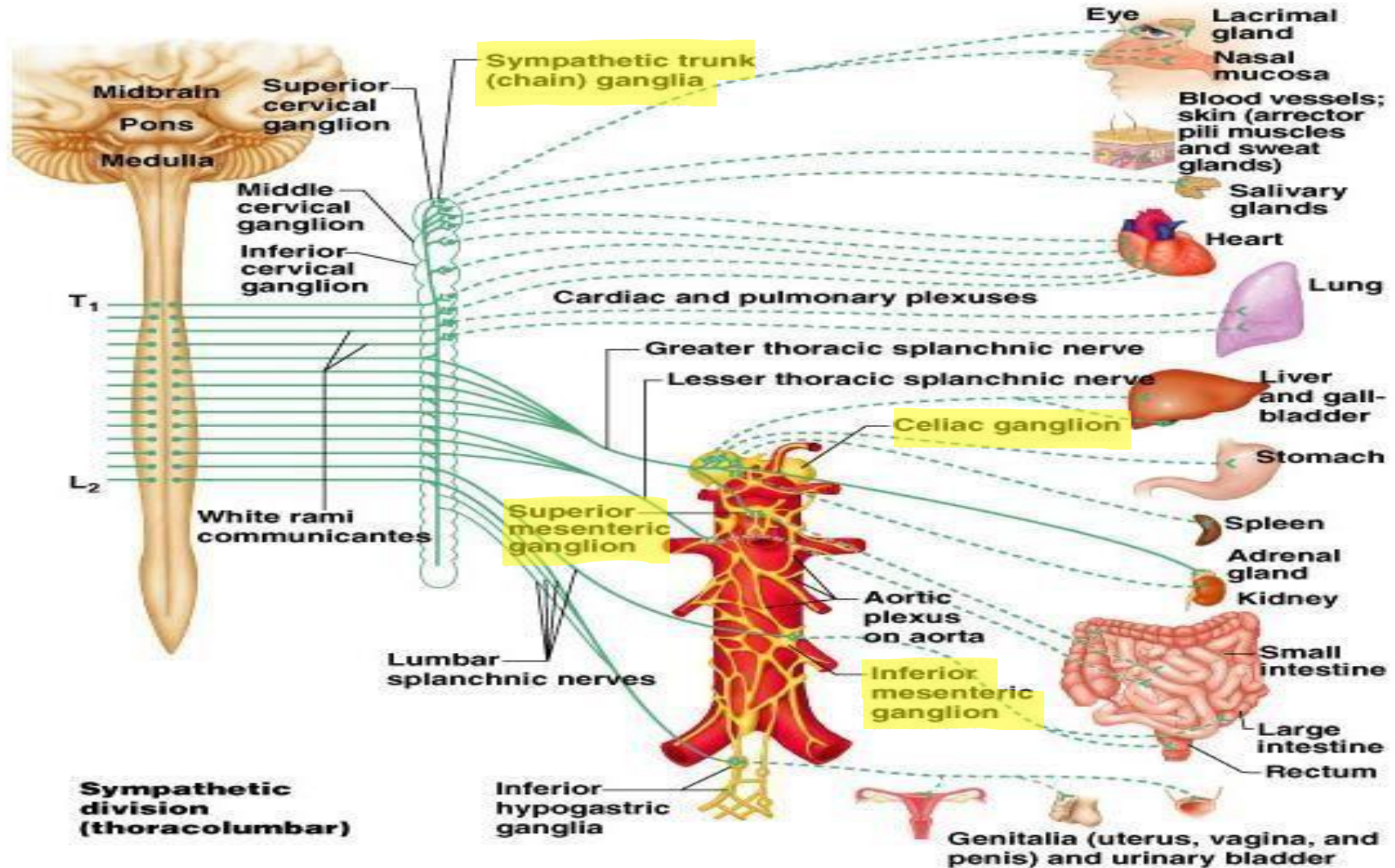
Thoracic sympathetic chain:

- **Site:** enters the thorax in front of neck of 1st rib and leaves it by passing behind the medial arcuate ligament
- In the upper part it lies on the necks of the ribs while in the lower part it lies on the side of the bodies of vertebrae
- **Ganglia:** (10 -12), 1st sometimes fuses with the I.C.S.G → stellate ganglia
- **Branches:**
 - A- Gray & white rami communicants
 - B- 2nd, 3rd & 4th ganglia (cardiac & pulmonary)
 - C- The upper five ganglia give aortic oesophageal branches
 - D- Greater, lesser and lowest splanchnic nerves

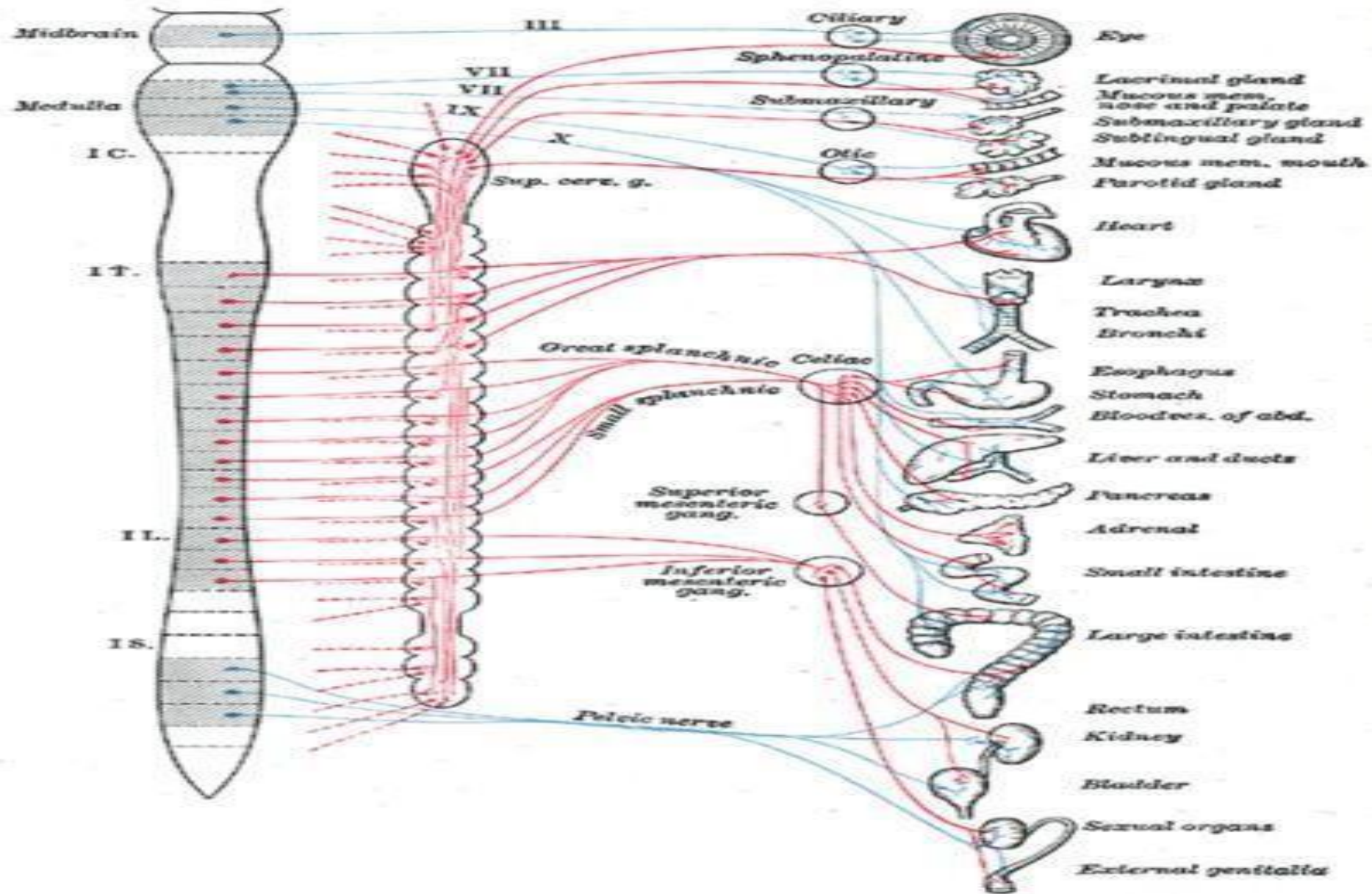


This image demonstrates the sympathetic chains running down the back of the chest cavity over the heads of the ribs. The arrows indicate the typical levels at which we cut the sympathetic chain for palmar and axillary hyperhidrosis.

Sympathetic chain

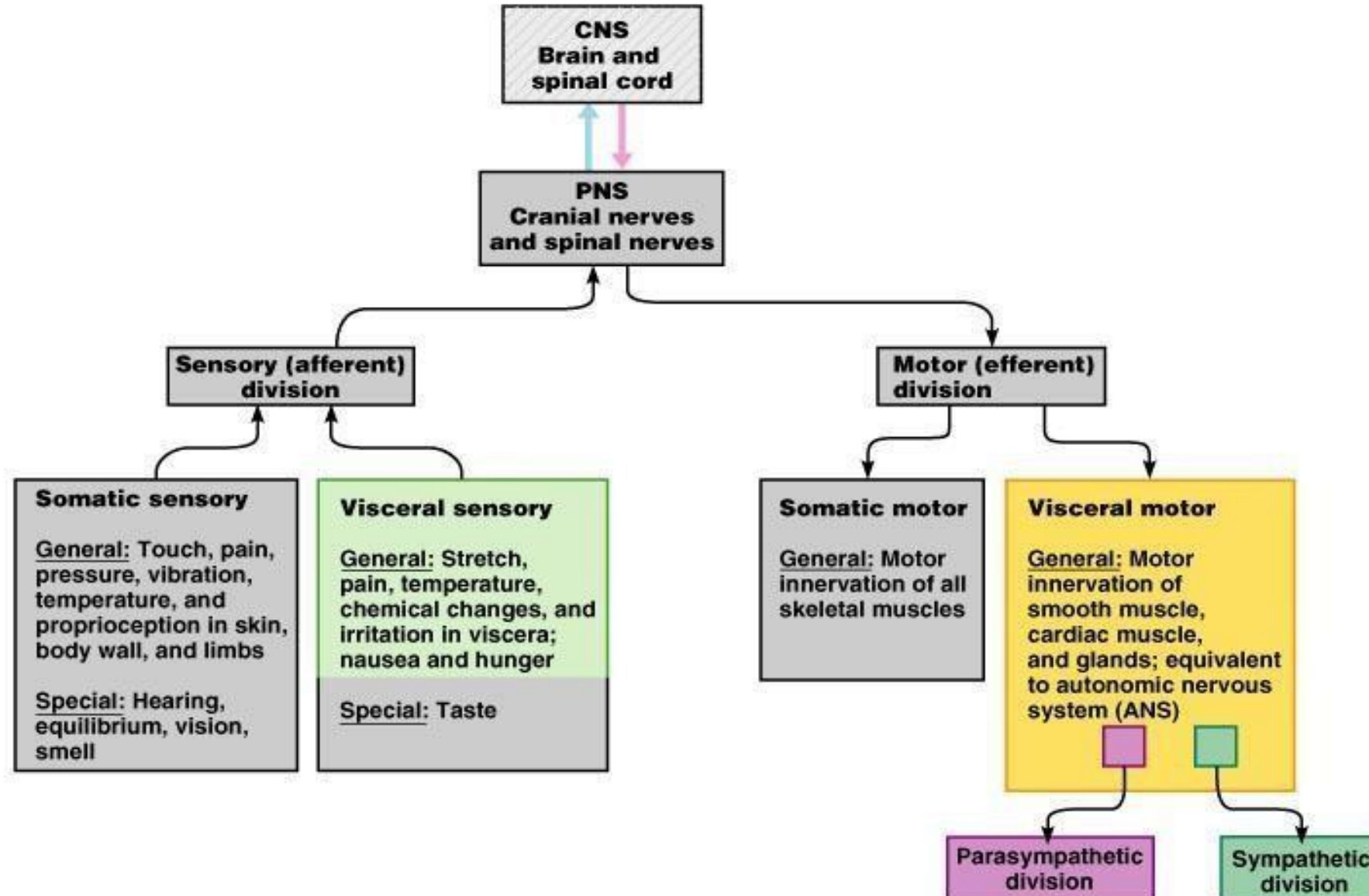


Splanchnic nerve



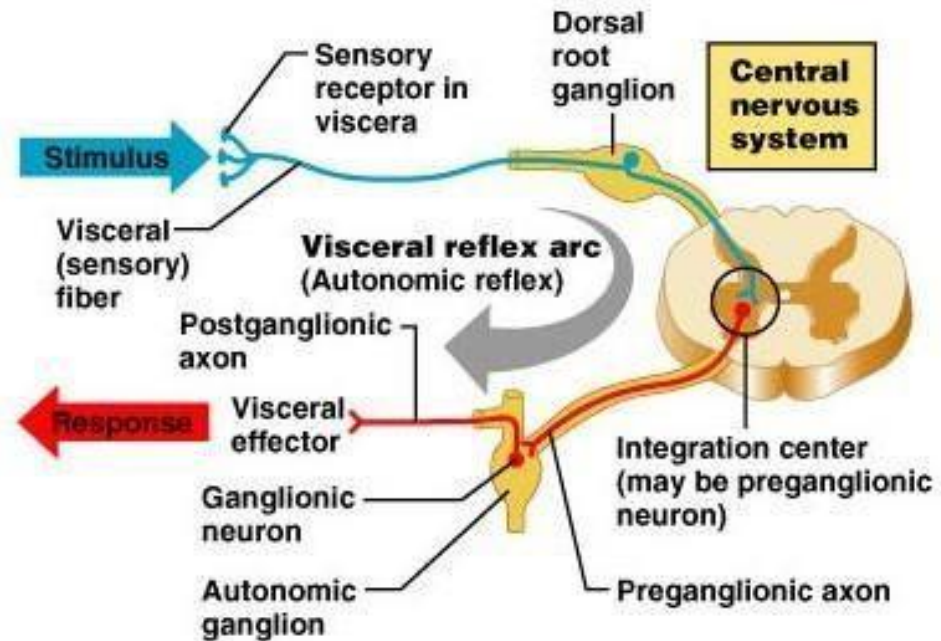
We will take it in Nervous System! باذن الله

Visceral sensory system



Visceral sensory and autonomic neurons participate in *visceral reflex arcs*

- Many are spinal reflexes such as defecation and micturition reflexes
- Some only involve peripheral neurons: spinal cord not involved (not shown)*



*e.g. “enteric” nervous system: 3 neuron reflex arcs entirely within the wall of the gut 30

Pelvic colon

The left descending colon is located at the left side, it crosses the left lumbar region and ends at the left iliac fossa (left brim or left inlet of the pelvis).

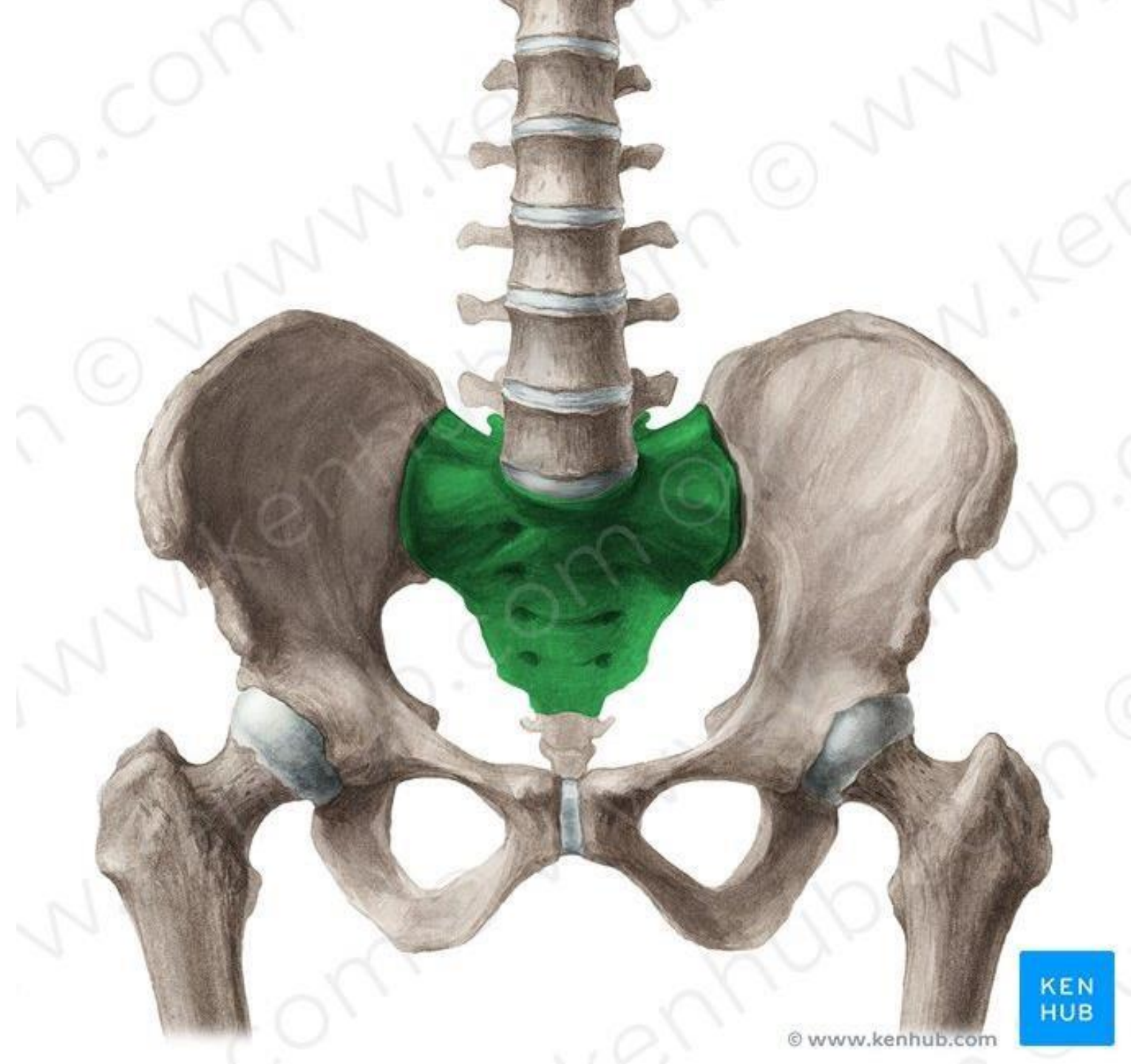
From there begins the sigmoid colon (the first part of the pelvic colon) as a continuation of the descending colon.

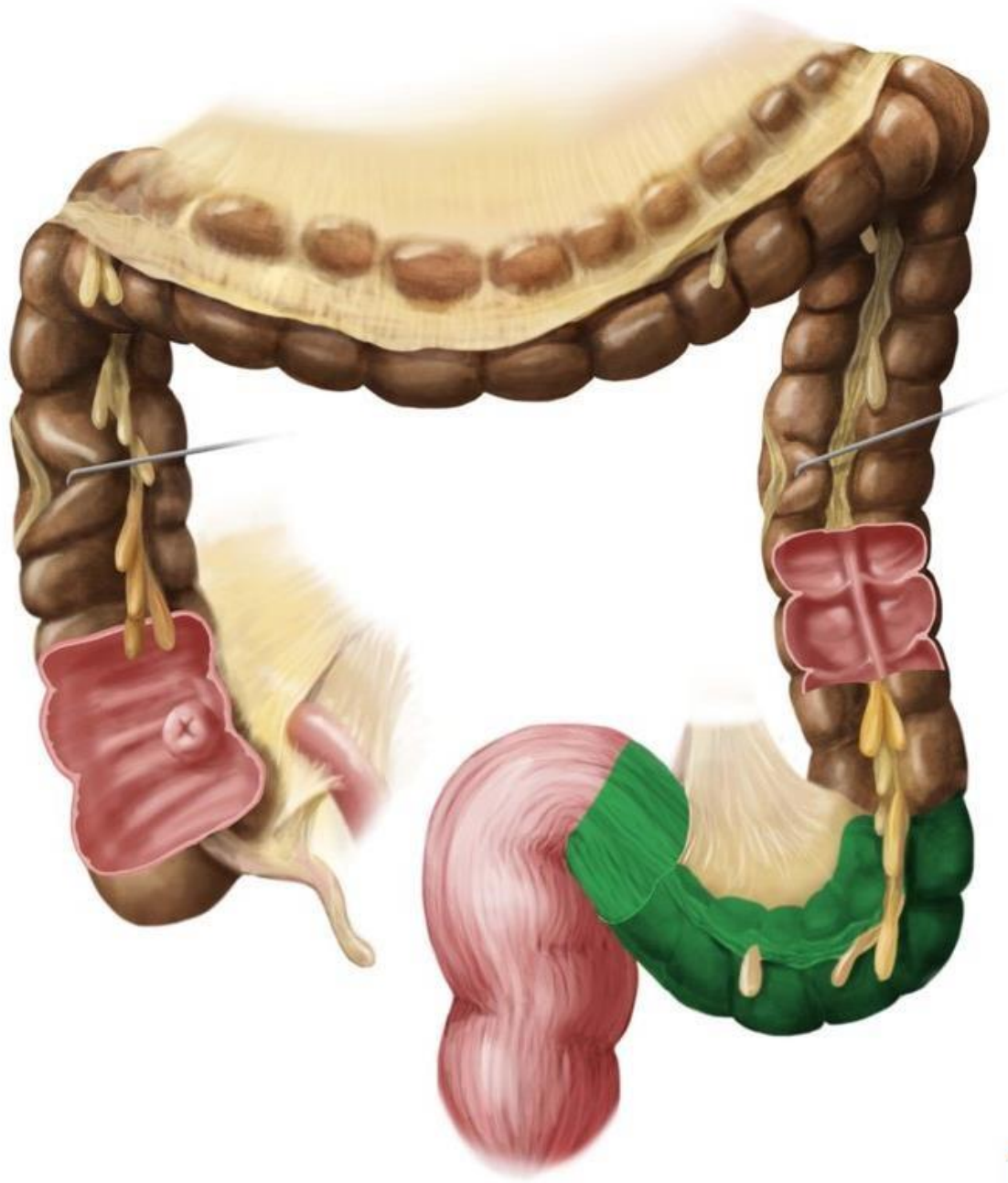
Pelvic colon

Begins:

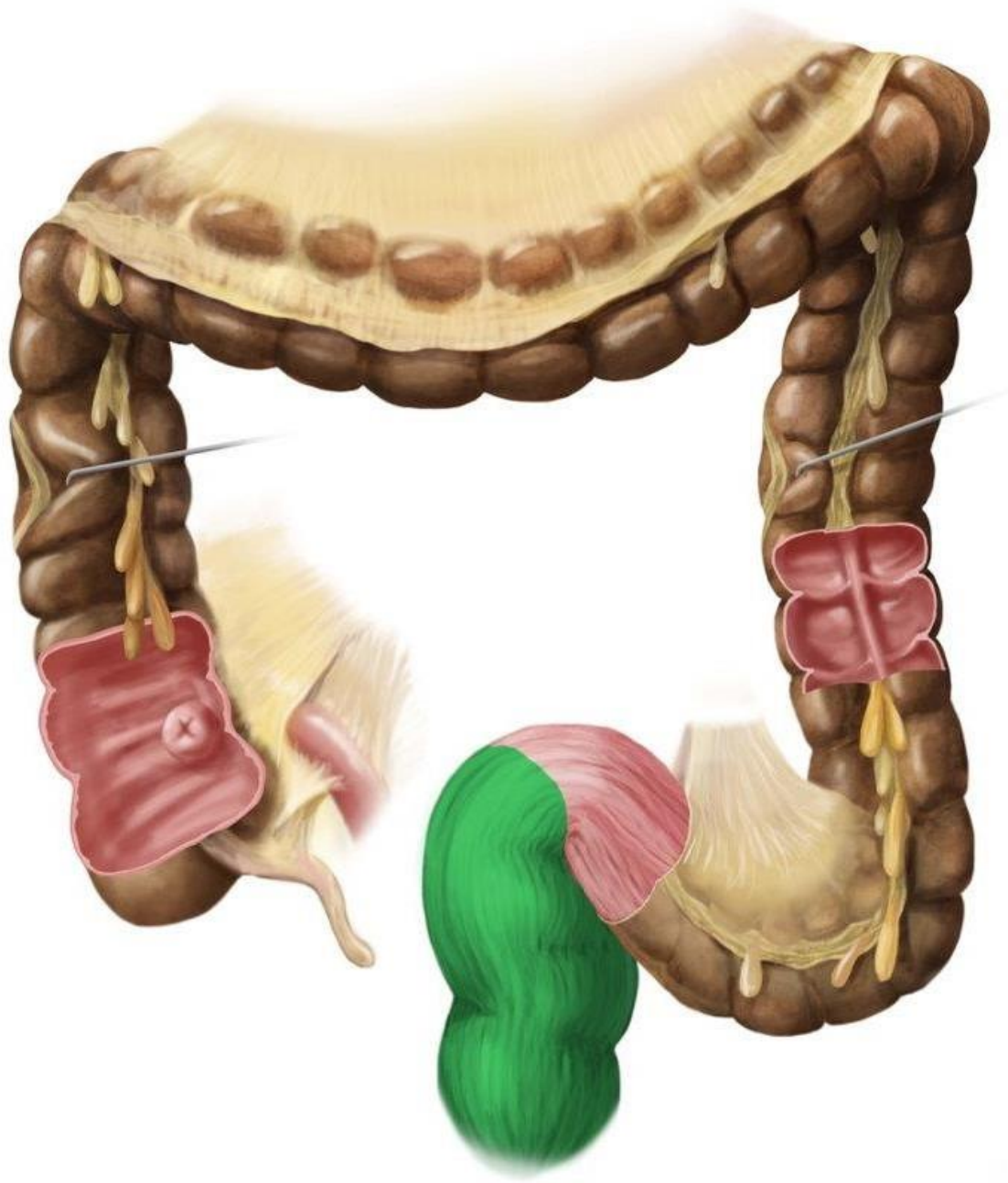
- begins as a continuation of the descending colon Lt side of pelvic brim(inlet of pelvic)
- **Parts of the pelvic colon**
 - Sigmoid colon: it is an intraperitoneal organ (surrounded by a mesocolon), it starts from the left side, deviates, and ends in the front of the middle of the sacrum and continues as Rectum.
 - Rectum: continues as anal canal, the anal canal can be divided into upper and lower parts, the upper part follows the rectum while the lower part is separated.
 - Upper part of the anal canal

Sacrum

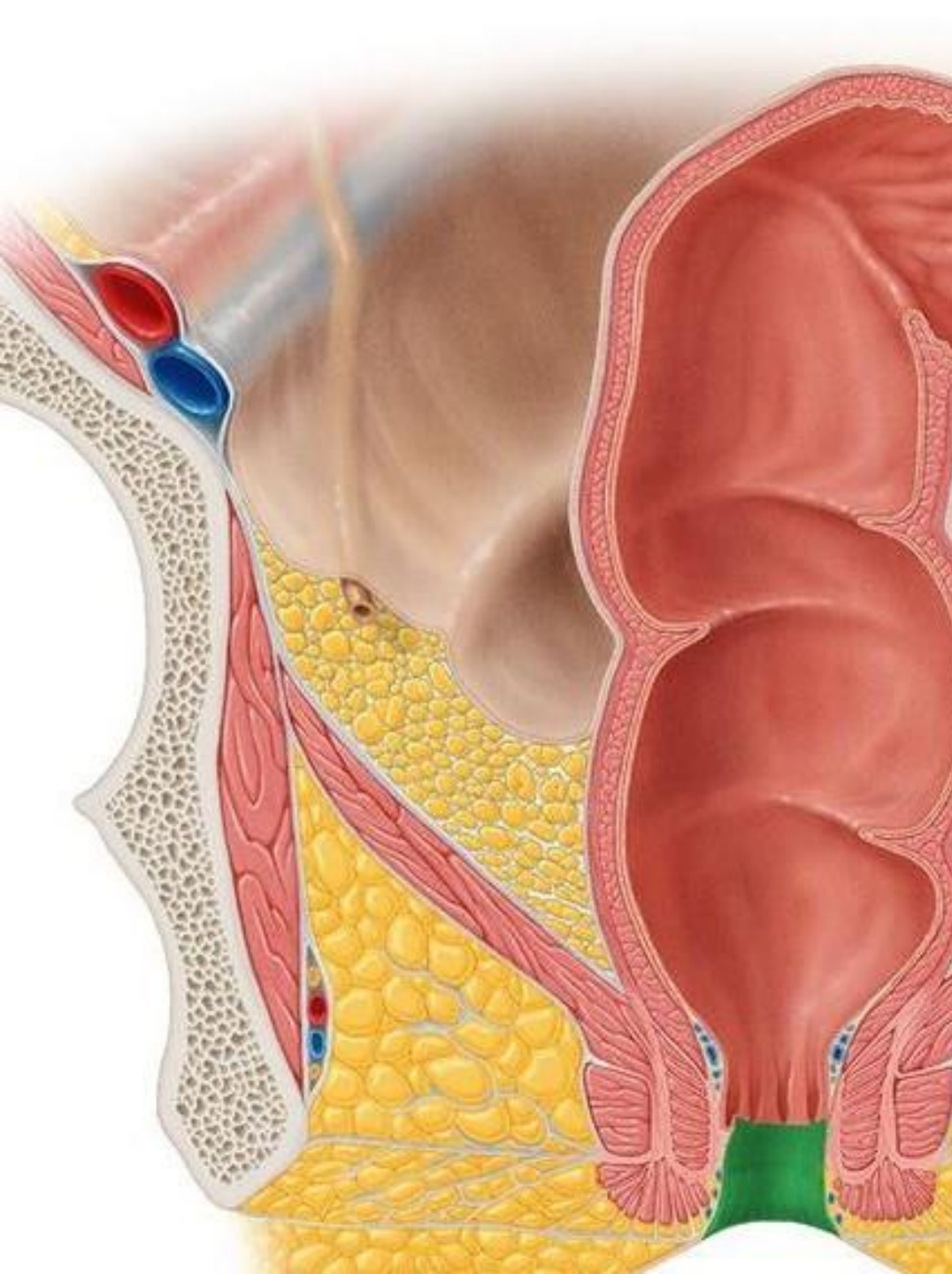




Sigmoid colon



Rectum



anal canal

Sigmoid Colon

This is an inverted picture of the sigmoid colon, see next slide!

Location and Description

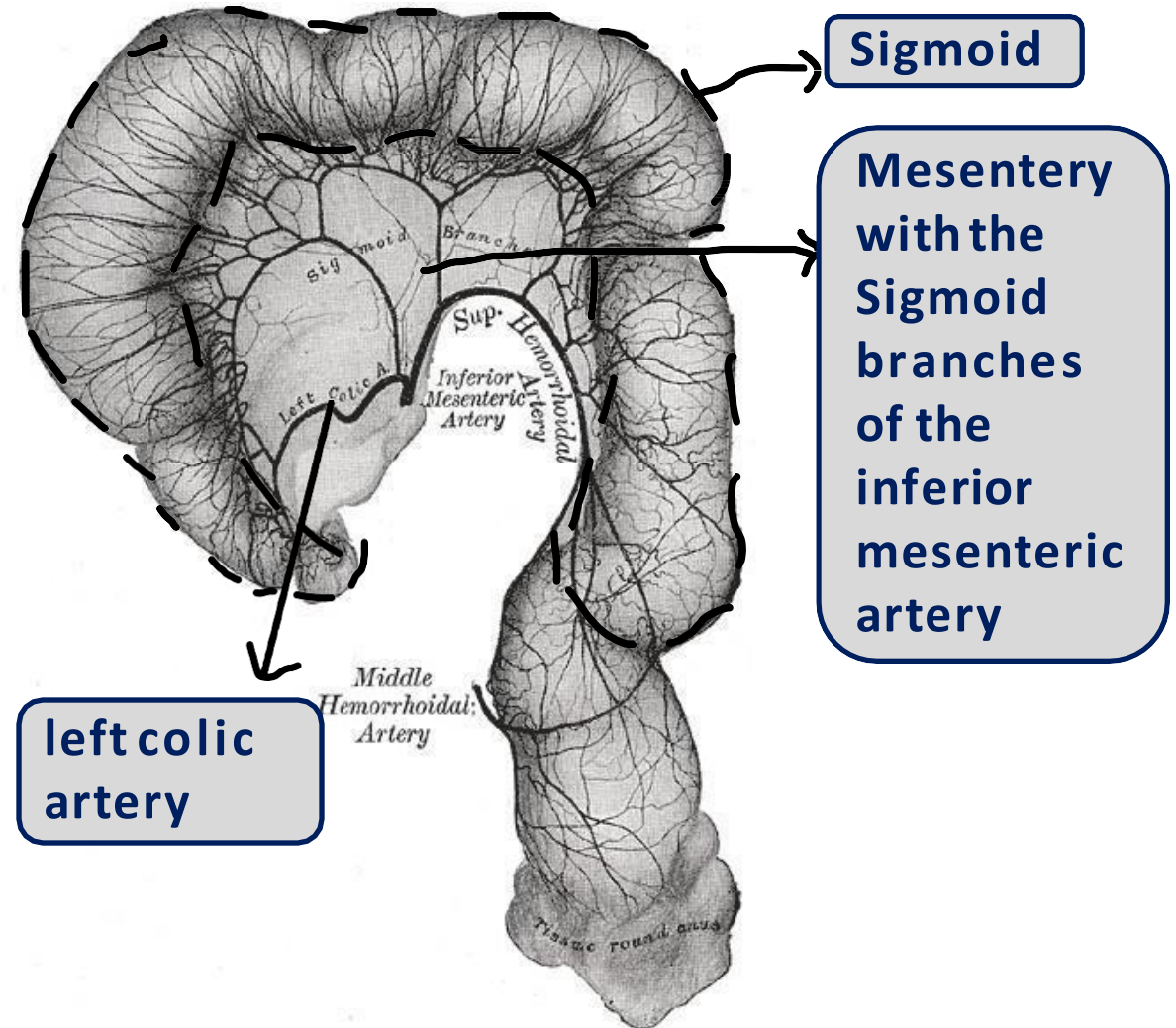
- The sigmoid colon is 10 - 15 in. (25 to 38 cm) long
It is a part of large intestine in pelvic cavity

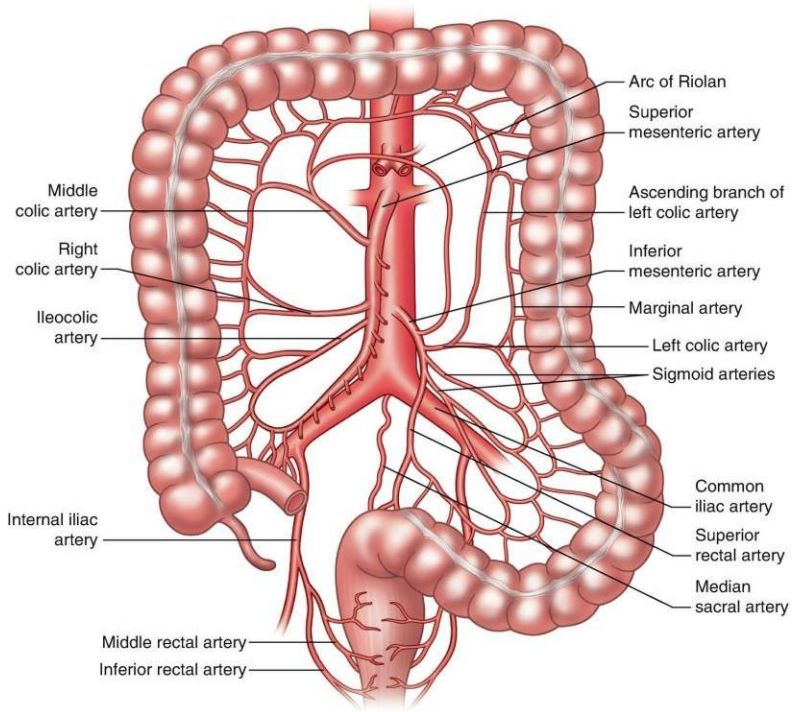
Begin: Lt. side of the pelvic brim (inlet of the pelvis)

End: it becomes continuous with the rectum in front of the third sacral vertebra (mid of the sacrum).

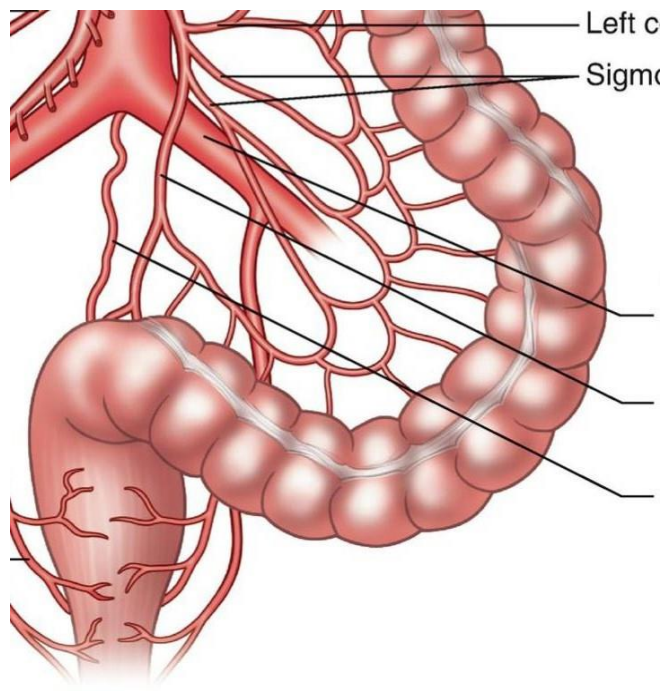
Parts:

- Lateral limb: going and deviating to the left side, contains lower Lt. colic artery
- Medial limb: going to the middle of sacrum contains superior Rectal artery which is a continuation of inferior mesenteric artery, it supplies the rectum since it descends in front of the sacrum.
- Free margin: curved to Rt. of midline
- Root: has an inverted V shape attachment (mesentery), one of the V lips goes laterally to the left external iliac artery while the second one goes medially in front of the sacrum and attach to it.

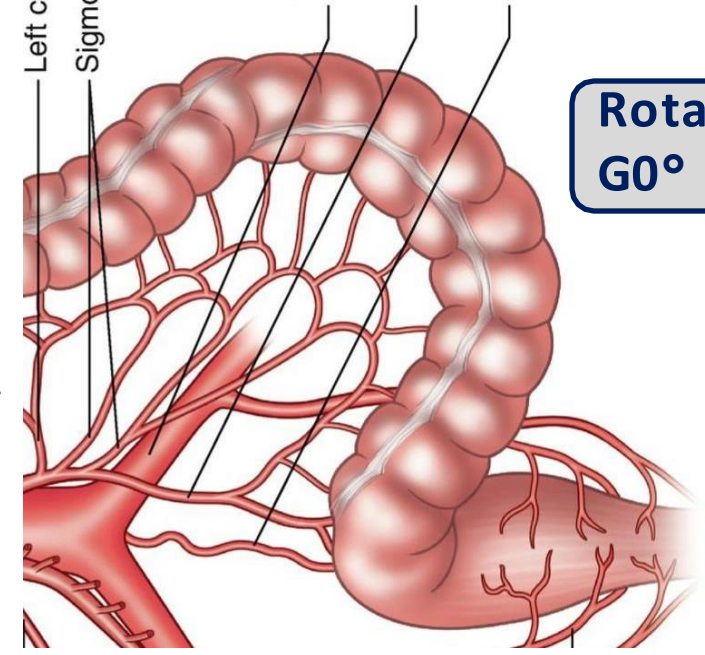




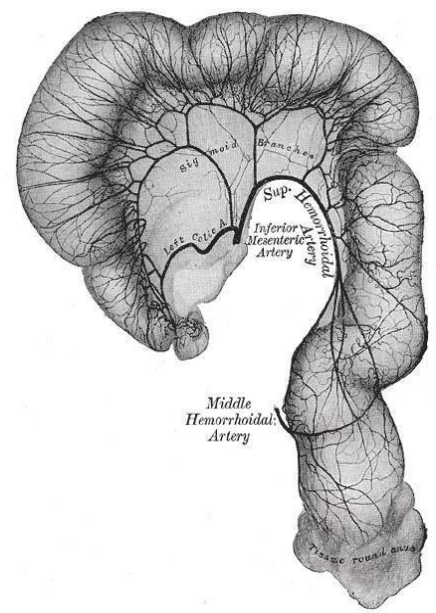
Mesentery and blood vessels



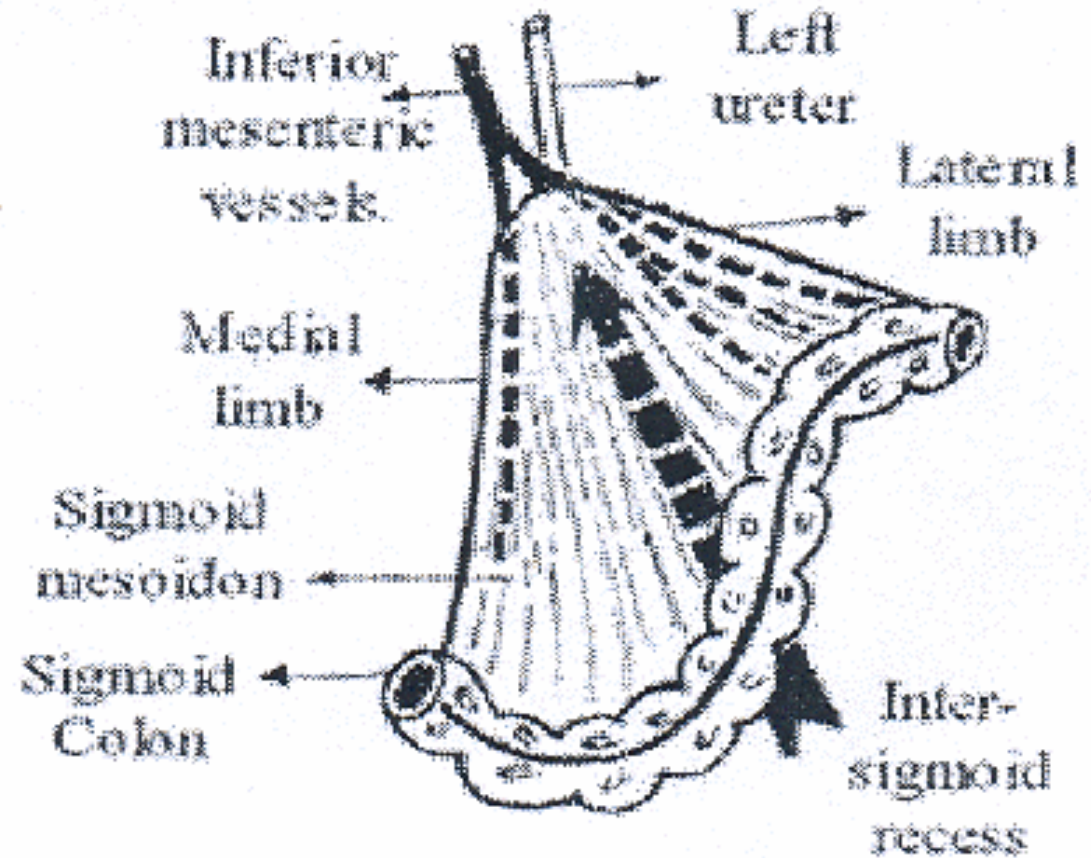
Zoomed picture of Sigmoid colon



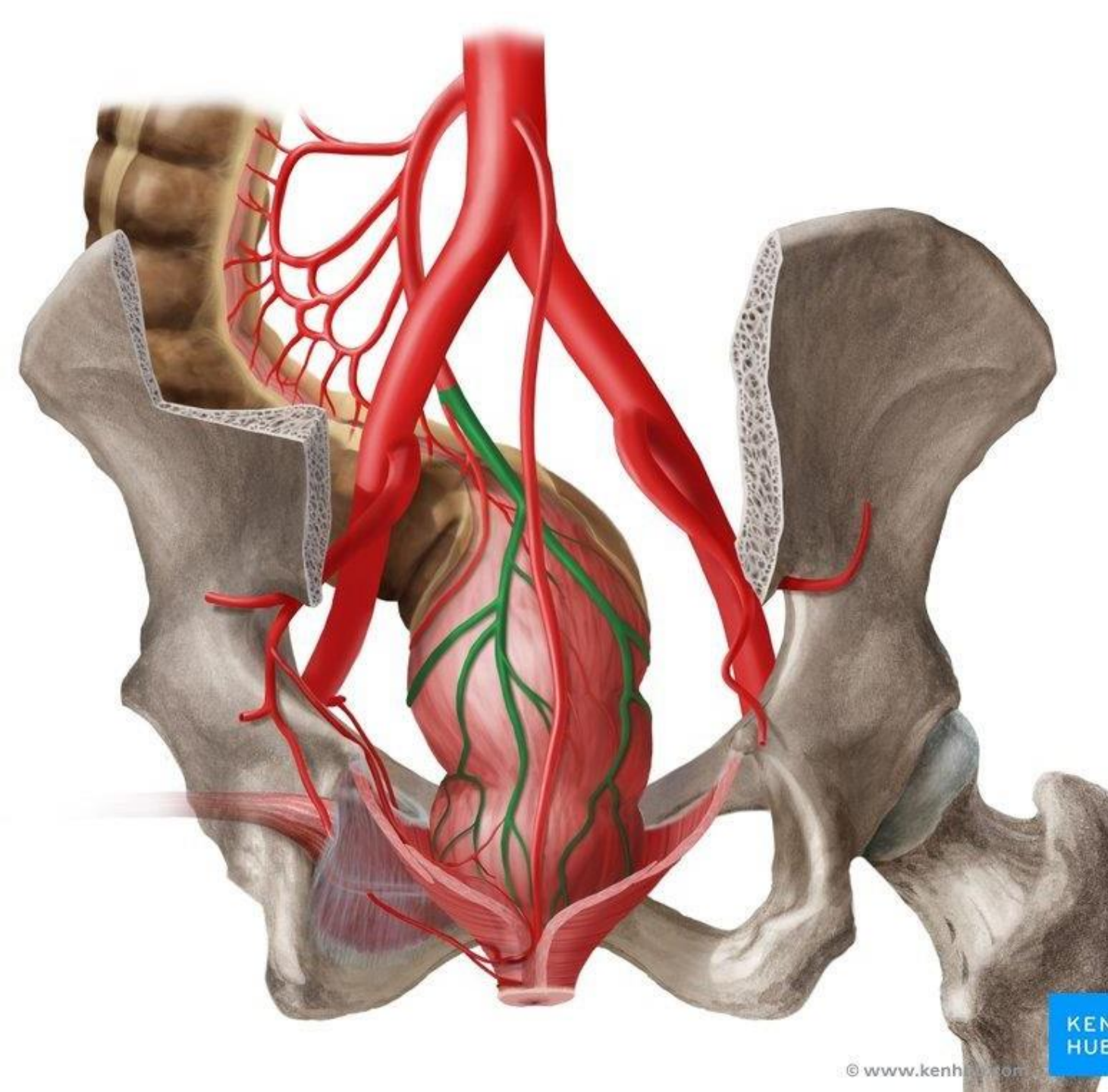
Rotate 90°



Extra note: medial and lateral limbs refer to the mesentery rather than the organ itself.



*** Sigmoid mesocolon ***
and inter- sigmoid recess



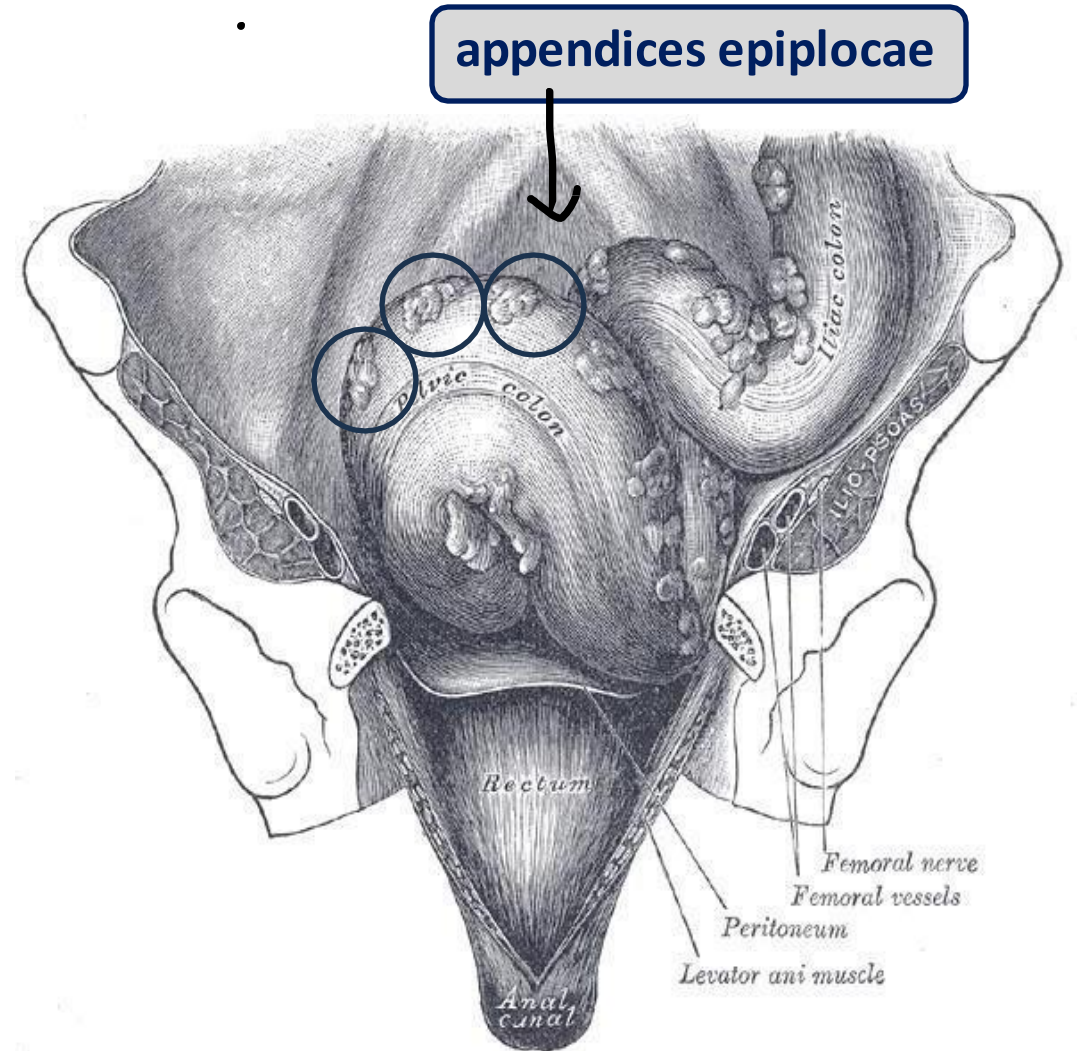
superior
rectal artery

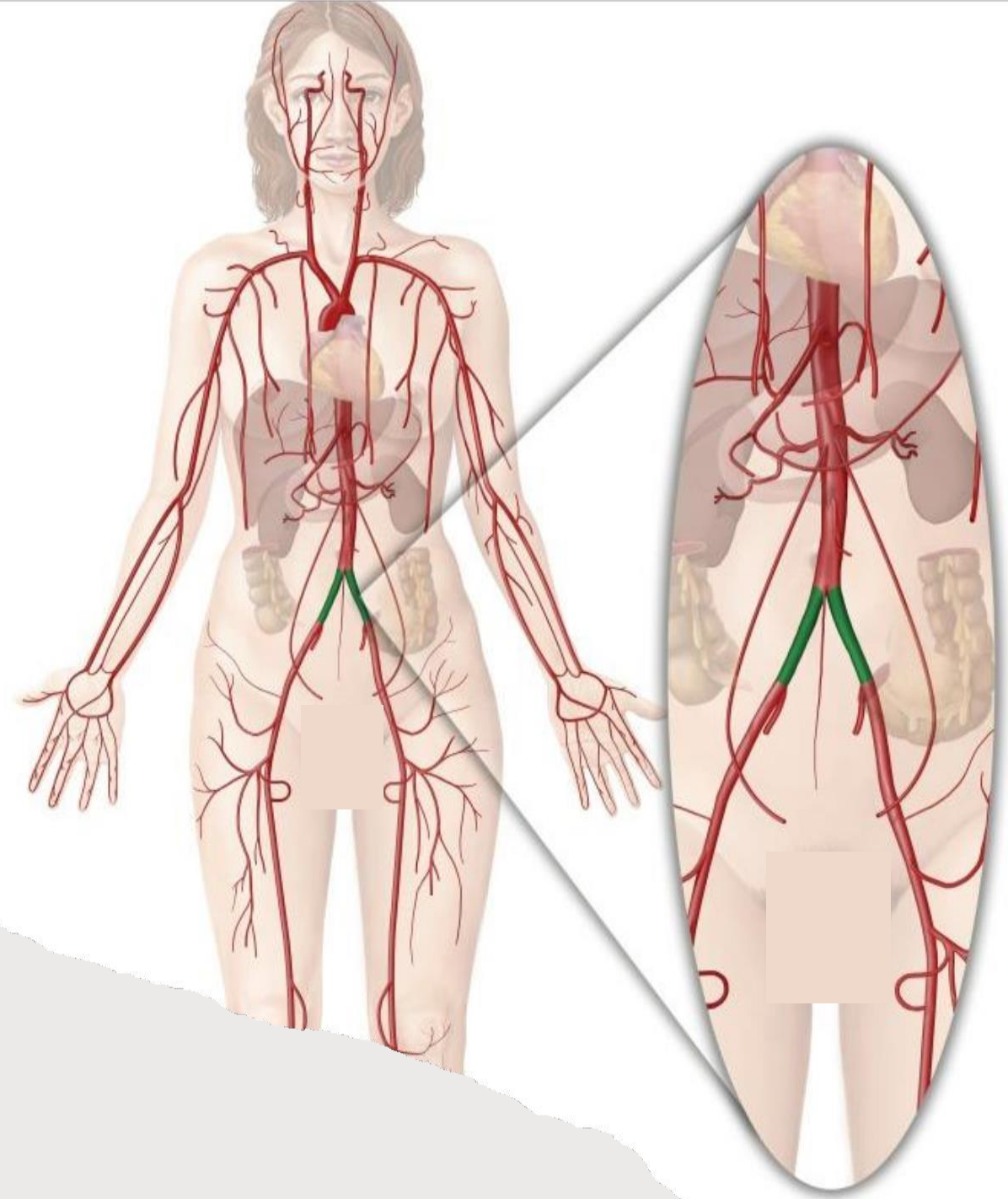
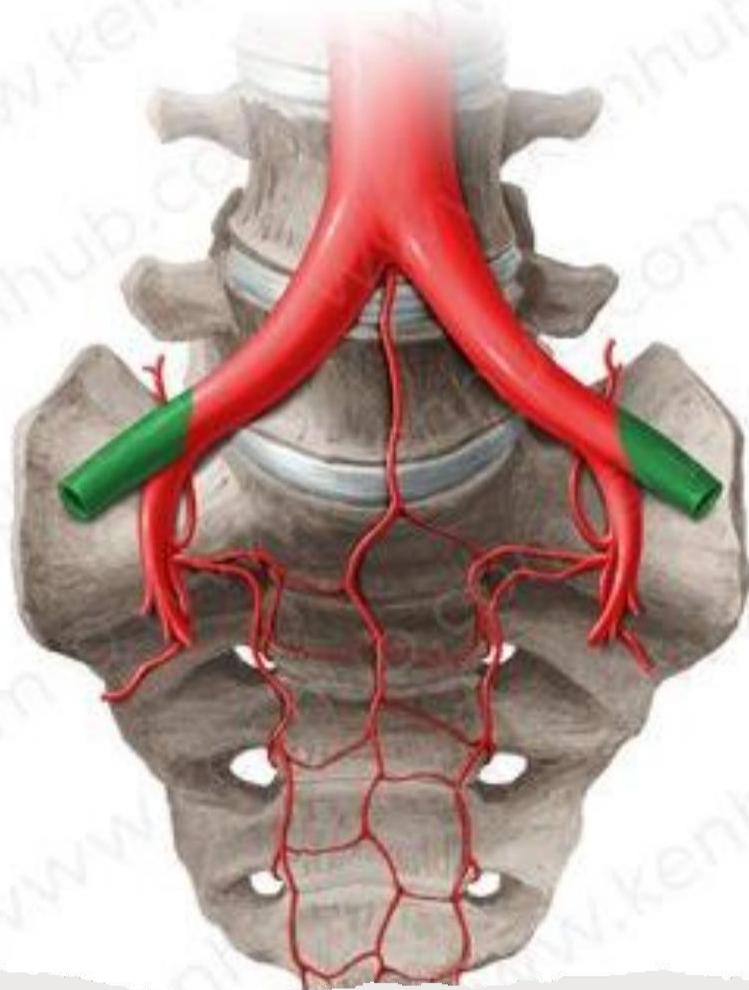
Pelvic colon.....cont

- The sigmoid colon is mobile and hangs down into the pelvic cavity in the form of a loop.
- It is attached to the posterior pelvic wall by the **fan-shaped sigmoid mesocolon**.

Attachment of the root of mesocolon

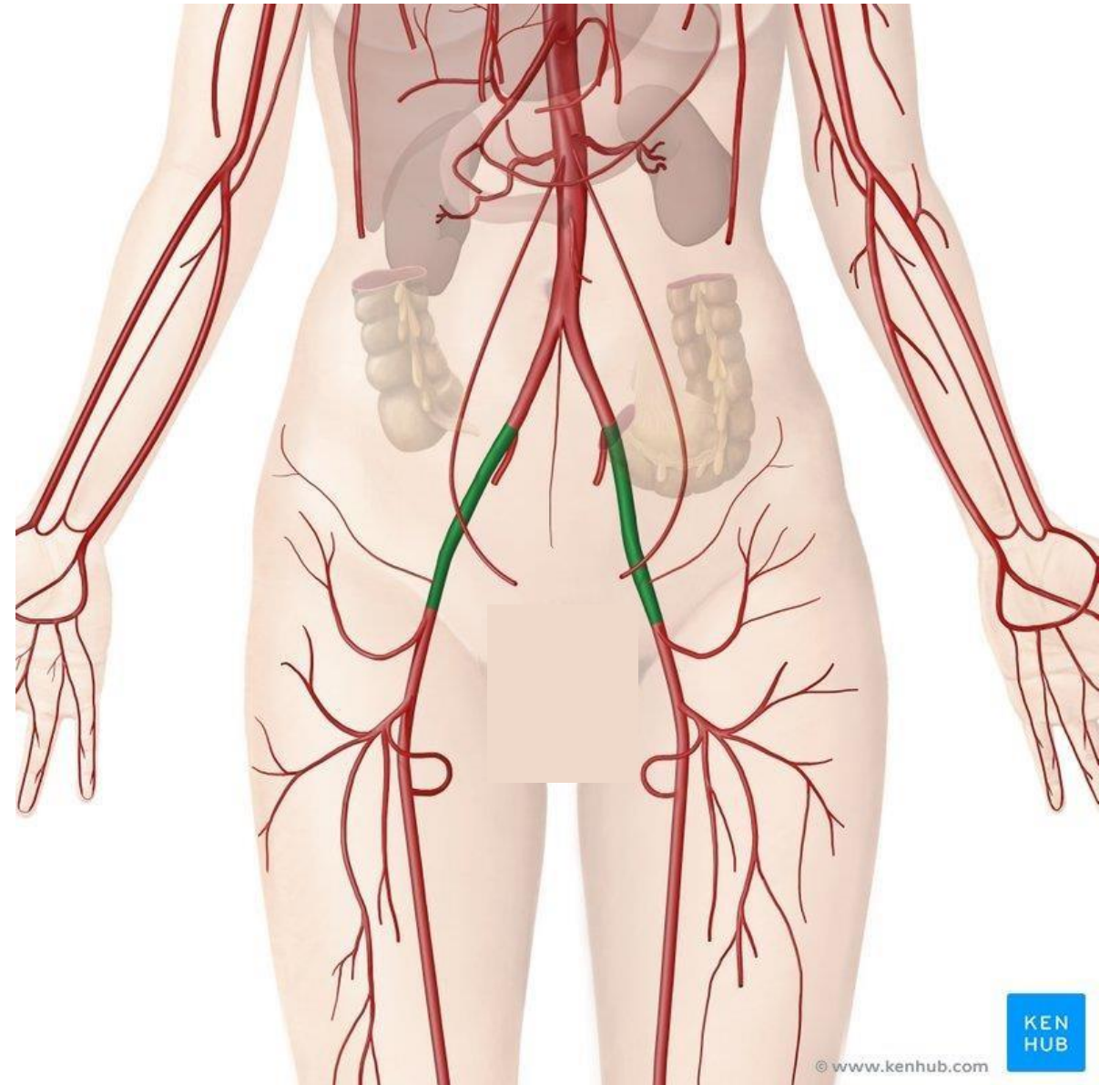
- **Medially: At middle piece of sacrum**
- **Laterally: Bifurcation of left common iliac artery and then continues with Middle of Left External iliac artery.**
- **The appendices epiploicae (tags of fat) are extremely abundant along the sigmoid colon.** (omental appendages) are very long in the sigmoid colon





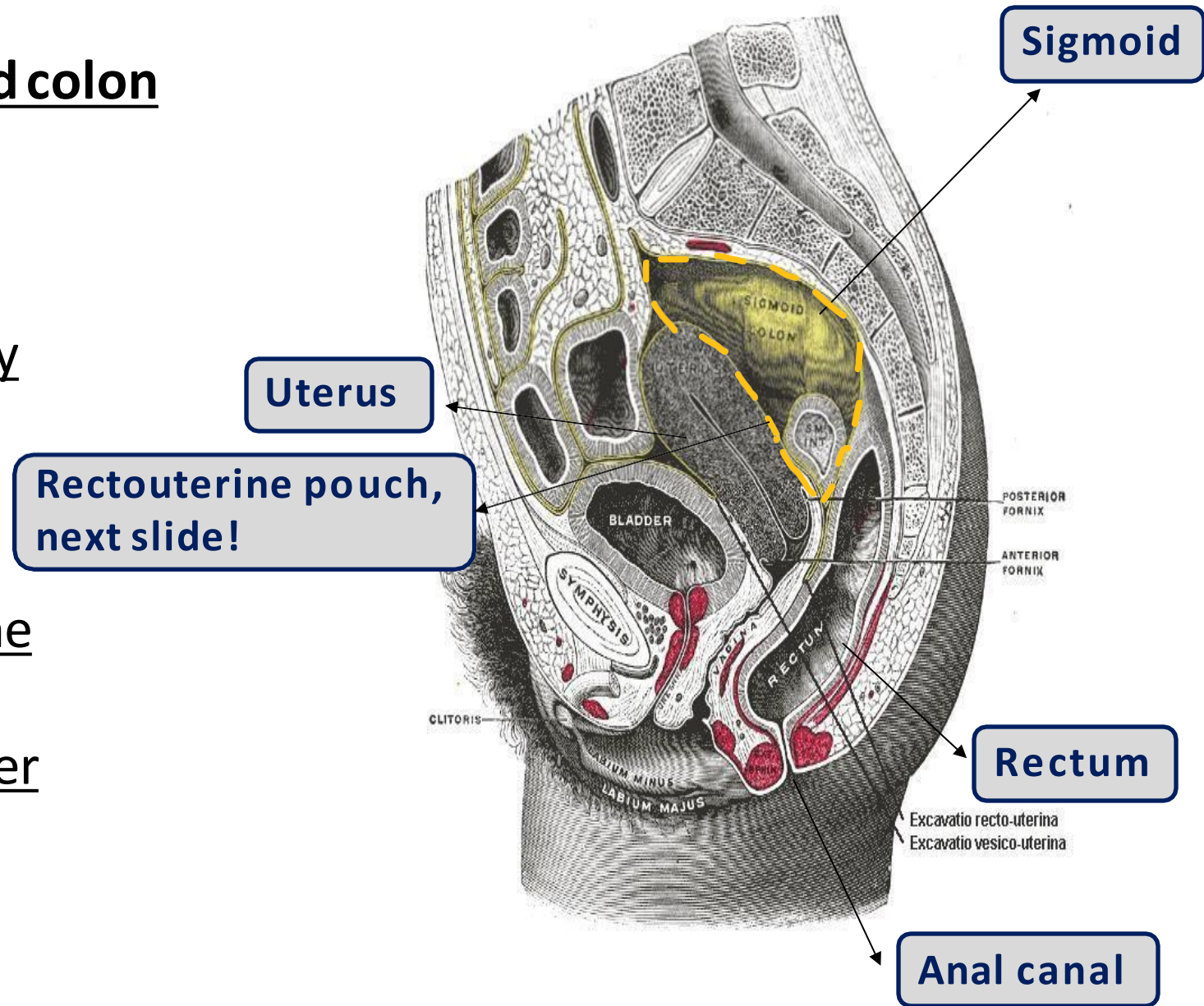
common iliac artery

external iliac artery



- Relations of sigmoid colon
- Left
 - Lt.Ext. iliac vesseles
 - Lat.wall of pelvis
 - Vasdefferance or ovary
- Right
 - Small intestines
- Superior
 - Coils of small intestine
- Inferior
 - In mal: urinary blabber
 - In femal : uterus

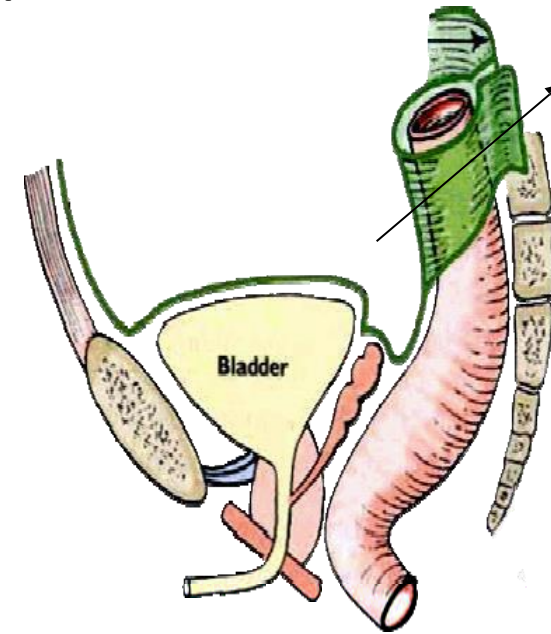
Mid-sagittal section



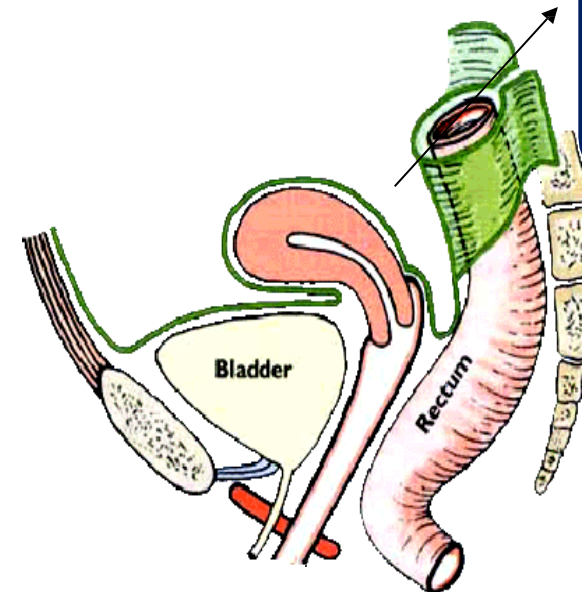
Relations of sigmoid colon

- **Posteriorly:**
- The rectum
- the sacrum.
- the lower coils (of small intestine) of the terminal part of the ileum
- Sacral plexus with the sacral nerves
- Left periformis muscle, which takes origin from sacrum.
- Left external iliac vessels
- Left Ureter
- Left internal common iliac Artery. So, internal and external iliac arteries are found posteriorly since the bifurcation of the common ilia artery is behind the sigmoid.

- The sigmoid colon usually occupies the **rectovesical** (between urinary bladder and rectum) **pouch in males** and the **rectouterine** (between uterus and rectum) **pouch in females.** Both can also be called Douglas pouch.



Sigmoid is located here (male)



Sigmoid is located here (female)

Blood Supply of sigmoid colon

- **Arteries**

- Sigmoid branches of the inferior mesenteric artery **Through the mesentery.**

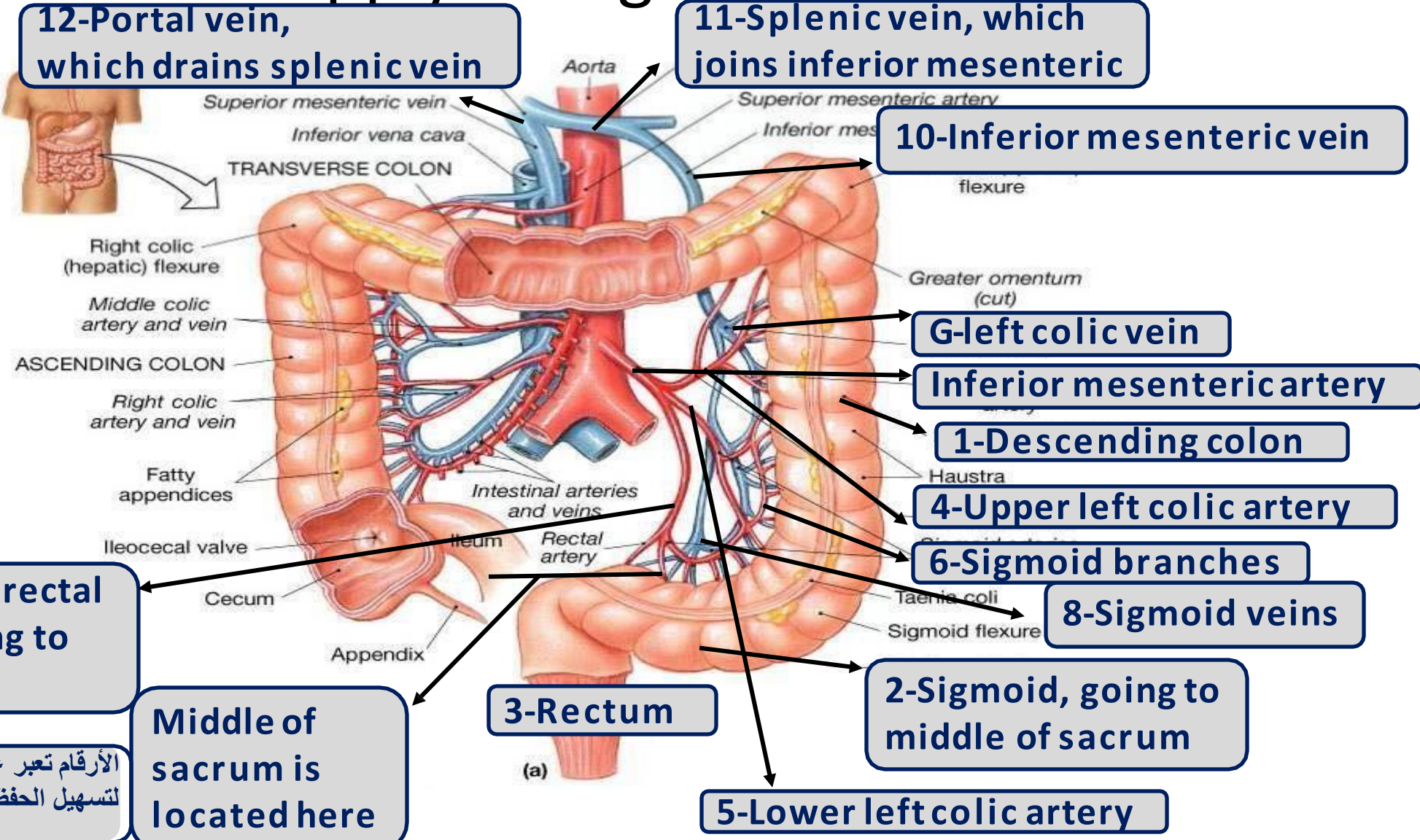
- The **most superior sigmoid artery** anastomoses with the descending branch of the **left colic artery**.

- **Veins**

- The veins drain => the inferior mesenteric vein => the portal venous system.

Very important picture for both practical and theoretical exams.

Blood supply for sigmoid colon



12-Portal vein, which drains splenic vein

11-Splenic vein, which joins inferior mesenteric

10-Inferior mesenteric vein

G-left colic vein

Inferior mesenteric artery

1-Descending colon

4-Upper left colic artery

6-Sigmoid branches

8-Sigmoid veins

2-Sigmoid, going to middle of sacrum

3-Rectum

5-Lower left colic artery

7-Superior rectal artery, going to the rectum


Middle of sacrum is located here

الأرقام تعبر عن ترتيب الدكتور لذكر الأجزاء فقط, لتسهيل الحفظ عليكم امشوا عتسلسلهم

Blood supply for sigmoid colon

One important thing to notice is that arteries are always internal (medial) in comparison to veins (external or lateral), inferior mesenteric artery is internal while the vein is external, left colic artery is internal while vein is external, superior mesenteric artery is internal while vein is external.

Lymph Drainage of sigmoid colon

- The lymph drains into nodes along the course of the sigmoid arteries  the inferior mesenteric nodes.
which drain into paraaortic lymph nodes.

Nerve Supply of sigmoid colon

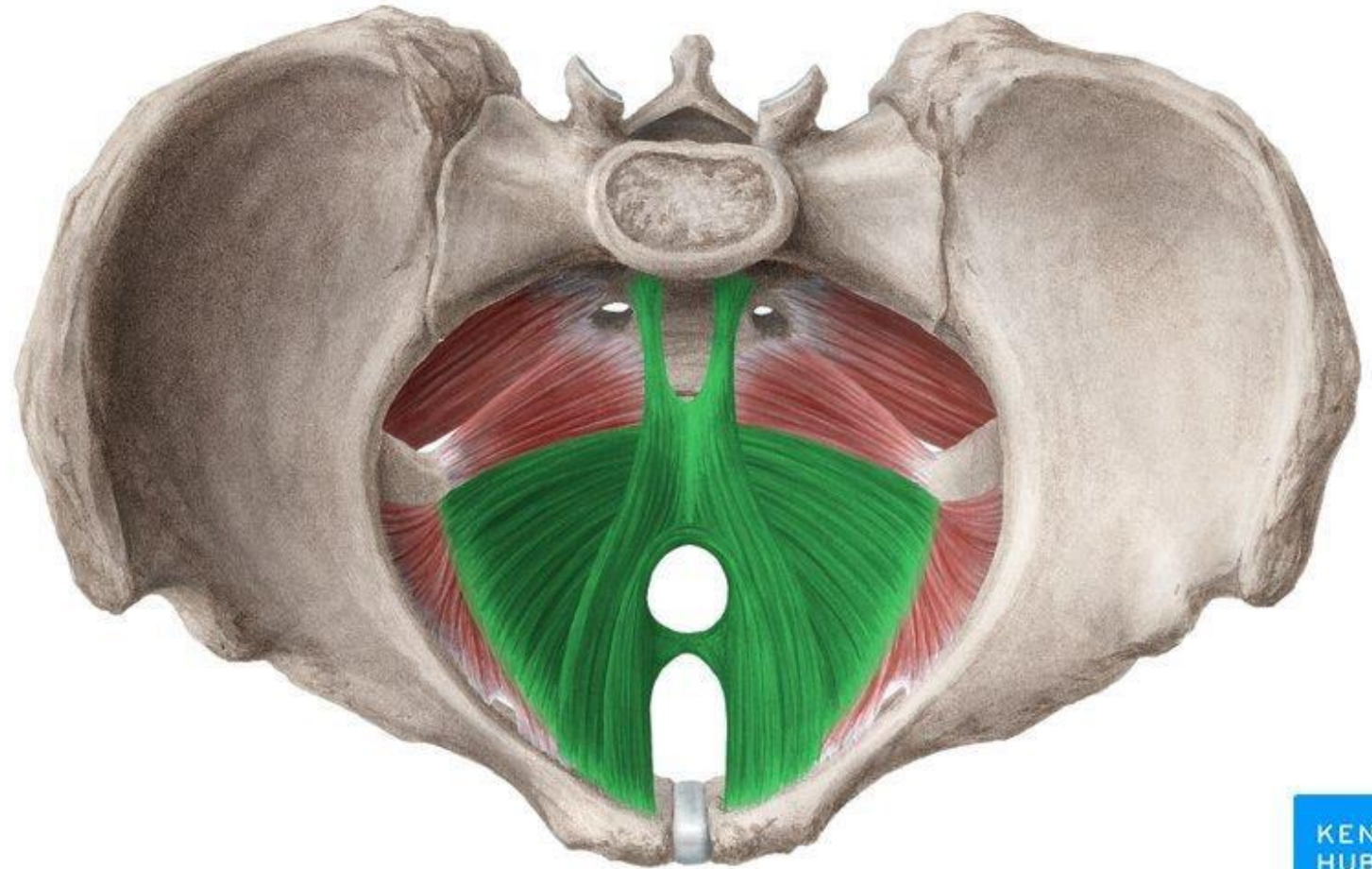
- The sympathetic and parasympathetic nerves from the inferior hypogastric plexuses
- Emerging from this plexus are splanchnic nerves, the parasympathetic supply is derived from the S2/S3/S4 pelvic splanchnic nerves, while the sympathetic supply is derived from L1/L2 pelvic splanchnic nerves.

Rectum

Location and Description

- The rectum is about 5 in. (13 cm) long
- begins in front of (middle of sacrum) the third sacral vertebra as a continuation of the sigmoid colon.
- ends in front of the tip of the coccyx by piercing the pelvic diaphragm and becoming continuous with the anal canal.
- The lower part of the rectum is dilated to form the **rectal ampulla**, which is a dilation at the lower end of the rectum, it acts a reservoir of feces.
- The rectum deviates to the left, but it quickly returns to the median plane
- On lateral view, the rectum follows **the anterior concavity** of the sacrum before bending downward and backward at its junction with the anal canal
- **The puborectalis** muscle which is a **portion of the levatorani muscles** (levator ani is sometimes called diaphragm of the pelvis) separates the rectum from anal canal, it originates from pubis and ends as a sling at the junction of the rectum with the anal canal and pulls this part of the bowel forward, producing the anorectal angle.

Puborectalis muscle



Rectum

Ischiorectal fossa

longitudinal folds

Rectum

Inferior rectal nerve carrying vessels and crossing ischiorectal fossa to reach external anal sphincter

Internal anal sphincter

External anal sphincter

Pectinate line

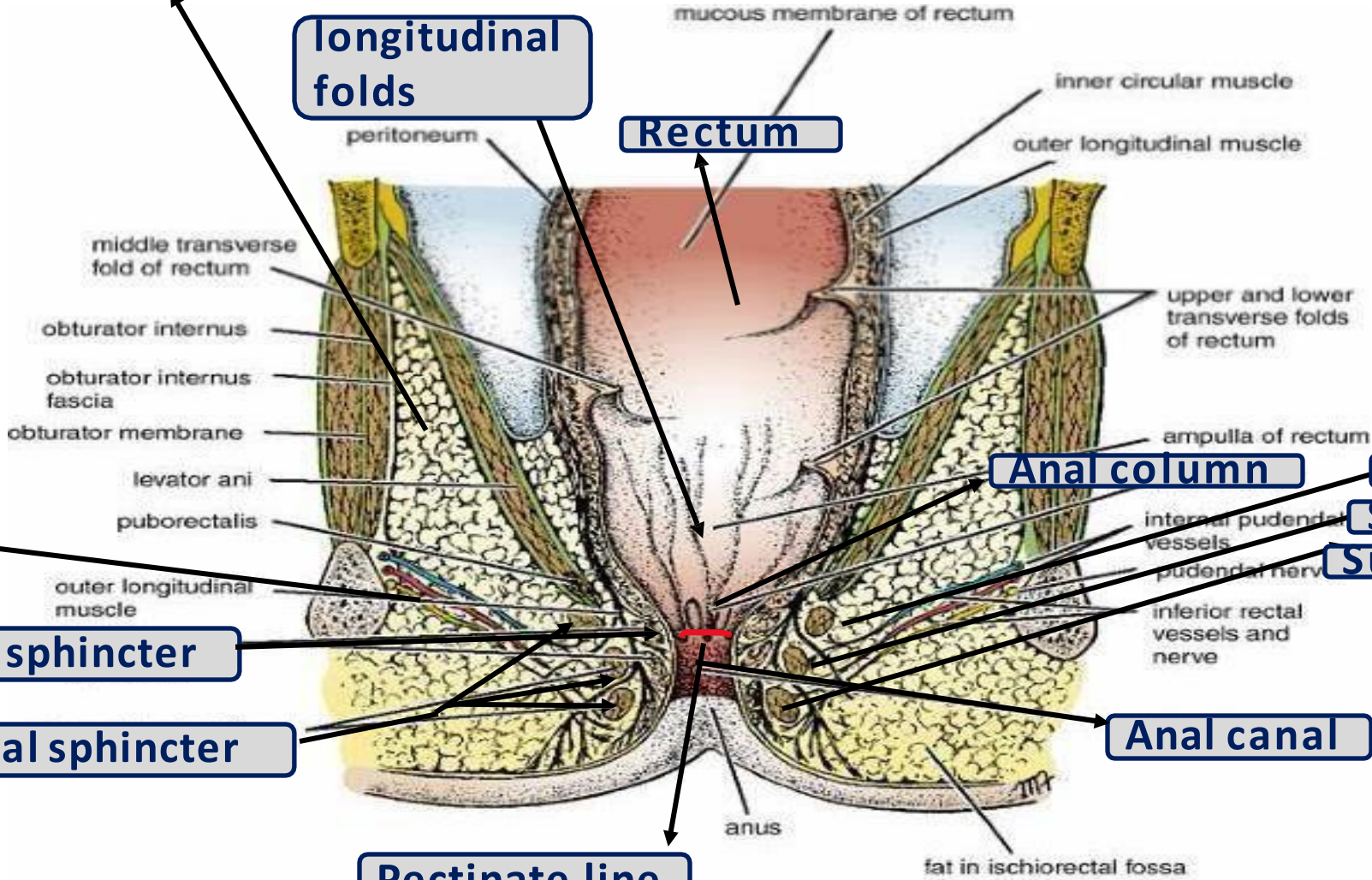
Anal column

Deep

Superficial

Subcutaneous

Anal canal



Rectum

Some notes about the previous picture:

The anal column is the anal canal that is part of the rectum.

Anal canal is divided into upper 2cm and lower 2cm.

The upper 2cm are above pectinate line, the lining epithelium is simple columnar with goblet cells.

The lower 2cm are below pectinate line, 1cm is stratified squamous non-keratinized while the other 1cm is stratified squamous keratinized with abundant hair follicles, sweat and sebaceous glands.

Longitudinal folds of mucosa come from rectum to anal canal and form anal valves and sinuses, below these valves and sinuses is pectinate line, which is found at the end of these longitudinal folds.

Sphincters of anal canal can be divided into internal and external.

Internal anal sphincter is involuntary, it is sensitive to stretch (supplied by sympathetic and parasympathetic innervations).

External anal sphincter is more important because its voluntary, it is divided into 3 parts (deep, superficial, subcutaneous). it is supplied by inferior rectal nerve (branch of S4).



Any damage to inferior rectal nerve (S4)can cause dysfunction of external sphincter and thus "incontinence"

الشخص ما بتحكم بالبراز تبعه

If you look at the rectum from anterior view you can see anterior concavity, it is moving with the concavity of the sacrum.

But if you look from lateral side, it looks like ξ .

It's the opposite on the left

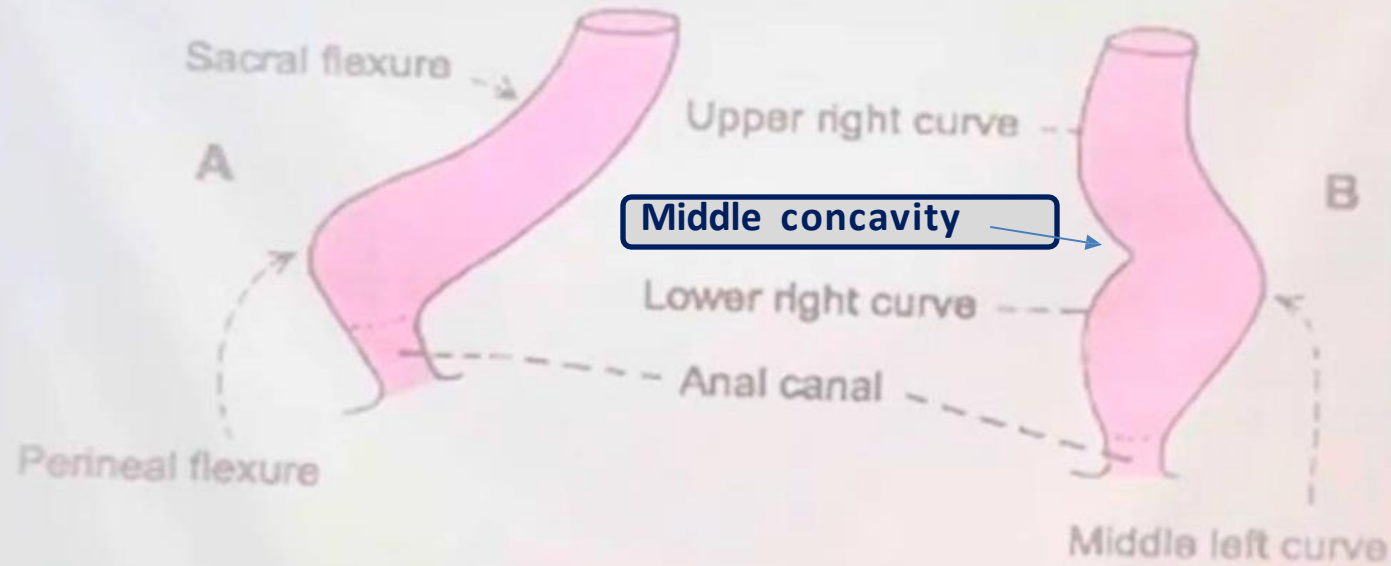
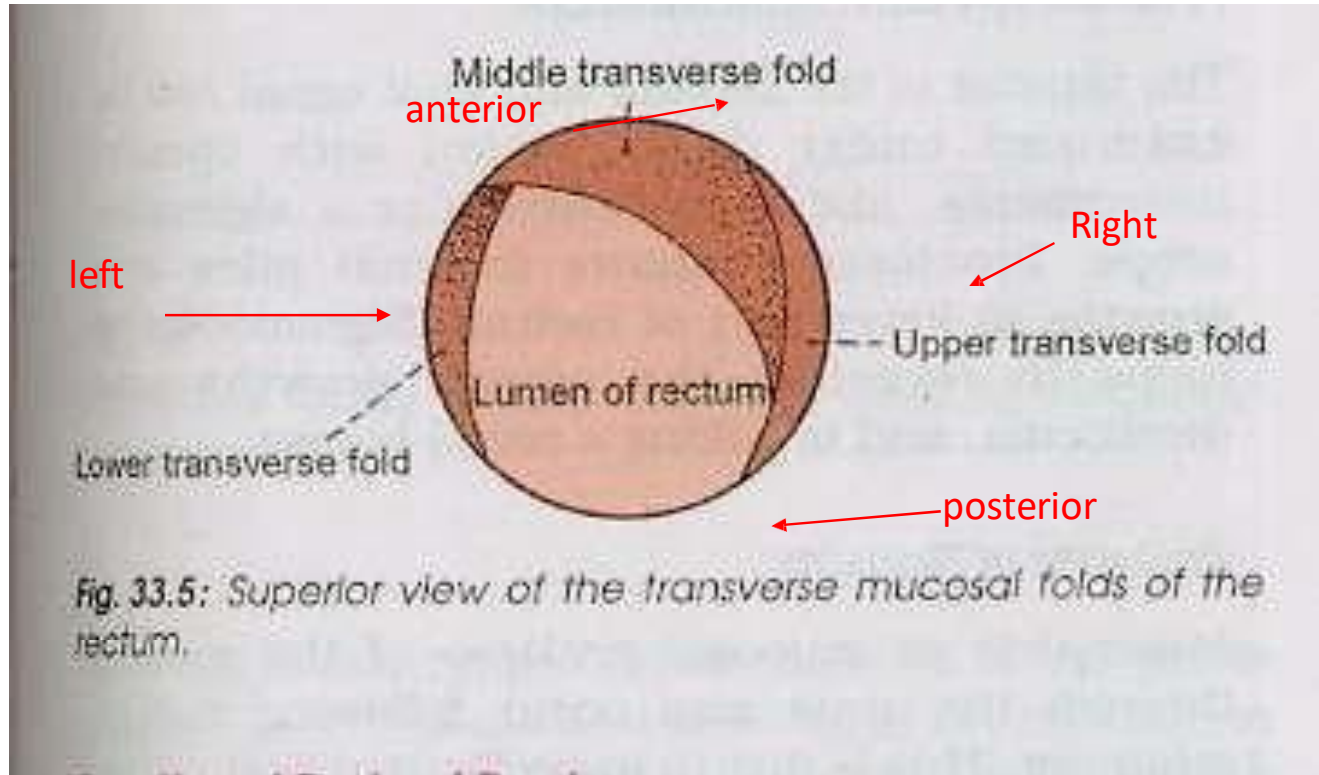


Fig. 33.2: Curvatures of the rectum. (A) Anteroposterior curves; and (B) side to side (lateral) curves.



Mucosal folds: the transverse or horizontal folds or **Houston's valve:** upper fold projects from right, middle fold projects from anterior and right wall, lowest fold projects from left wall.

rectum.....cont

Relationship between peritoneum and rectum:

- The peritoneum relationship is divided into 3 parts:
- first third: covers the rectum's anterior and lateral surfaces.
- middle third: only the anterior surface of the rectum, giving us the pouches (pouch of Douglas).
- the lower third: devoid of peritoneum .

Relations of rectum(imp)

- **Posteriorly:**
 - The rectum is in contact with the sacrum and coccyx
 - the piriformis muscle
 - Coccygeus muscle
 - levator ani muscle
 - the sacral plexus
 - the sympathetic trunks.

- **Anteriorly:**

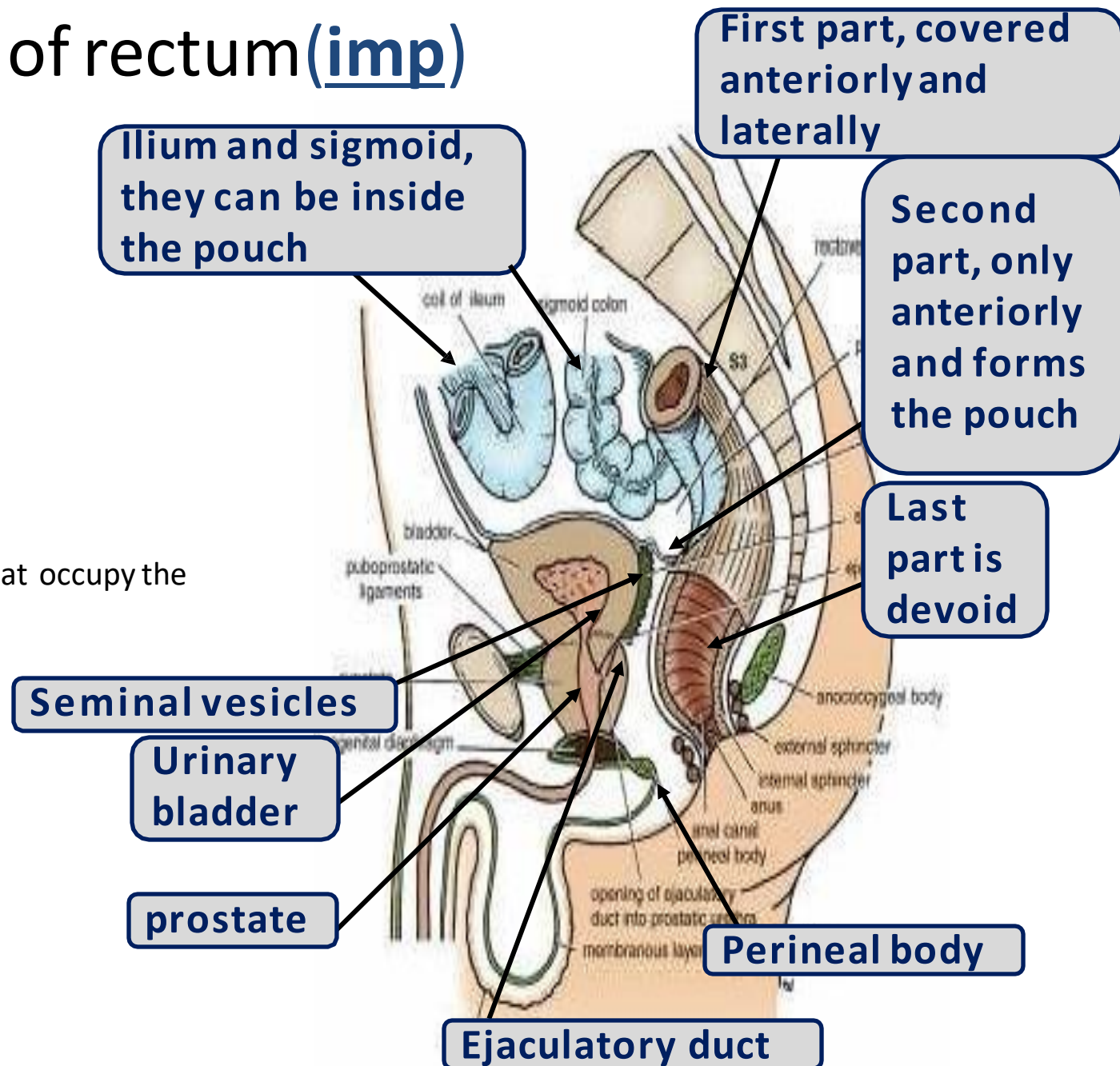
- 1- In the **male**

The upper two thirds of the rectum

- It is covered by peritoneum
- It is related to the sigmoid colon and coils of ileum that occupy the rectovesical pouch.

The lower third of the rectum

- It is devoid of peritoneum
- It is related to the posterior surface of the bladder
- to the termination of the vas deferens
- the seminal vesicles on each side
- and to the prostate





Some notes about the relations of rectum:

-per rectal examination is an examination done by putting the index finger in the anal canal. Anteriorly, you must feel the prostate, seminal vesicles, perineal body and maybe the urinary bladder.

In old male patients(>40), you should always check the prostate for hypertrophy as it may indicate cancer, soft prostate = normal, hard = hypertrophy.

-perineal body is a fibrous tissue that can be felt midway between urethra and anus.

-ejaculatory duct opens into prostatic urethra.

Relations of rectum...cont

Anteriorly:

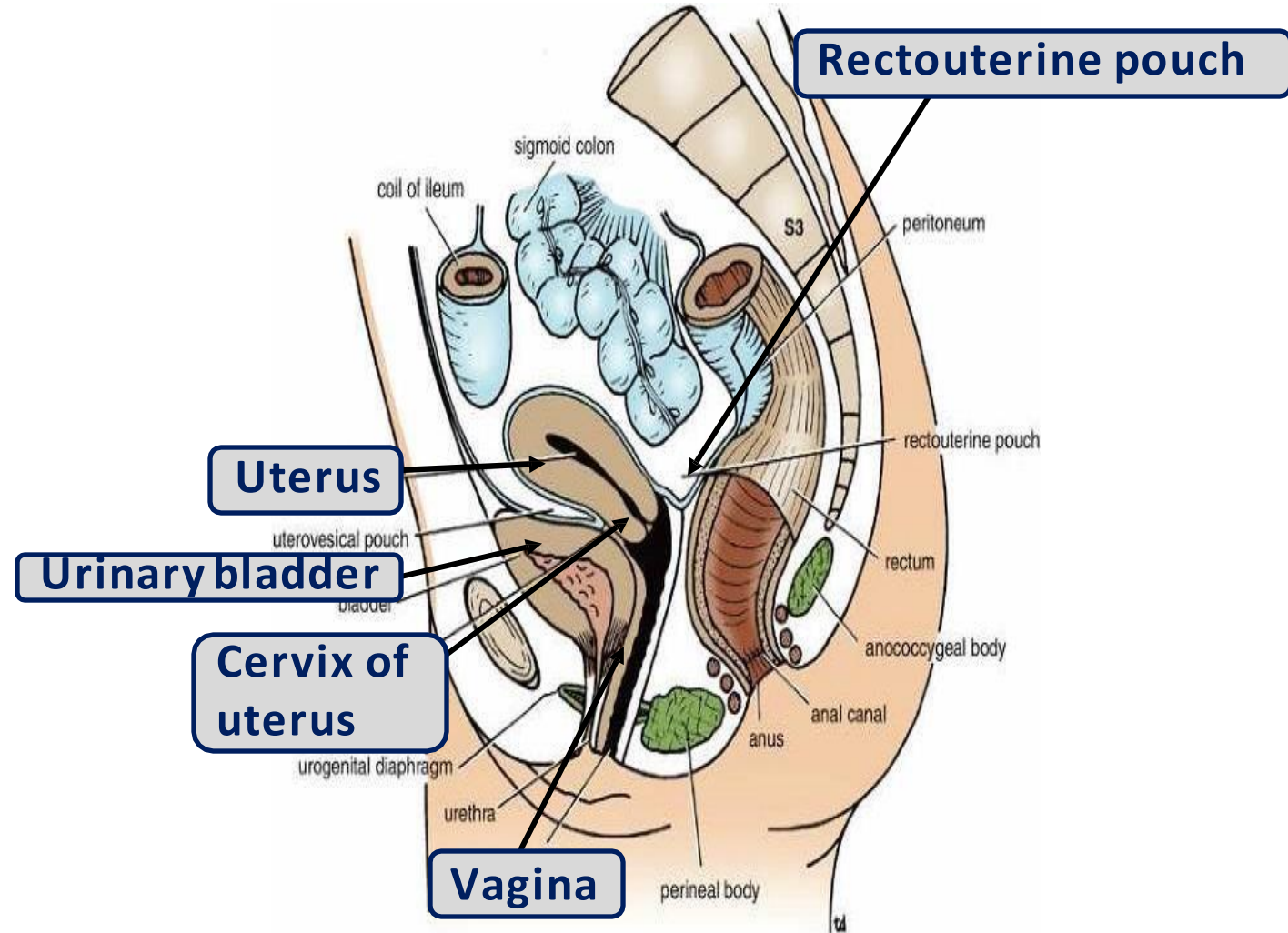
2- In the **female**

The upper two thirds of the rectum

- It is covered by peritoneum
- It is related to the sigmoid colon and coils of ileum that occupy the rectouterine pouch (pouch of Douglas).

The lower third of the rectum

- It is devoid of peritoneum
- It is related to the posterior surface of the vagina.
- Unlike in males, the urinary bladder **cannot** be felt anteriorly since it is separated from rectum by the vagina.
- If there is a tumor in the Cervix it can be felt in female



Relations of rectum (posteriorly)

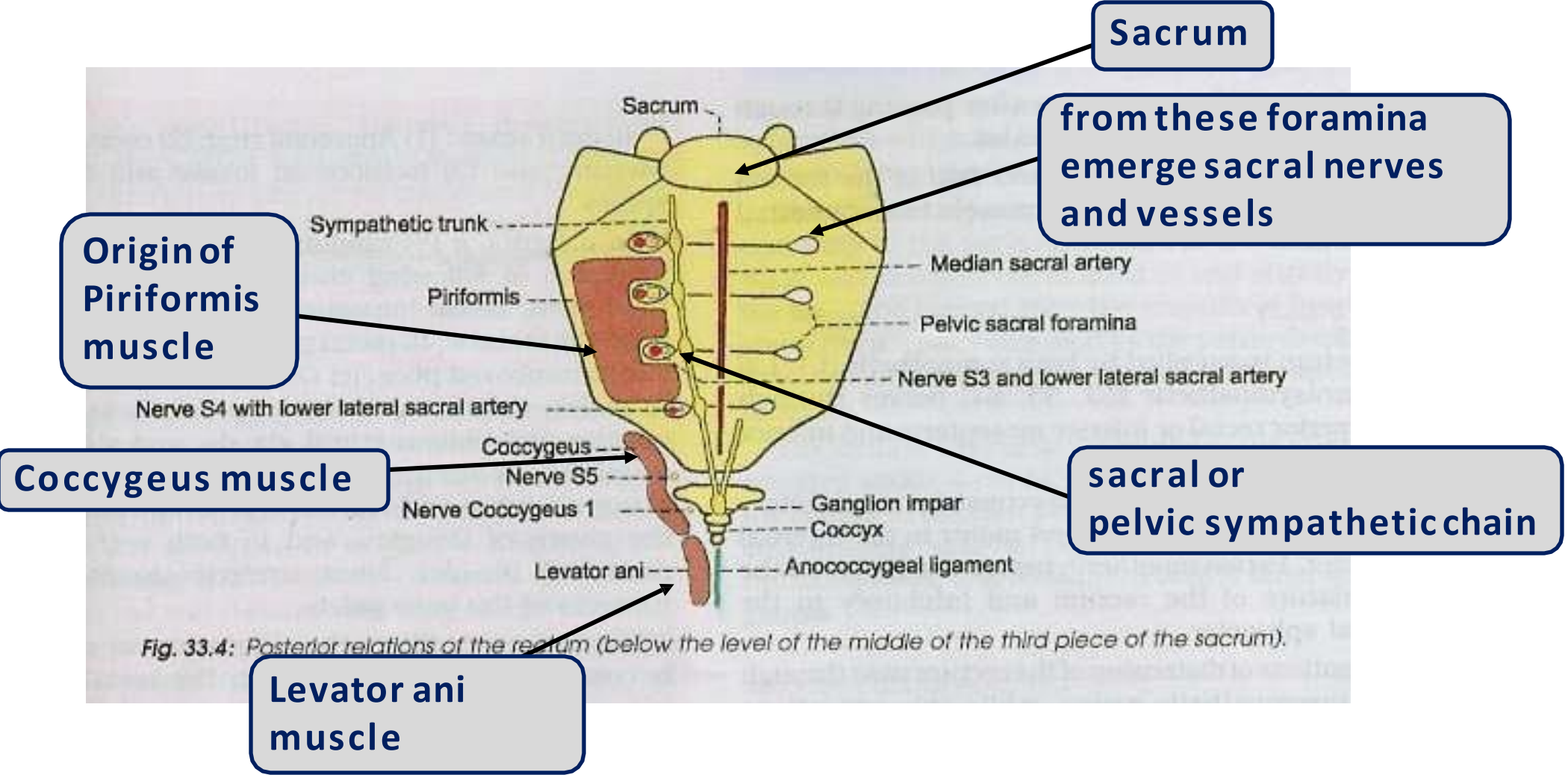
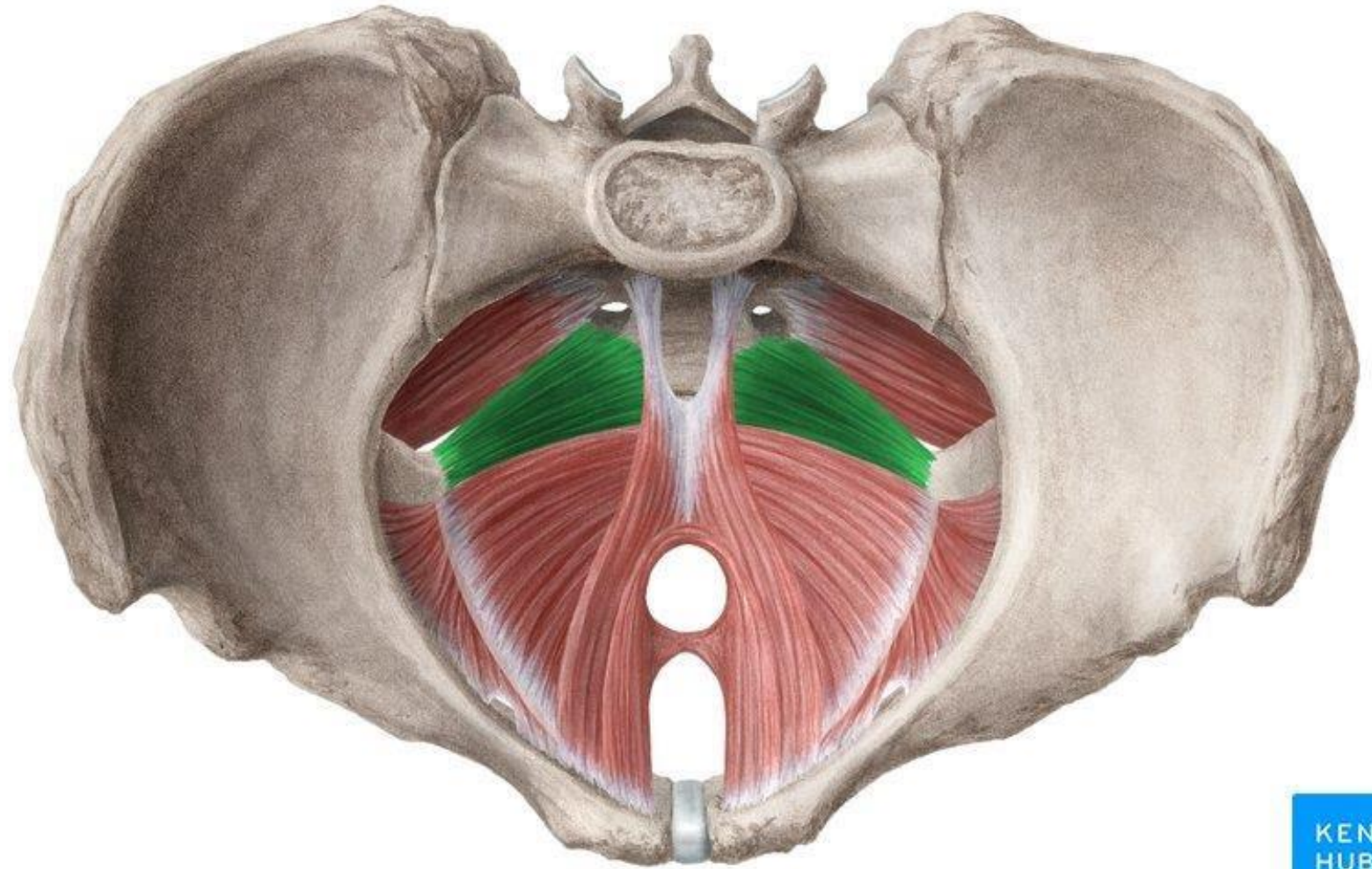
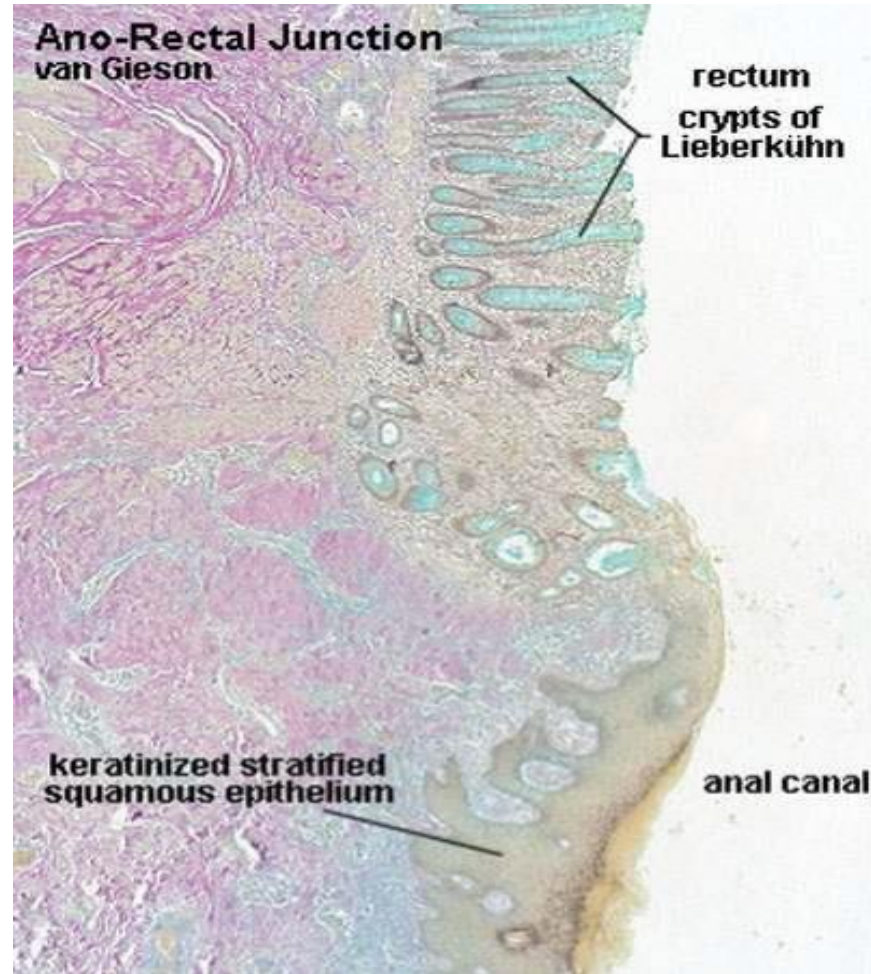
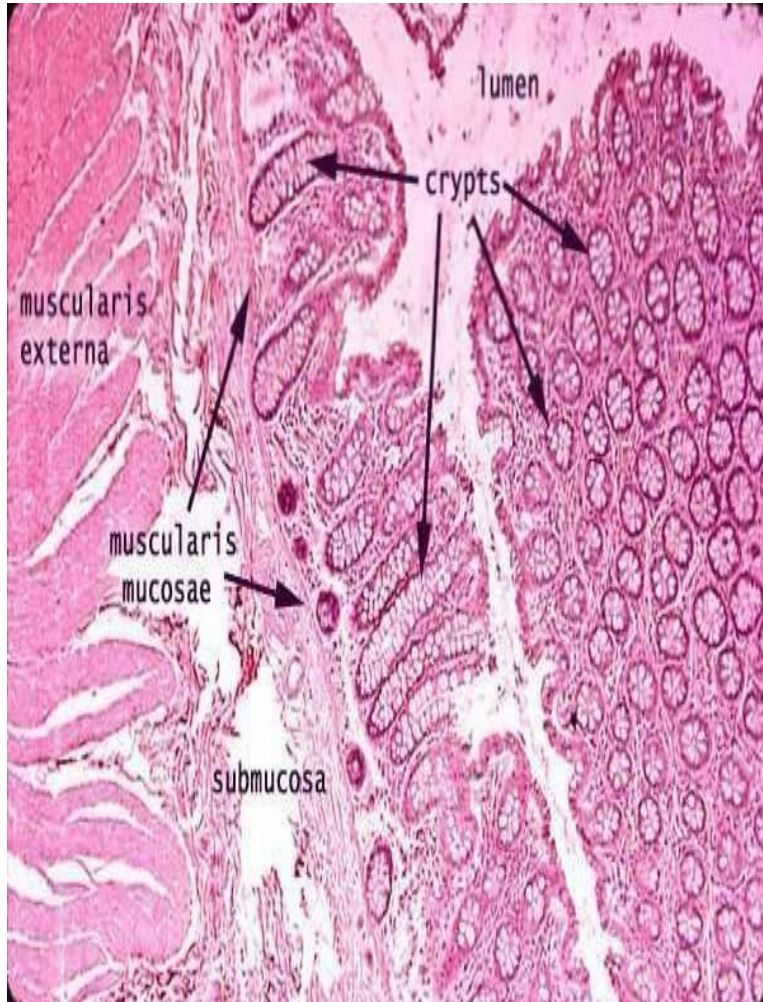


Fig. 33.4: Posterior relations of the rectum (below the level of the middle of the third piece of the sacrum).

Coccygeus muscle



Histology of rectum



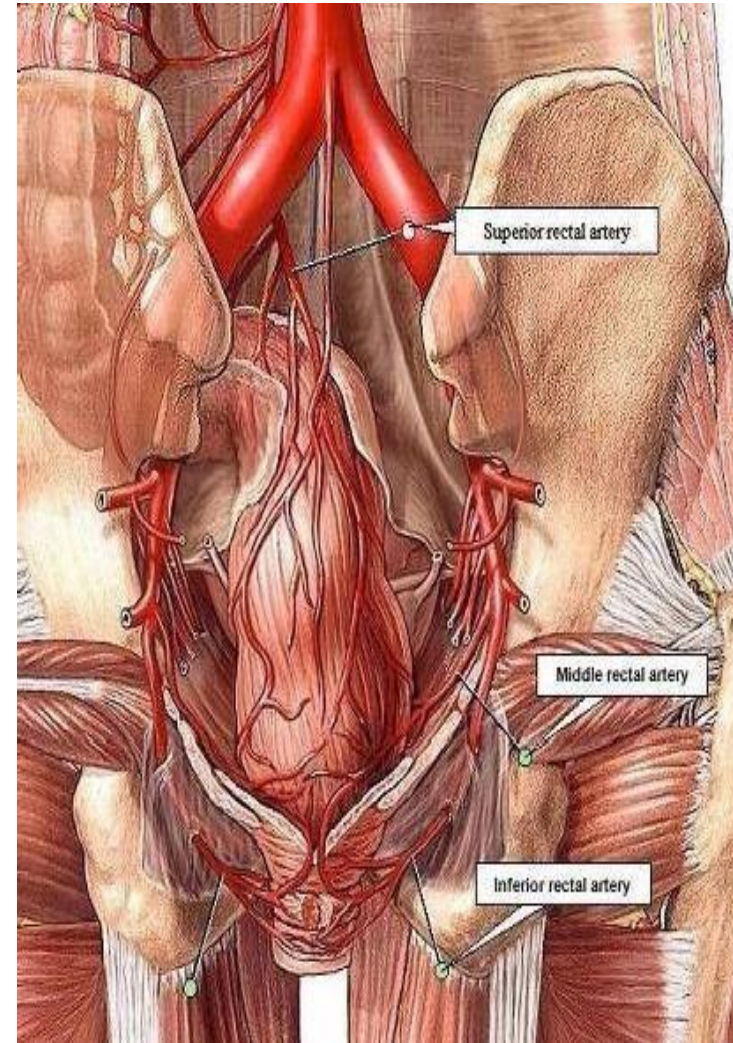
Was talked about in the histology lectures. Remember it is made of transverse and longitudinal folds of mucosa.

Histology of the rectum

- **The muscular coat** of the rectum is arranged in
 - 1 **outer longitudinal** of smooth muscle
 - 2 **inner circular layers** of smooth muscle
- **The three taenia coli** of the sigmoid colon however, come together so that the longitudinal fibers form a broad band on the anterior and posterior surfaces of the rectum ♦ No taenia coli
- **Transverse folds of the rectum** (semicircular permanent folds) ♦ The mucous membrane of the rectum+ the circular muscle layer

Blood Supply of rectum

- **Arteries**
 - **The superior, middle, and inferior rectal arteries** supply the rectum.
- 1 The superior rectal artery**
- It is a **direct continuation of the inferior mesenteric artery** and is the chief artery supplying the mucous membrane.
 - It enters the pelvis by descending in the root of the sigmoid mesocolon and divides into right and left branches, which pierce the muscular coat and supply the mucous membrane.
 - They anastomose with one another and with the middle and inferior rectal arteries.



Blood supply of rectum

- **2-The middle rectal artery**

- -It is a small branch of the internal iliac artery
- - It is distributed mainly to the muscular coat.

- **3-The inferior rectal artery**

- It is a branch of the internal pudendal artery which is a branch of internal iliac in the perineum.
- It anastomoses with the middle rectal artery at the anorectal junction.

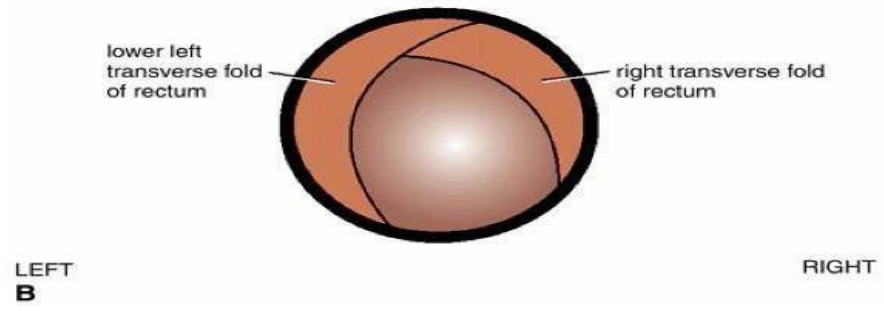
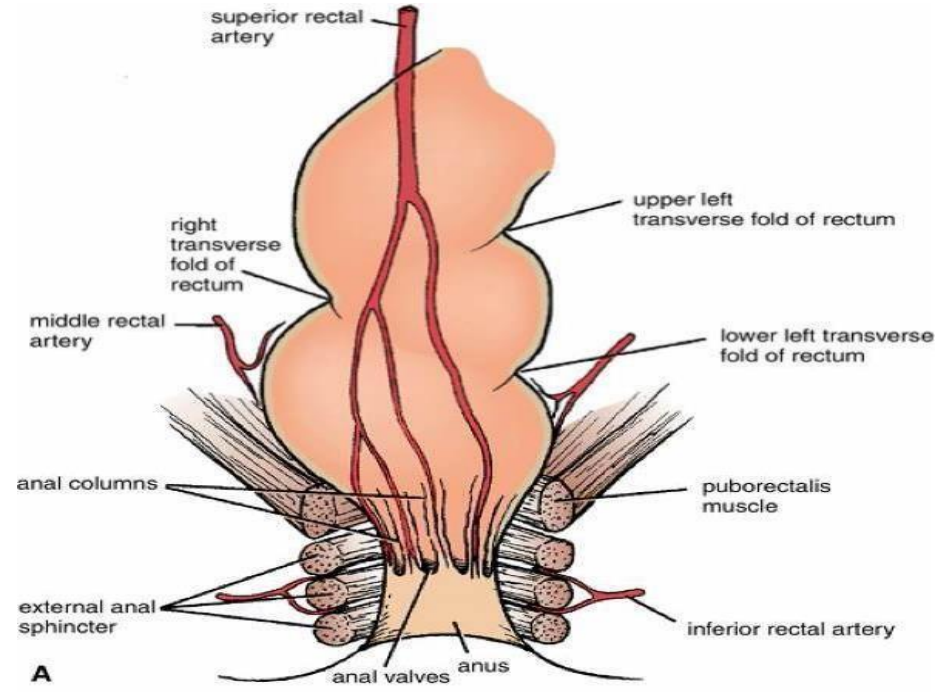
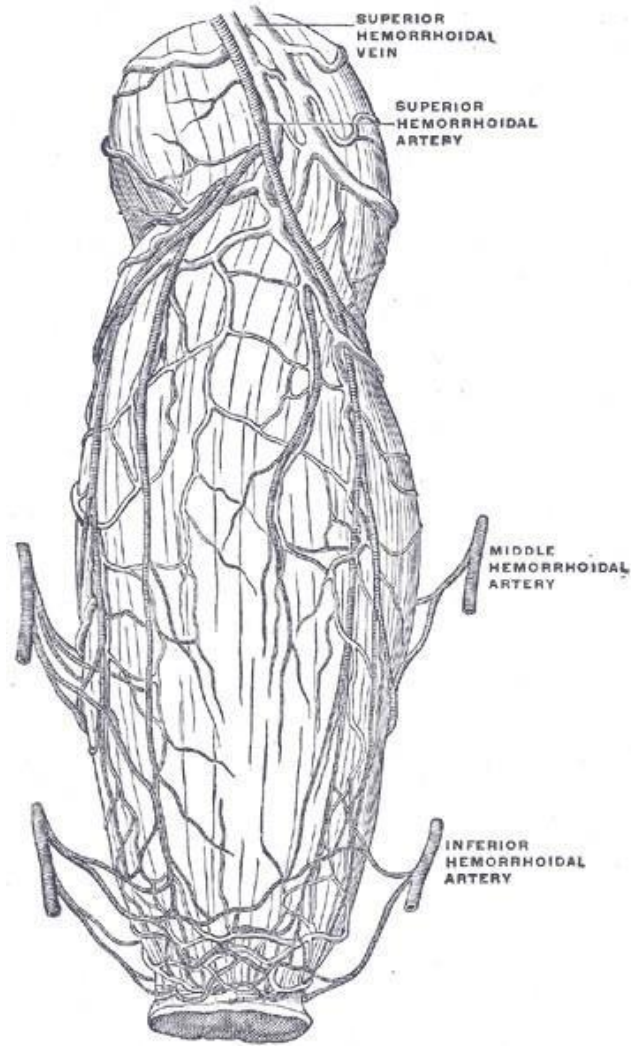
Blood supply of rectum

- **Veins (opposite to arteries)**
- The veins of the rectum correspond to the arteries.
- The superior rectal vein is a tributary of the portal circulation and drains into the inferior mesenteric vein.
- The middle rectal vein: the internal iliac vein, then drain into inferior vena cava
- inferior rectal vein: internal pudendal veins which drain into internal iliac vein.
- The union between the rectal veins forms an important portal systemic anastomosis.

Some problems may arise in the cases of hypertension (like in the cases of liver cirrhosis, where the portal vein cannot drain into the liver which causes hypertension), like hemorrhoids and piles (piles is a connection between inferior and superior rectal veins, thus a connection between portal and systemic circulation).

Blood supply of rectum

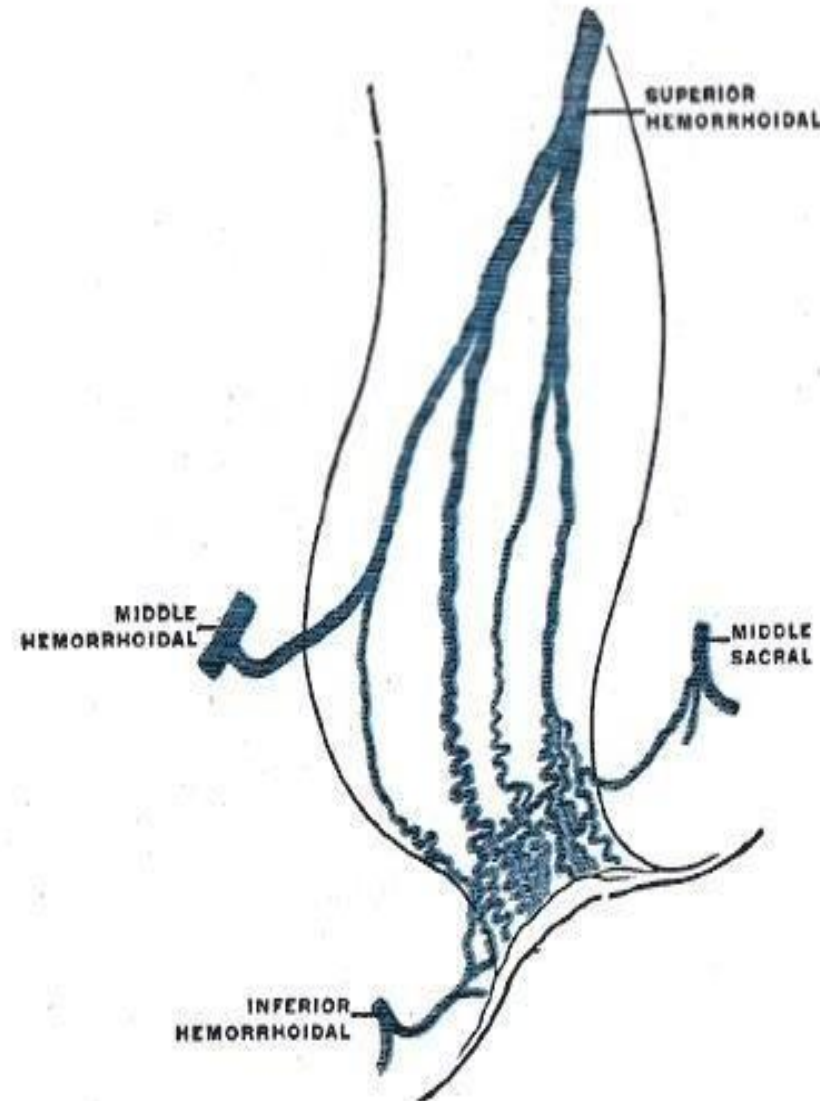
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The hemorrhoidal plexus (or rectal venous plexus)

- surrounds the rectum, and communicates in front with the vesical venous plexus in the male, and the uterovaginal plexus in the female.
- A free communication between the portal and systemic venous systems is established through the hemorrhoidal plexus.



Rectal plexus & Hemorrhoids

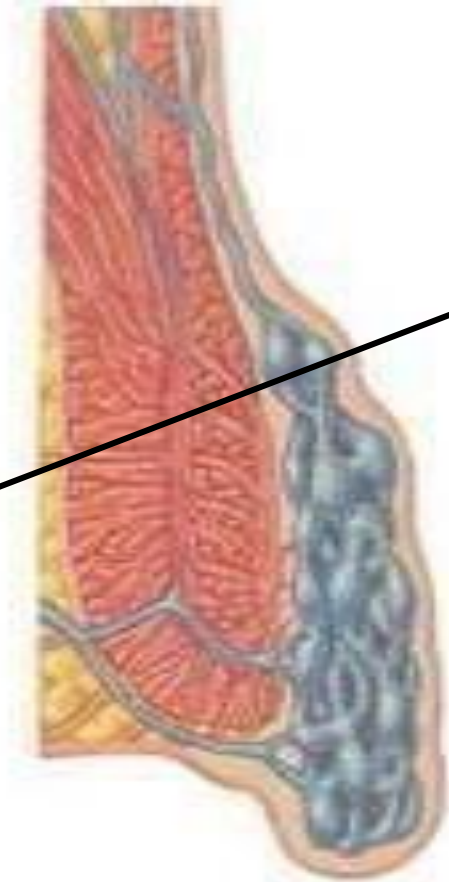
Subcutaneous (external) hemorrhoids: mostly inferior rectal and sometimes middle rectal veins. extremely painful since this area is supplied by somatic nerve (S4)



Origin below dentate line
[external rectal plexus]



Origin above dentate line
[internal rectal plexus]



Origin above and below dentate line
[internal and external rectal plexus]

Internal hemorrhoids: superior rectal veins. painless since this area is supplied by autonomic nerves.

Lymph Drainage of rectum

- the upper part drain into the pararectal nodes then into inferior mesenteric nodes.
- the lower part follow the middle rectal artery to the internal iliac nodes.
- Rectum and upper part of anal canal = paraaortic lymph nodes in the abdomen.
- Lower part of anal canal = superficial inguinal lymph nodes.

Nerve Supply of rectum

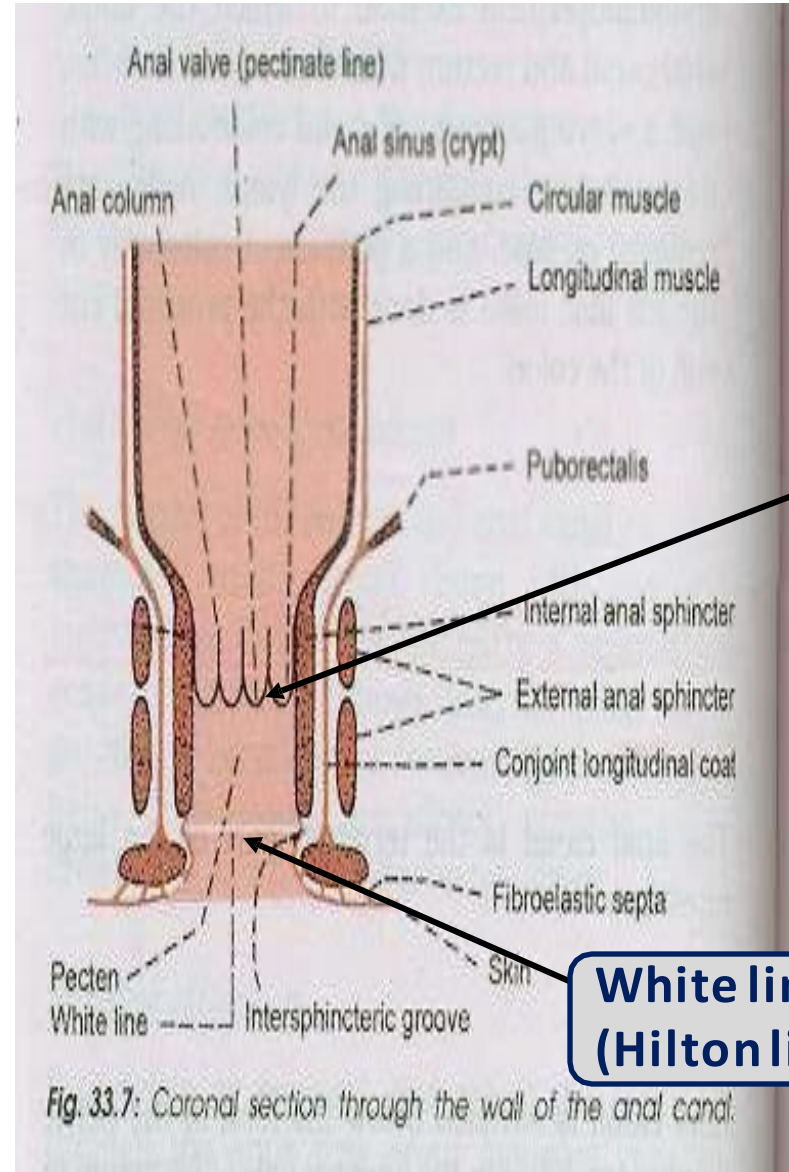
- The nerve supply is from the sympathetic and parasympathetic nerves from the inferior hypogastric plexuses.
- The rectum is sensitive only to stretch.
- Same innervation as the sigmoid.

Anal canal

Don't worry, we explained most of it already!!

The anal canal

- It is the terminal part of the large intestine.
- It is situated below the level of the pelvic diaphragm and lies in anal triangle of perineum.
- The anal canal is 3.8cm long (4cm)
- It extends from the anorectal junction to the anus.
- The anorectal junction is marked by the forward convexity of the perineal flexure of the rectum, the anus is the surface opening of the anal canal, situated about 4cm below and in front of the tip of the coccyx in the cleft between two buttocks.



**anal valves
and sinuses
at the end
of the anal
column**

**White line
(Hilton line)**

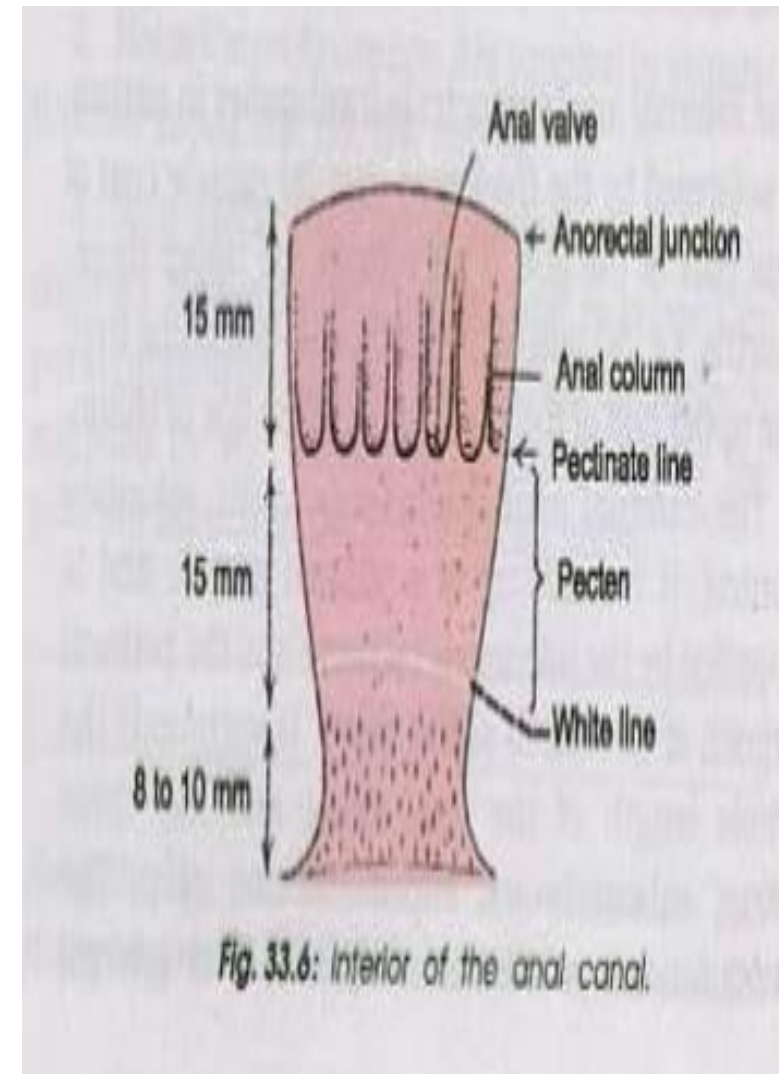
The anal canal is divided into upper 2cm and lower 2cm. They differ in origin, sensation, lymphatic drainage and blood supply. They are anatomically divided **by pectinate line**.

-**Upper 2cm**: endodermal origin, autonomic sensation and innervation, lymphatic drainage by paraaortic lymph nodes (so, tumors in the upper part of anal canal metastasize to the abdomen), supplied by superior rectal vessels.

-**Lower 2cm**: ectodermal origin, somatic sensation (can feel pain), lymphatic drainage by inguinal lymph nodes (so, tumors in the lower part of anal canal metastasize to femoral triangle), supplied by inferior and middle rectal vessels.

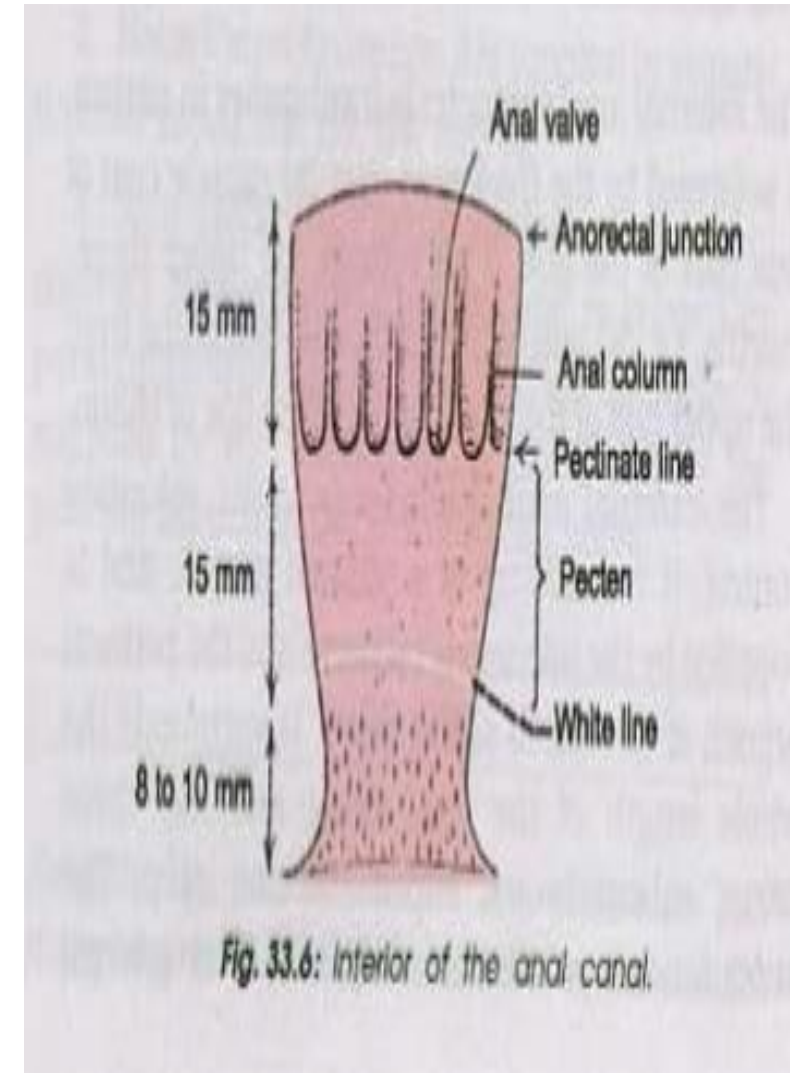
-The lower 2cm can also be divided **by white line** histologically into: Upper 1cm which is non-keratinized and lower 1cm which is keratinized.

- Anorectal ring:
- this is a muscular ring present at the anorectal junction.
- It is formed by the fusion of the puborectalis, deep part of external sphincter and the internal sphincter, which can be felt on rectal examination .
- Deep part of external sphincter and puborectalis muscle are the most important since they are voluntary

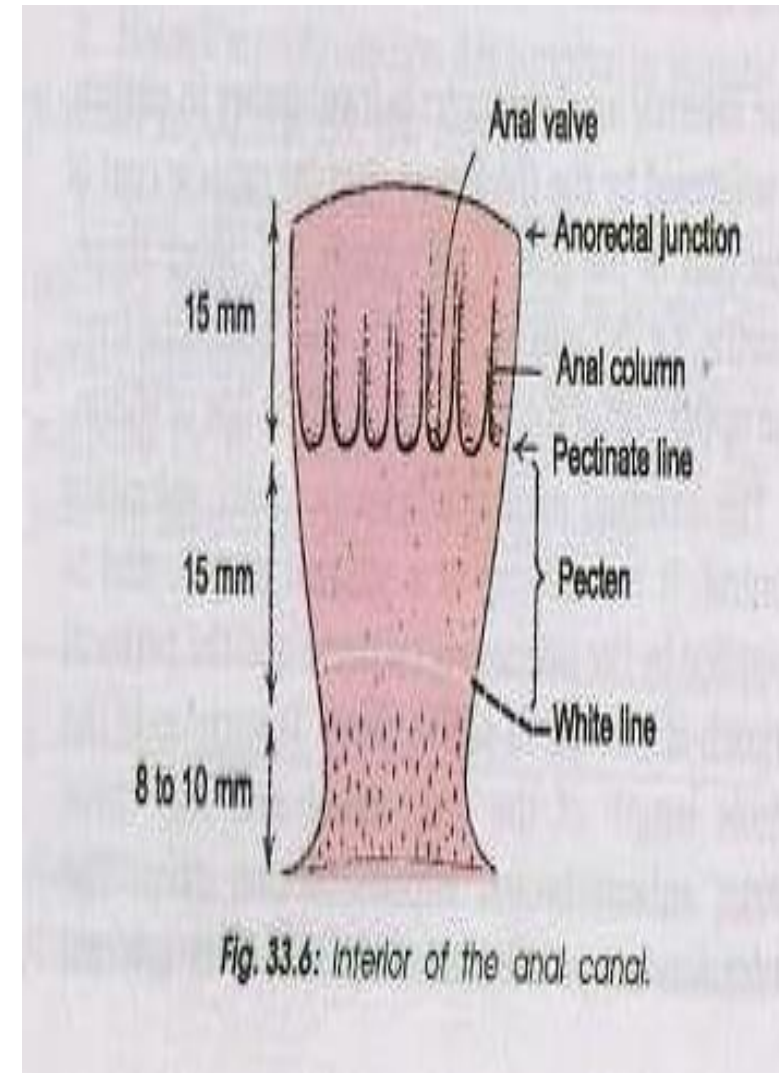


Interior of the anal canal shows many features and can be divided into three parts :

1- upper part is lined by mucous membrane, & is of endodermal origin. The mucous membrane shows 6 to 10 vertical folds, these folds are called the **anal columns of Morgagni**.



- **The lower ends** of the anal columns are united to each other by short semilunar folds of mucous membrane, these folds are called the **anal valves**. Above each valve there is a depression in the mucosa which is called the **anal sinus**, the anal valves together form a transverse line that runs all round the anal canal. This is the **pectinate line**.



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2- The middle part of anal canal

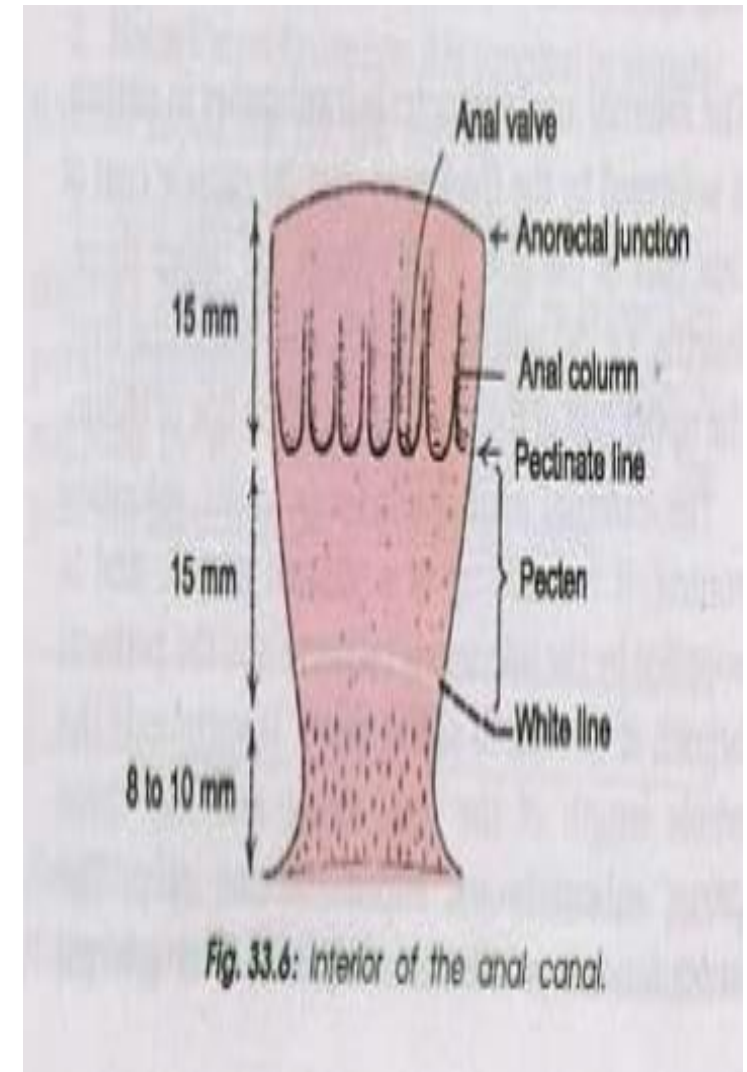
-It is termed as transitional zone or pecten, it is also lined by mucous membrane.

-The mucosa has a bluish appearance because of a dense venous plexus that lies beneath.

- The lower limit of the pecten often has a whitish appearance because of which it is referred to as the white line or Hilton's line, is situated at the level the interval between the subcutaneous part of external anal sphincter and the lower border of internal anal sphincter.

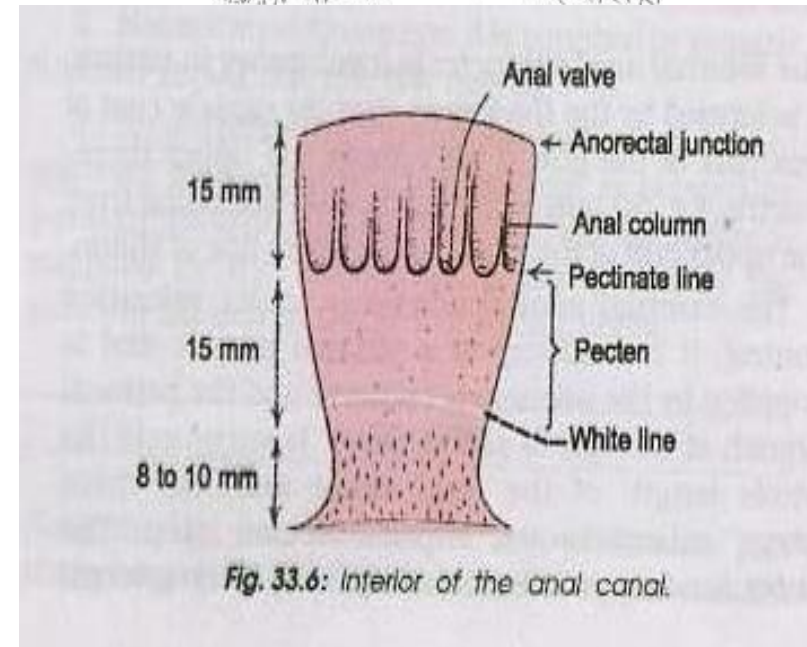
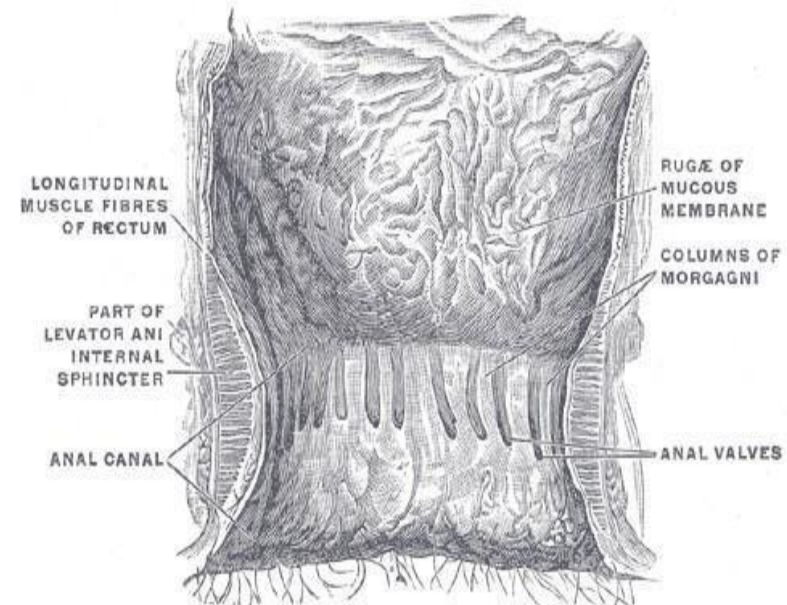
3- Lower cutaneous part

is about 8mm long and is lined by true skin containing sweat and sebaceous glands.



Whiteline or Hilton line

- A landmark for the intermuscular border between internal and external anal sphincter muscles.
- This line represents the transition point from non-keratinized stratified squamous epithelium to keratinized stratified squamous epithelium in the anus.



female

Prostate and perianal body are the most important things to be felt anteriorly. Again, if you go up you can feel vas deferens (which opens into seminal vesicles) and seminal vesicles

Relations of anal canal Anteriorly

In male

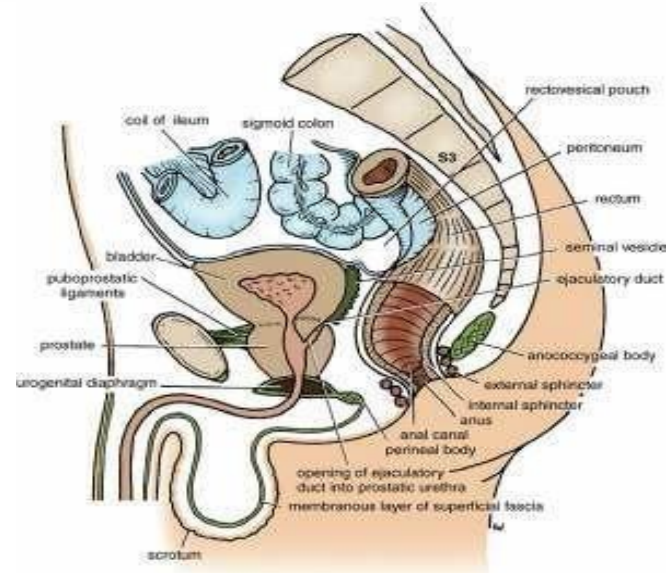
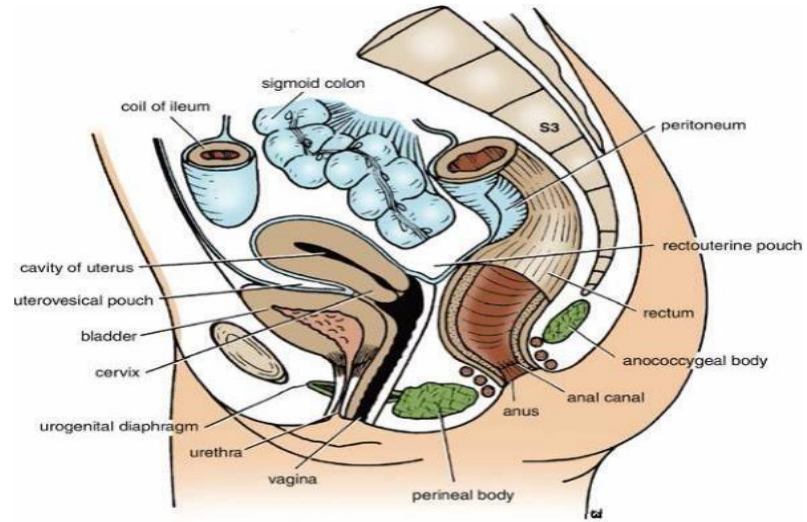
- perineal body
- membranous urethra
- bulb of penis

In female

- lower end of the vagina

Posteriorly

- anococcygeal ligaent
 - tip of the coccyx
- ### laterally
- ischiorectal fossae.



male

skipped

Musculature of the anal canal:

1. internal anal sphincter is involuntary in nature, It is formed by the thickened circular muscle coat of this part of the gut.

2. the external anal sphincter is under voluntary control. & has three parts: subcutaneous, superficial and deep parts.

subcutaneous part lies below the level of internal sphincter and surrounds the lower part of the anal canal.

The superficial part is elliptical in shape and arises from the terminal segment of the coccyx and anococcygeal ligament, the fibres surround the lower part of the internal sphincter and are inserted into the perineal body.

The deep part surrounds the upper part of the internal sphincter and is fused with the puborectalis.

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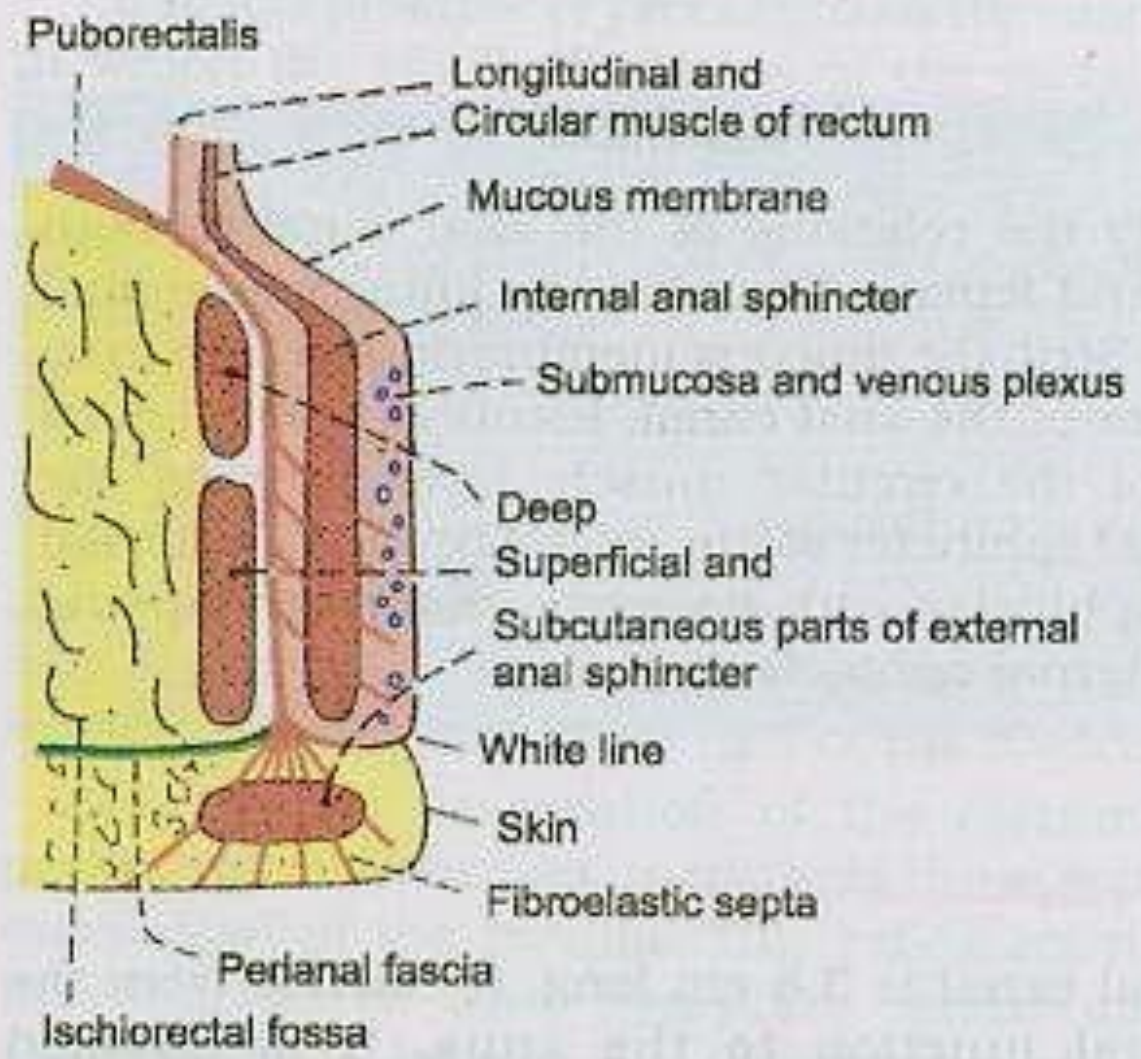


Fig. 33.8: Coronal section through the anal canal.

Blood supply of anal canal

Arterial supply:

- the part of the anal canal above the Pectinate line (**upper half**) is supplied by the superior rectal artery
- the part below the pectinate line (**lower half**) is supplied by the inferior rectal artery and the middle rectal artery.
- Viens: same but opposite.

V2 important: arteries are internal and veins are external (SLIDE 54)

**The doctor said that the last few slides are just for knowledge. So, we removed them.
Here is a link for them if you are interested:**

<https://drive.google.com/file/d/1vvUYA95Lsrhj4sA0y8eQIRRsrf-a3jIX/view?usp=drivesdk>

لأرائكم:

https://docs.google.com/forms/d/e/1FAIpQLSdN9YK7ry3f5EtqmJAzL1lqa9ogsCGEEVrFH9DfBd8IIAN1Eg/viewform?usp=sf_link