

# Abdominal wall and Pelvis anatomy

By Radha Krishnan

## Abdominal wall

- Layers of the Anterior Abdominal Wall
- Rectus Sheath
- Abdominal Regions & Organ Relations

## Inguinal Region

- Inguinal Canal Overview
- Inguinal Canal Boundaries
- Spermatic Cord
- Hernias
- Cremaster Muscle & Gubernaculum

## Retroperitoneal Anatomy

- Retroperitoneal Space
- Ureter Course

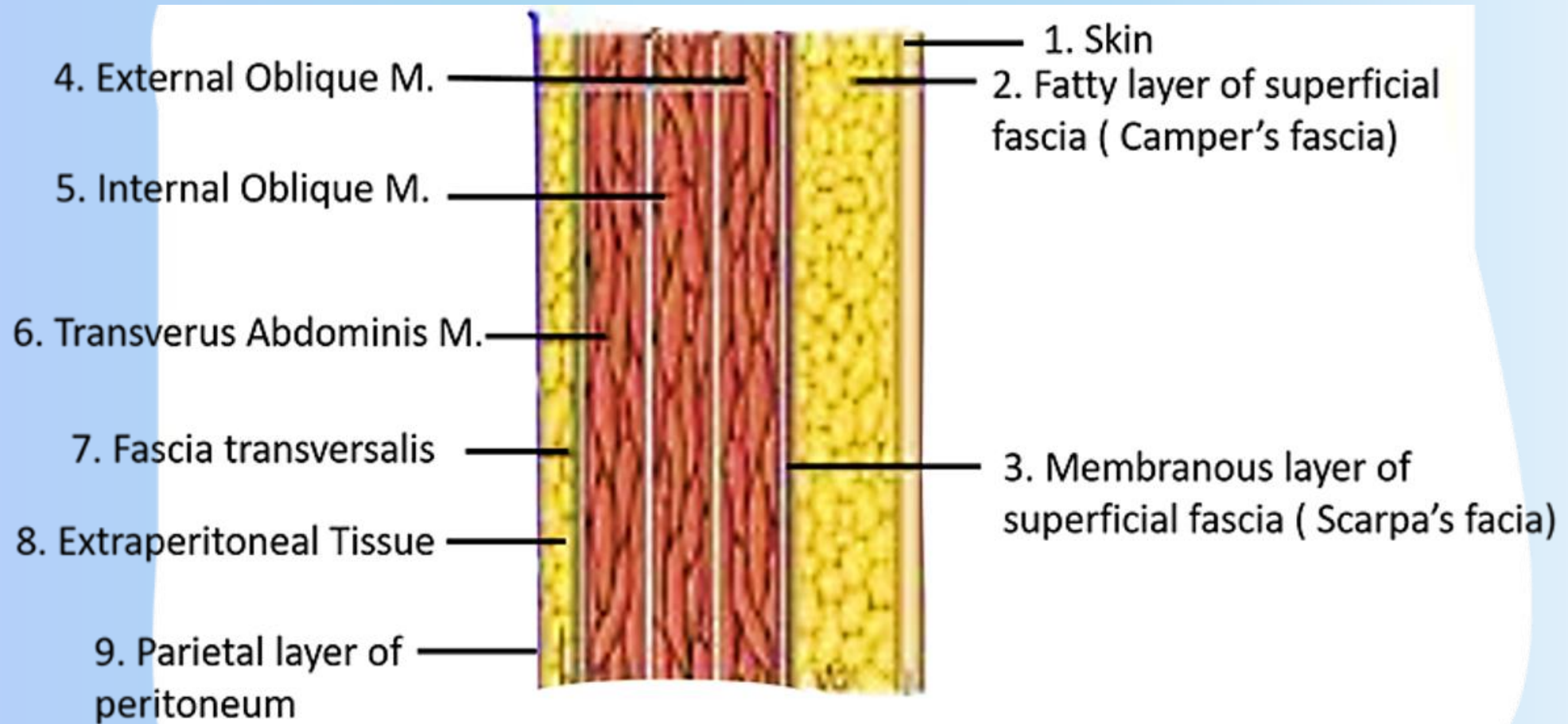
## Posterior Relations

- Stomach Relations

## Pelvic Anatomy

- Pelvic Inlet
- Pelvic Floor
- Pelvic Autonomic Plexuses
- Micturition Control (urination)

# Layers of the Anterior Abdominal Wall



# Layers of the Anterior Abdominal Wall

## Layers (Superficial → Deep)

- Skin
- Superficial fascia
- Camper fascia - superficial fatty layer
- Scarpa fascia - deep membranous layer

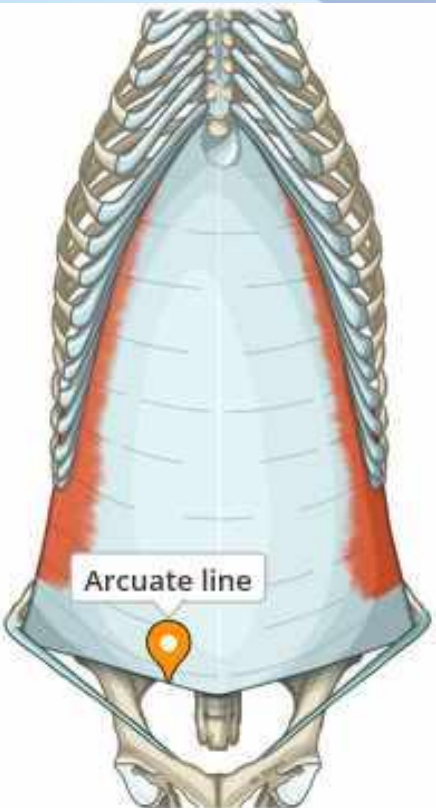
## Muscle layers

- External oblique
- Internal oblique
- Transversus abdominis
- Transversalis fascia
- Extraperitoneal fat
- Parietal peritoneum

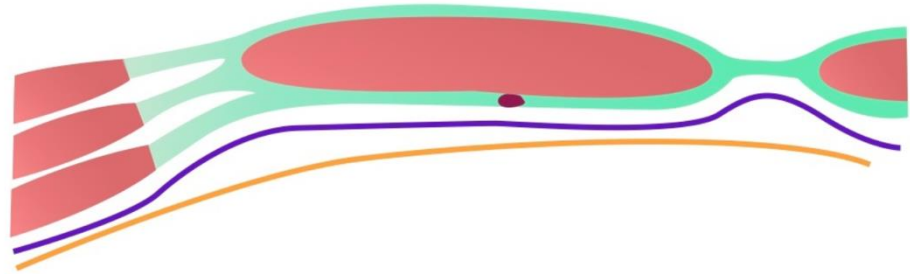
## Tip

- Scarpa fascia continues into the perineum as Colles fascia
- C comes before S (A-Z) so Camper fascia is more superficial

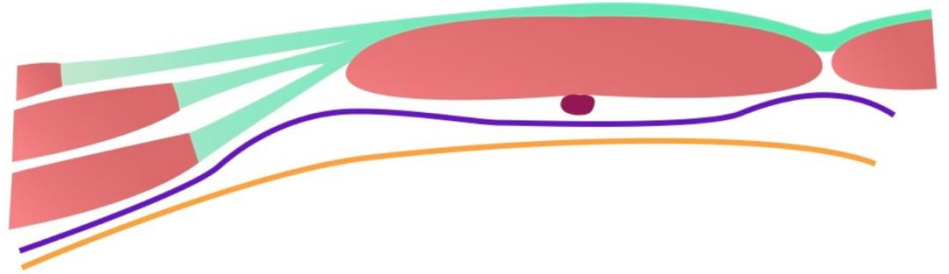
# Rectus Sheath



ABOVE  
ARCUATE  
LINE



BELOW  
ARCUATE  
LINE



- RECTUS SHEATH
- TRANSVERSALIS FASCIA
- PARIETAL PERITONEUM

## Rectus sheath

- encloses rectus abdominis muscle

Formed by aponeuroses of:

- External and internal obliques
- Transversus abdominis

## Important Structures in Rectus Sheath

- Superior epigastric artery
- Inferior epigastric artery

### Tip

Inferior epigastric artery runs inside the rectus sheath and is an important landmark for inguinal hernias

## Above the Arcuate Line

External oblique aponeurosis → anterior wall

Internal oblique splits

- anterior layer → anterior wall
- posterior layer → posterior wall

Transversus abdominis → posterior wall

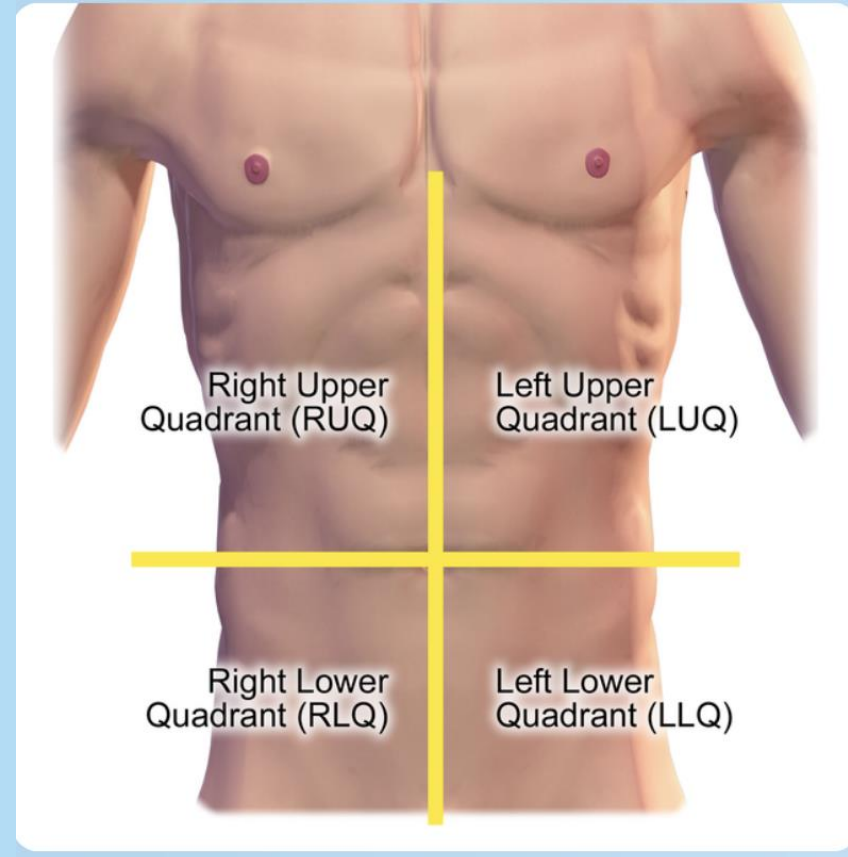
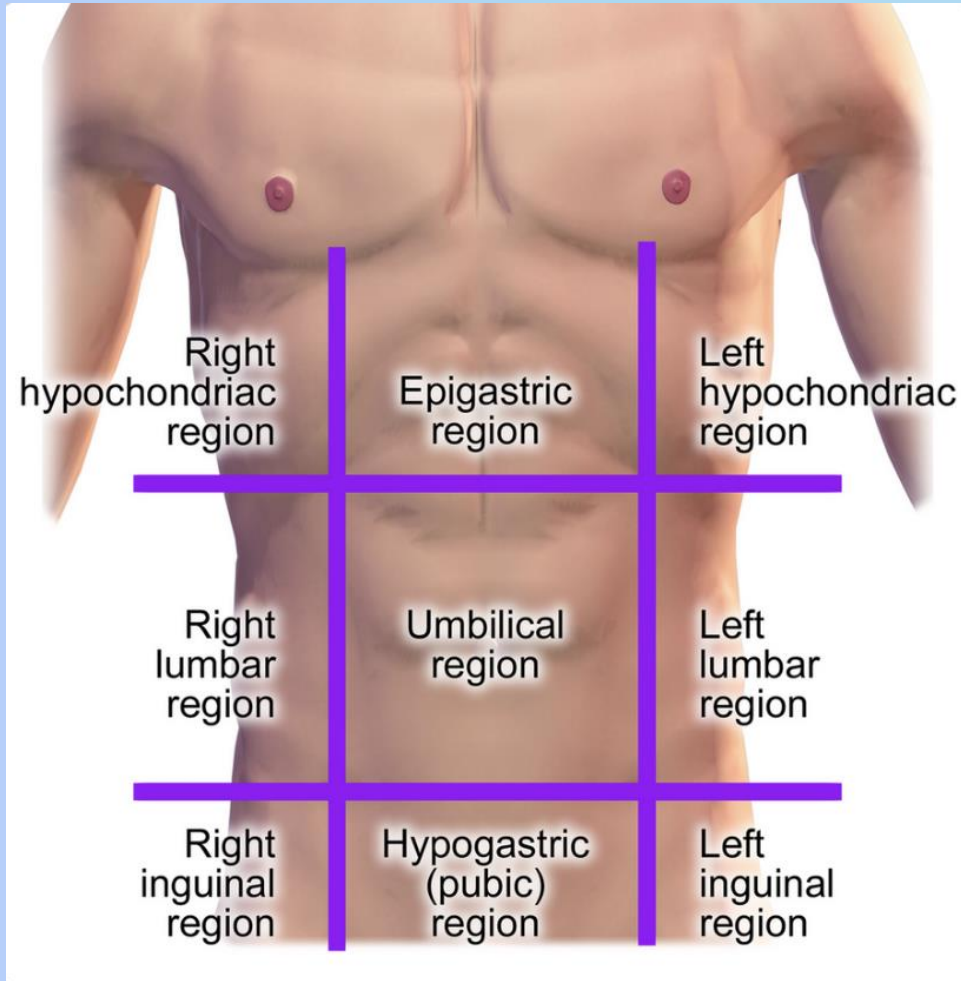
## Below the Arcuate Line

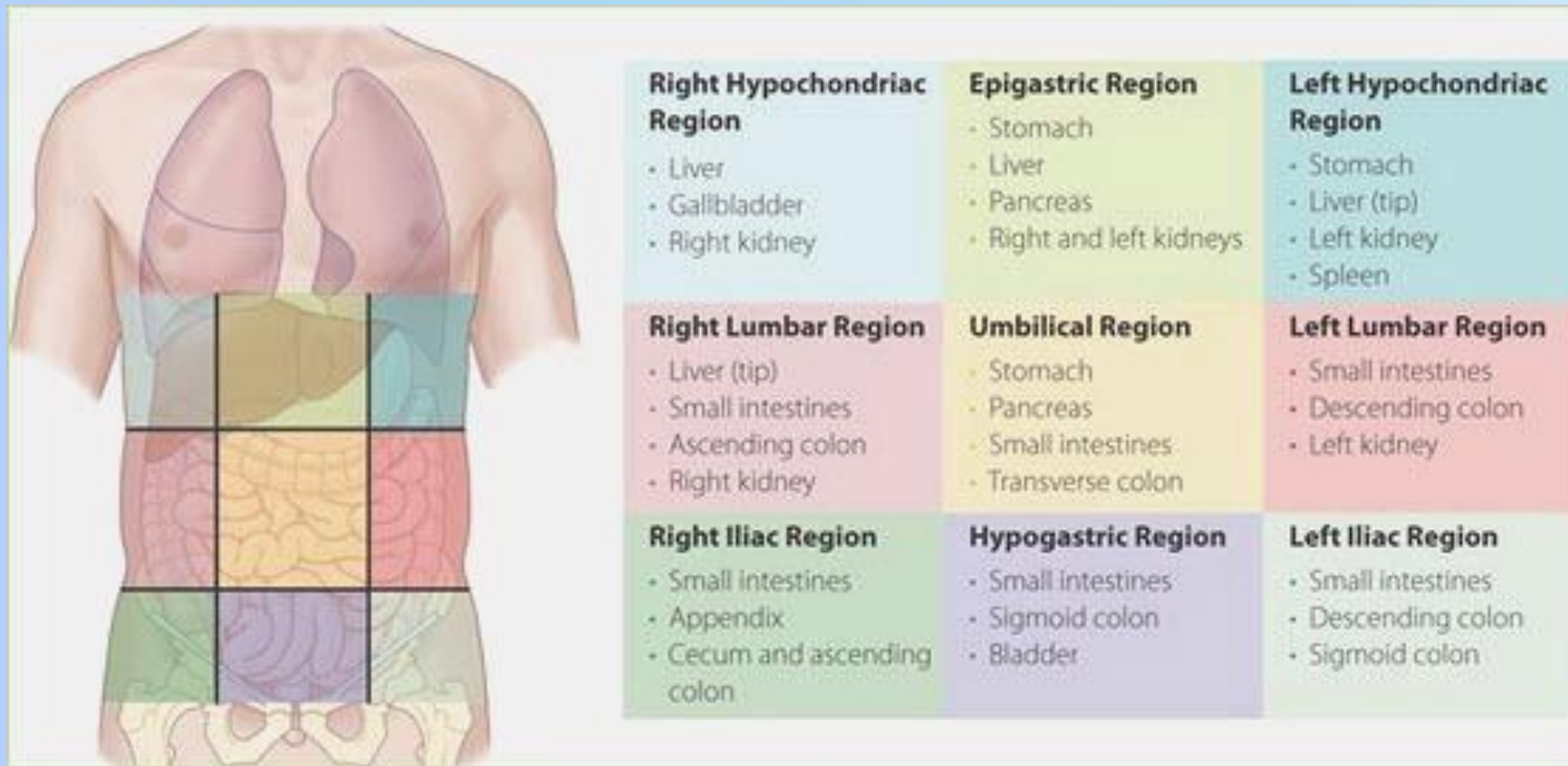
All three aponeuroses pass anterior to rectus abdominis

Posterior wall contains only:

- Transversalis fascia

# Abdominal Regions & Organ Relations

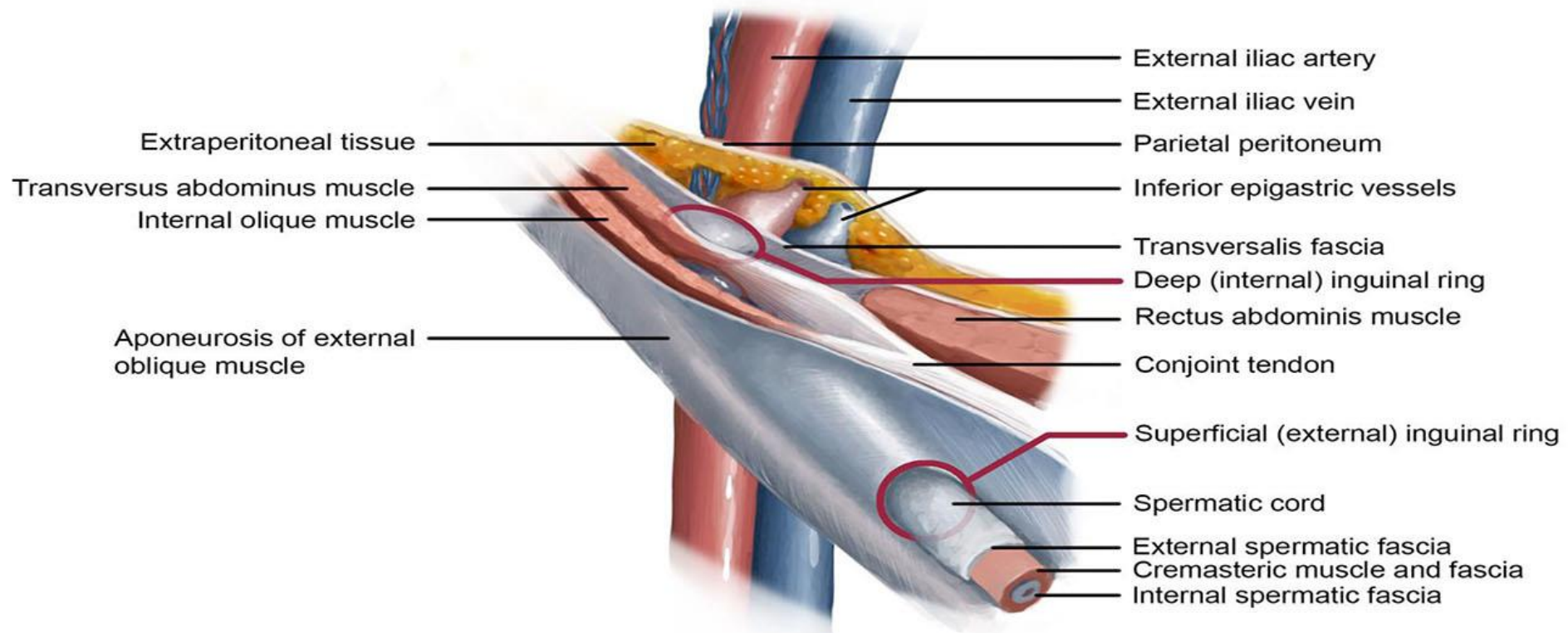




## Clinical / Exam Correlation:

A 5cm deep stab wound in the left hypochondriac region may injure,  
 All of the following structures are located next to the right kidney  
 EXCEPT/liver is located near to?

## Inguinal Canal



# Inguinal Canal Boundaries

Boundary	Structure
Anterior wall	External oblique aponeurosis
Posterior wall	Transversalis fascia
Roof	internal oblique and transversus abdominis
Floor	Inguinal ligament

## Key Relationships

- Internal oblique muscle contributes to the cremaster muscle
- Transversalis fascia forms deep inguinal ring

# Inguinal Canal Overview

## Inguinal Canal

- Extends from deep inguinal ring → superficial inguinal ring
- Runs superolateral → inferomedial

## Contents (what passes through)

- Spermatic cord
- Round ligament of uterus
- Genital branch of genitofemoral nerve

## Deep (Internal) Inguinal Ring

- Opening in transversalis fascia
- Entrance

## Superficial (External) Inguinal Ring

- Exit of
- Opening in external oblique aponeurosis

# Spermatic Cord

## Main Contents

- **Ductus (vas) deferens** - transports sperm
- **Genital branch of genitofemoral nerve** - innervates cremaster
- Testicular and Cremasteric artery
- Pampiniform venous plexus
- Lymphatic vessels

## Exam Traps/Tips

- Pampiniform plexus helps regulate testicular temperature
- What structures does the spermatic cord contain?
- What doesn't transmit spermatozoa?
- (navicular fossa, prostatic urethra, epididymis, ampulla of the ductus deferens, **duct of the seminal vesicle**)

# Direct vs Indirect Inguinal Hernias

## Indirect Inguinal Hernia

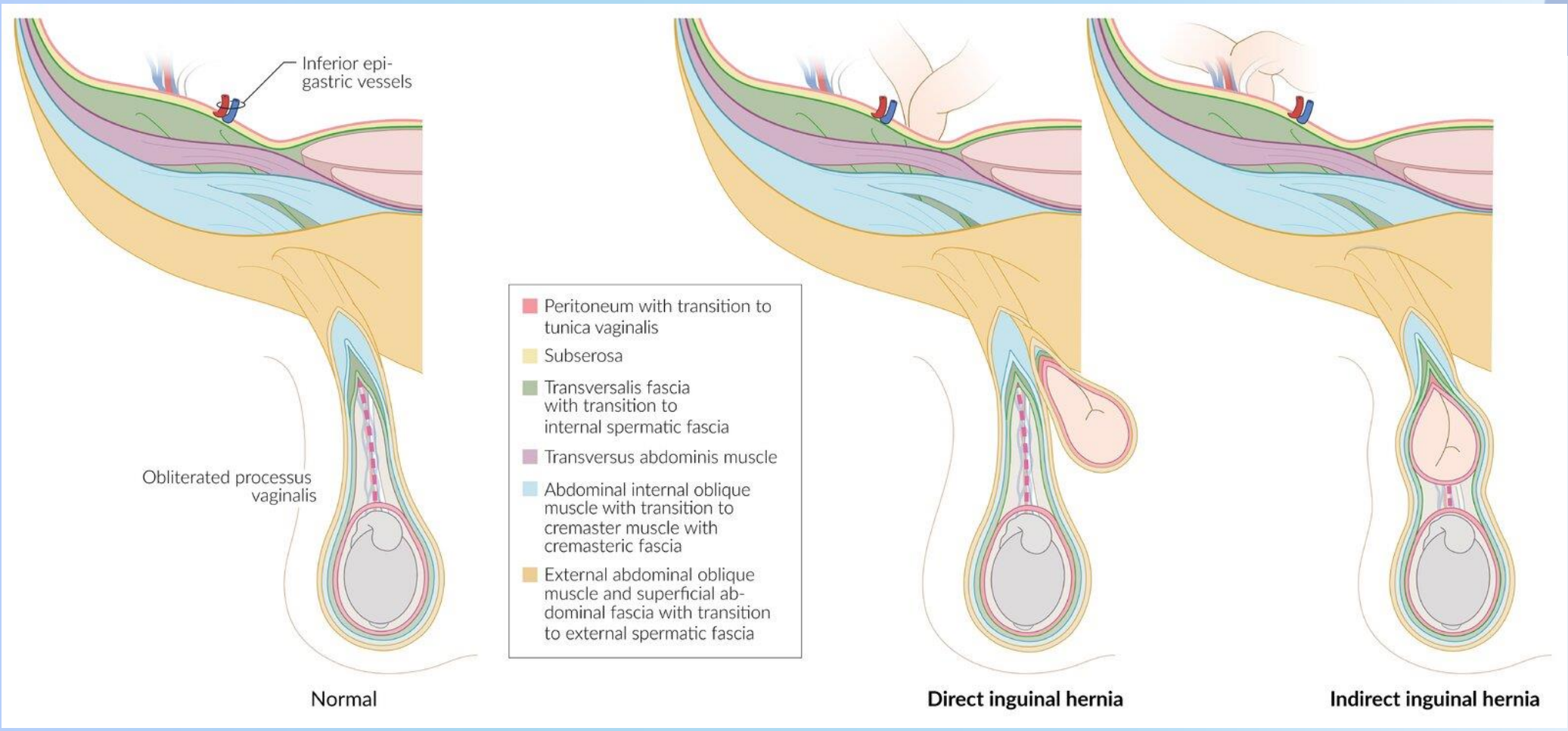
- common type of hernia
- enters through the deep inguinal ring
- Travels through the canal
- • May descend into the scrotum

## High-Yield Exam Tip

- Indirect hernia → lateral to inferior epigastric vessels
- Direct hernia → medial to inferior epigastric vessels
- "MDs don't lie" (Medial = Direct, Lateral = Indirect)

## Direct Inguinal Hernia

- Occurs due to weakness of posterior wall of the canal
- Protrudes through Hesselbach's triangle
- • Usually does not enter the scrotum and more common in older adults



Inferior epi-gastric vessels

Obliterated processus vaginalis

- Peritoneum with transition to tunica vaginalis
- Subserosa
- Transversalis fascia with transition to internal spermatic fascia
- Transversus abdominis muscle
- Abdominal internal oblique muscle with transition to cremaster muscle with cremasteric fascia
- External abdominal oblique muscle and superficial abdominal fascia with transition to external spermatic fascia

Normal

Direct inguinal hernia

Indirect inguinal hernia

# Cremaster Muscle

## Cremaster Muscle

- Derived from **internal oblique fibers**
- **Genital branch of the genitofemoral nerve**
- **Elevation of testis** (thermoregulation and protection)

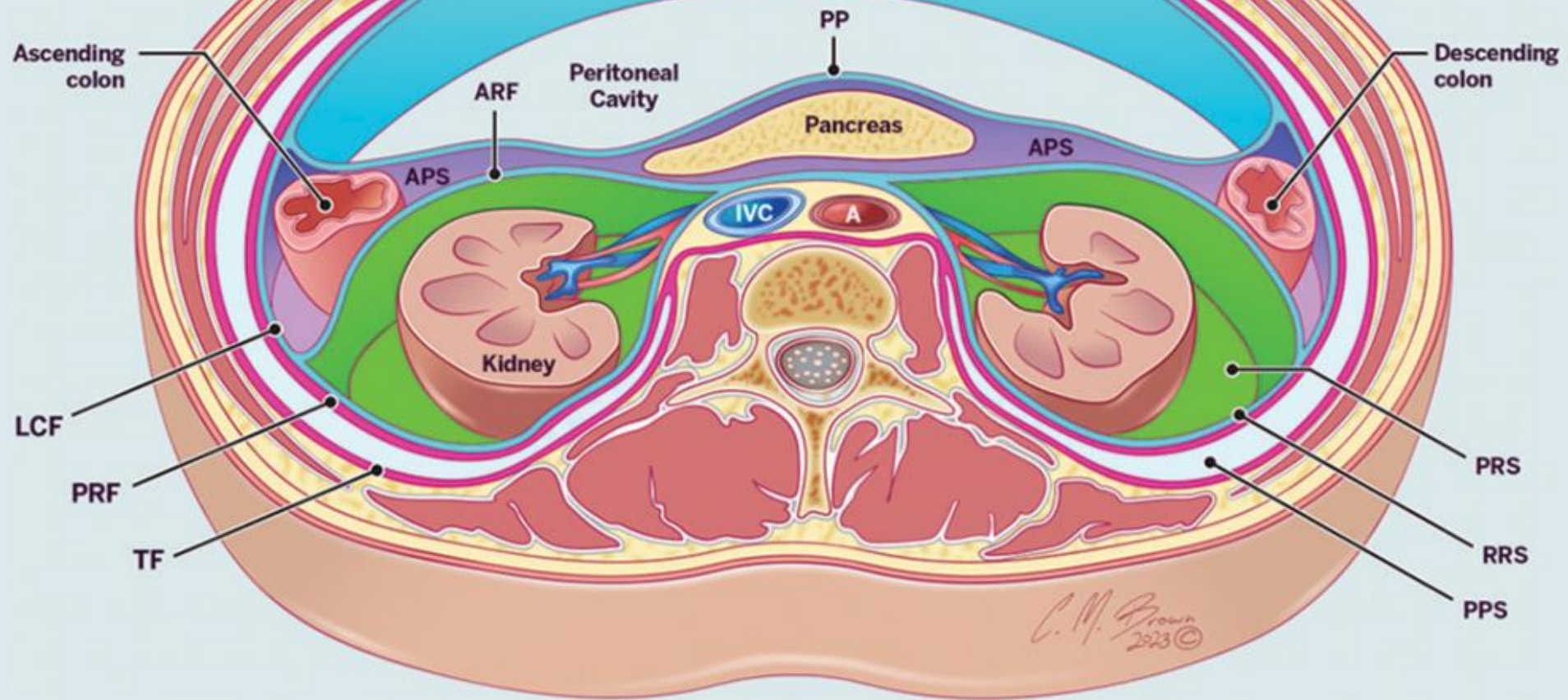
## Cremaster Reflex

- **Stroking medial thigh** → contraction of cremaster muscle → **testis elevates**
- **Afferent limb:** Ilioinguinal nerve (L1)
- **Efferent limb:** Genital branch of genitofemoral nerve (L1-L2)

# Retroperitoneal Space

- Area posterior to parietal peritoneum and anterior to posterior abdominal wall.
- Exam Tip
- Tail of pancreas is NOT retroperitoneal
- It lies within the splenorenal ligament
- Memorize organs passing through this space
- Primary Retroperitoneal Organs
  - Kidneys
  - Ureters
  - Suprarenal (adrenal) glands
  - Abdominal aorta
  - Inferior vena cava
- Secondary Retroperitoneal Organs
  - Pancreas (head, neck, body)
  - Duodenum (2nd-4th parts)
  - Ascending colon
  - Descending colon

## Retroperitoneal space at level of Kidneys

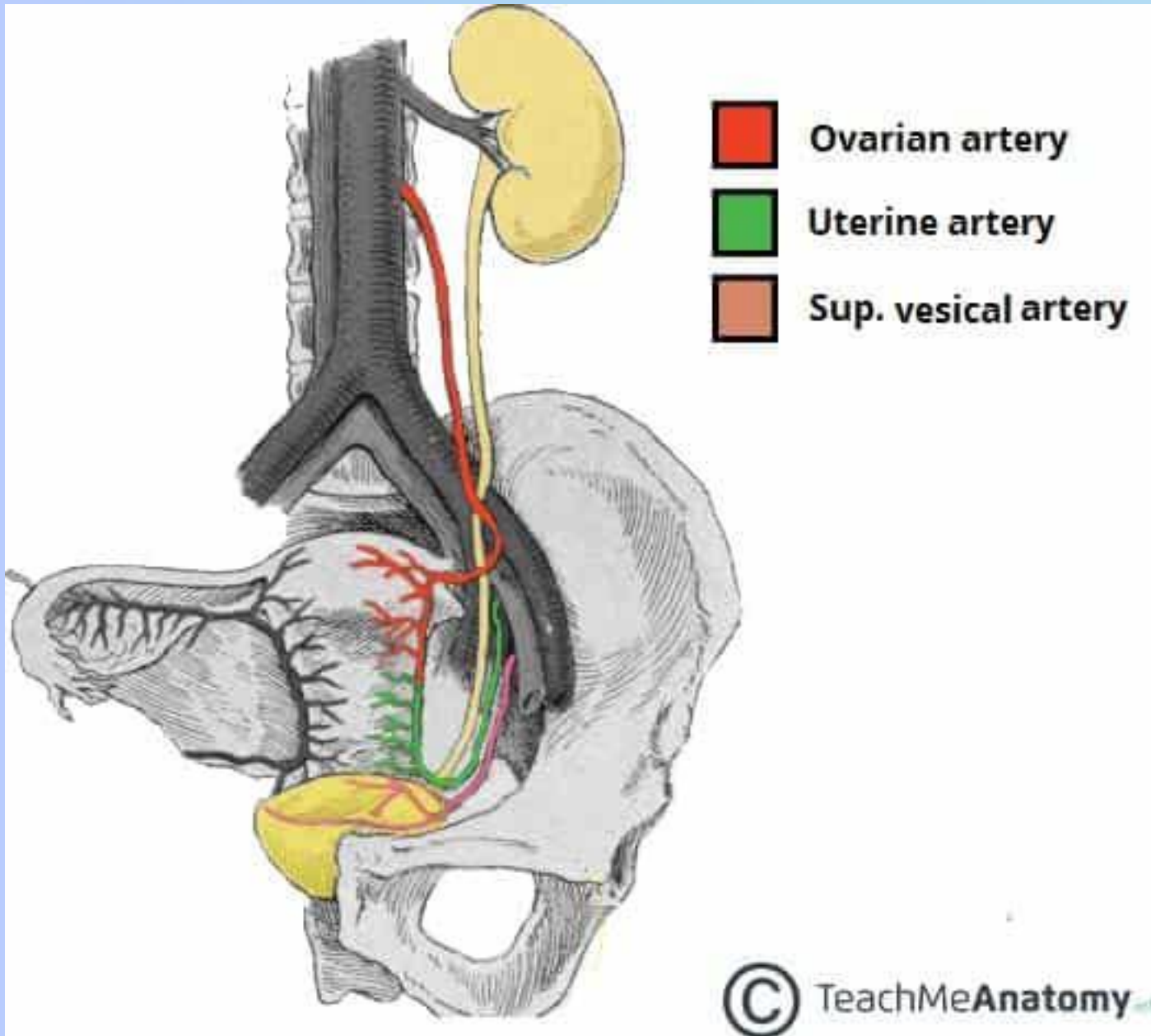


# Ureter Course

- Begins at **renal pelvis**
- Descends along **psoas major muscle**
- **Crosses the pelvic brim** at the bifurcation of common iliac vessels
- Enters the **pelvis**
- Passes obliquely through the **bladder wall**
- Ureter runs **retroperitoneally**
- Crosses **pelvic inlet**

## Clinical Importance

- Ureter may be **injured during hysterectomy** if mistaken for uterine vessels



## Clinical Relationship (Female)

- Ureter passes inferior to the uterine artery; “Water under the bridge”

# Stomach Relations

## Anterior Relations

- Left lobe of liver
- Diaphragm
- Anterior abdominal wall

## Exam Tip

- The pancreas lies posterior to the stomach and forms a major part of the stomach bed.

## Posterior Relations (Stomach Bed)

- Pancreas
- Spleen
- Left kidney
- Left suprarenal gland
- Transverse mesocolon
- Diaphragm

# Pelvic Inlet (Pelvic Brim)

- Boundary between the **greater pelvis** and **lesser pelvis**.

## Boundaries

- Sacral promontory (posterior)
- Arcuate line of ilium
- Pectineal line (pecten pubis)
- Pubic crest and pubic symphysis (anterior)

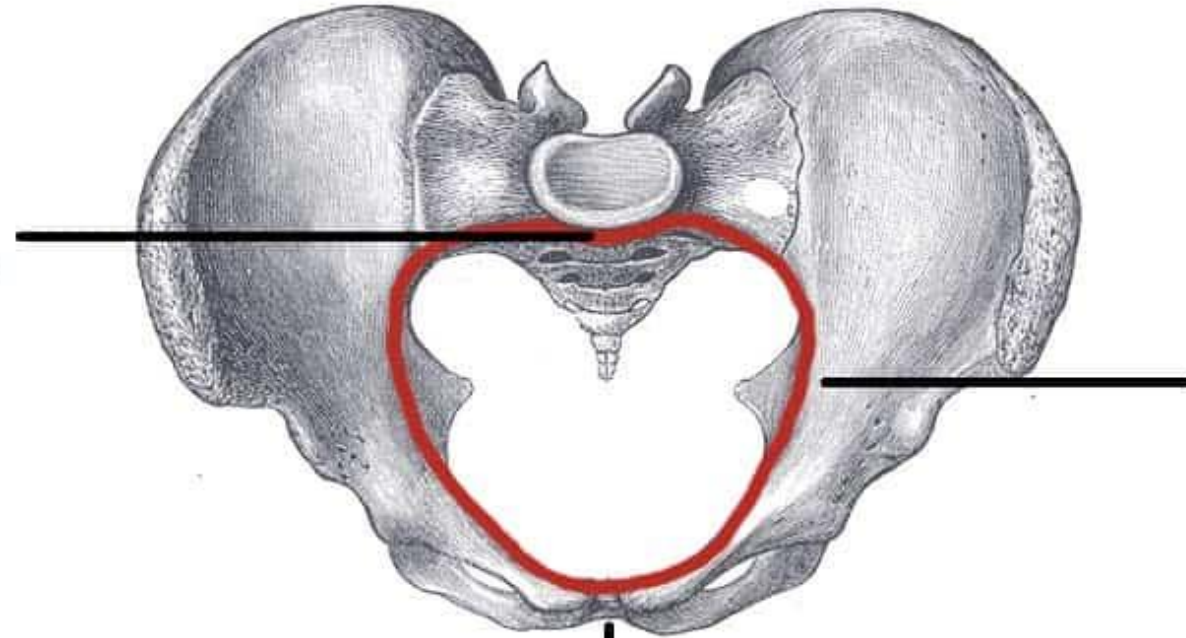
## Structures Crossing the Pelvic Brim!

- Ureters
- Common iliac, Ovarian vessels / Testicular vessels
- Lumbosacral trunk and obturator nerve
- Vas deferens
- Sigmoid colon

## Clinical / Exam Tip

- **Nerves of pelvic inlet and what they supply (eg: adductor muscles of thigh (Three adductors, gracilis, and obturator externus))**

Posterior Border  
*Sacral promontory*



Lateral border  
*Iliopectineal line*

Anterior border  
*Pubic symphysis*

# Pelvic Floor

## Main Muscles

- Levator ani
- Pubococcygeus
- Puborectalis
- Iliococcygeus
- Coccygeus (ischiococcygeus)

## Exam Tip

- Puborectalis muscle maintains anorectal angle, important for fecal continence (control/holding stool )
- Resists increases in intra-abdominal pressure

# Pelvic Autonomic Plexuses

## Celiac plexus (largest autonomic plexus)

- Supplies foregut organs

## Superior mesenteric plexus

- Supplies midgut organs

## Inferior mesenteric plexus

- Supplies hindgut organs

## Inferior hypogastric plexus (pelvic plexus)

- Autonomic supply to pelvic organs

### Parasympathetic Innervation

- Foregut & midgut: Vagus nerve (CN X)
- Hindgut: Pelvic splanchnic nerves (S2-S4)

Embryonic Gut Region	Abdominal Structures Derived from Region	Parasympathetic Source
Foregut	Esophagus, Stomach, Proximal duodenum ( <i>to major duodenal papilla in 2nd part</i> ), Pancreas, Liver, Gallbladder & bile ducts	Vagus nn. (CN X)
Midgut	Distal duodenum, Jejunum, Ileum, Cecum, Appendix, Ascending colon, Proximal 2/3rd of transverse colon	Vagus nn. (CN X)
Hindgut	Distal 1/3rd of transverse colon, Descending colon, Sigmoid colon, Rectum	Pelvic splanchnic nn.

Foregut:  
"LEG PLS" (Lungs, Esophagus, Gallbladder, Pancreas, Liver, Stomach) or better

Little Embryo People Do Like Swallowing, Producing Gas" (Lungs, Esophagus, Pancreas, Duodenum, Liver, Stomach, Gallbladder)

Midgut: Distal Duodenum to Proximal 2/3 Transverse Colon.

Hindgut: Distal 1/3 Transverse Colon to upper Anal Canal

Exam tip: what does inferior mesenteric plexus supply?

# Micturition Control (Urination)

- **Detrusor Muscle** (Smooth muscle of the urinary bladder wall)

Parasympathetic stimulation → contraction

- Pelvic splanchnic nerves (S2-S4)

**Exam tip:**

Micturation is stimulated by which nerves

## External Urethral Sphincter

- Skeletal muscle (voluntary control of urination)
- **Pudendal nerve (S2-S4)**

## Summary of Control

- Parasympathetic → bladder contraction (urination)
- Somatic control (pudendal nerve) → sphincter contraction

# **Lumbosacral plexus (osteo, muscles, genital area innervation, spaces)**

By StudyAid Presenter

## Pelvic Osteology

- Bones of the Pelvis

## Lumbar Plexus

- Formation of Lumbar Plexus
- Lumbar Plexus Branches

## Sacral Plexus

- Sacral Plexus Formation
- Sciatic Nerve

## Gluteal Region

- Gluteal Nerves

## Genital & Perineal Innervation

- Pudendal Nerve

# Hip bones

## Hip Bone (Os Coxae)

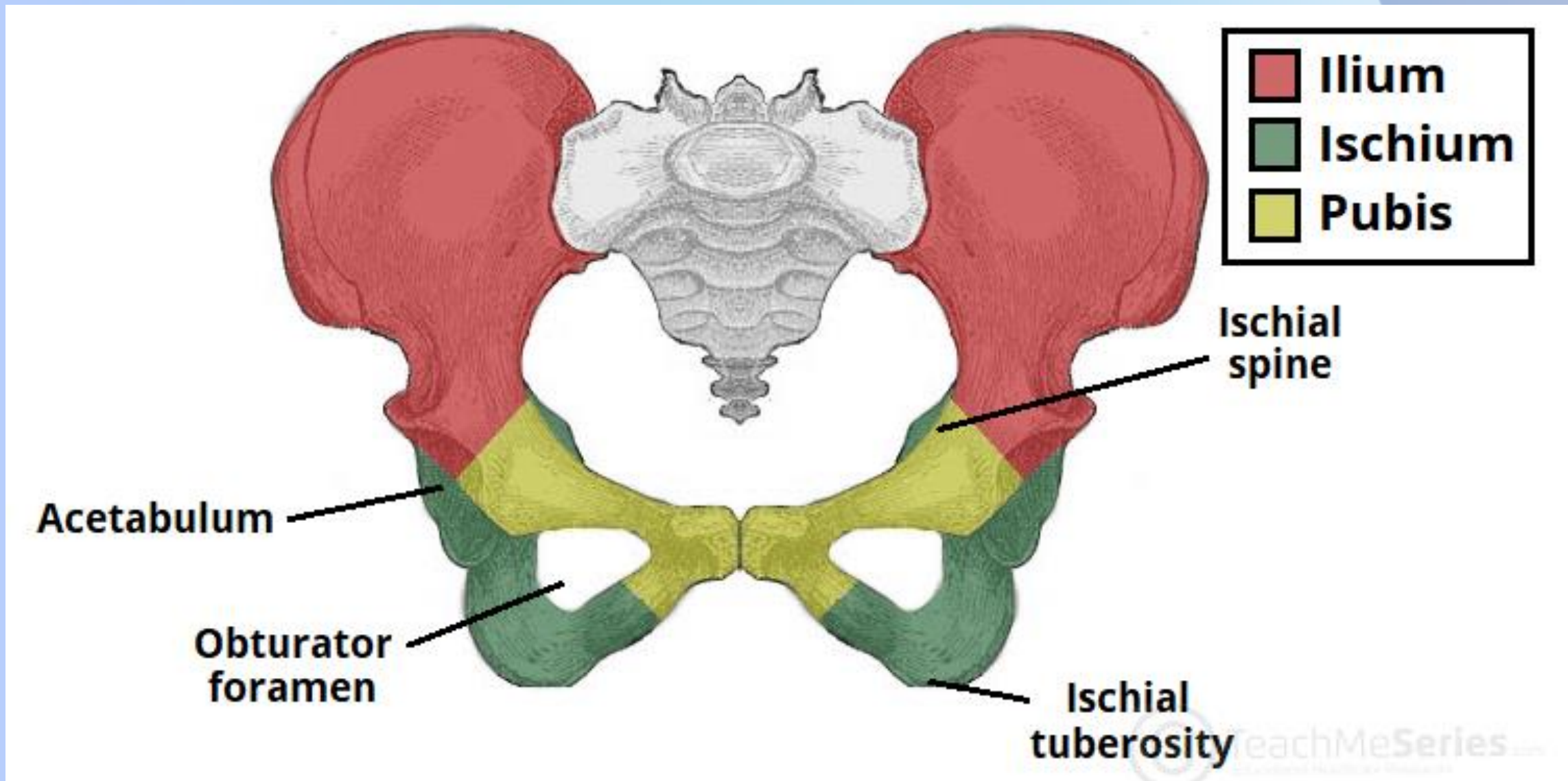
- **Ilium** - superior, broad wing-like part
- **Ischium** - posteroinferior part; bears body weight when sitting
- **Pubis** - anteroinferior part; forms the **pubic symphysis**

## Exam Tip

- **Ischial spine** is landmark for **pudendal nerve block**(passes near the ischial spine and sacrospinous ligament)

## Important Bony Landmarks

- **ASIS (Anterior Superior Iliac Spine)** - attachment of **inguinal ligament** and **sartorius**
- **AIS (Anterior Inferior Iliac Spine)** - origin of **rectus femoris**
- **Pubic tubercle** - attachment of **inguinal ligament**
- **Ischial spine** - projection between greater and lesser sciatic notches



# Formation of the Lumbar Plexus

## Location

- within the posterior part of the psoas major muscle
- Nerve branches emerge from different borders of psoas major

## Provides motor and sensory innervation to:

- Anterior and medial thigh
- Lower abdominal wall
- External genital region

- Formed by the anterior (ventral) rami of spinal nerves L1-L4
- Sometimes receives contribution from T12 (subcostal nerve)

## Injury can cause:

- Weak hip flexion
- Weak knee extension
- Loss of sensation in anterior thigh

# Branches of Lumbar Plexus

- Iliohypogastric nerve (L1)
- Ilioinguinal nerve (L1)
- Genitofemoral nerve (L1-L2)
- Lateral femoral cutaneous nerve (L2-L3)
- Femoral nerve (L2-L4)
- Obturator nerve (L2-L4)

Nerves emerge from different borders of the **psoas major muscle**:

**Lateral border:**

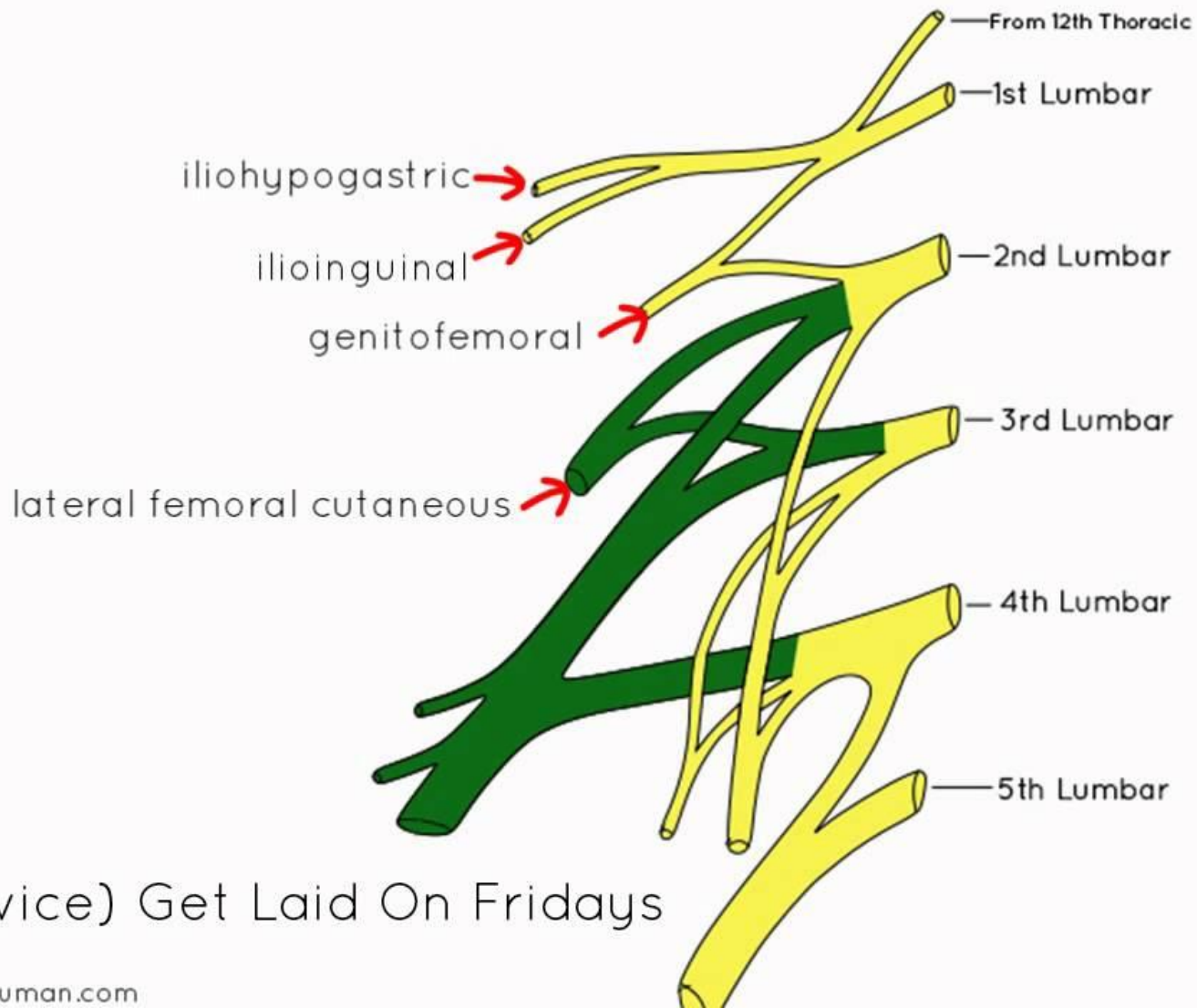
- Iliohypogastric
- Ilioinguinal
- Lateral femoral cutaneous
- Femoral nerve

**Anterior surface:**

- Genitofemoral nerve

**Medial border:**

- **Obturator nerve**



I (twice) Get Laid On Fridays

2 from 1  
2 from 2  
2 from 3

# Sacral Plexus Formation

- Formed by ventral rami of spinal nerves L4-S4
- L4-L5 form the lumbosacral trunk, which joins S1-S4
- Lies on the anterior surface of the piriformis muscle
- Located in the posterior wall of the pelvis

## Exam Tip

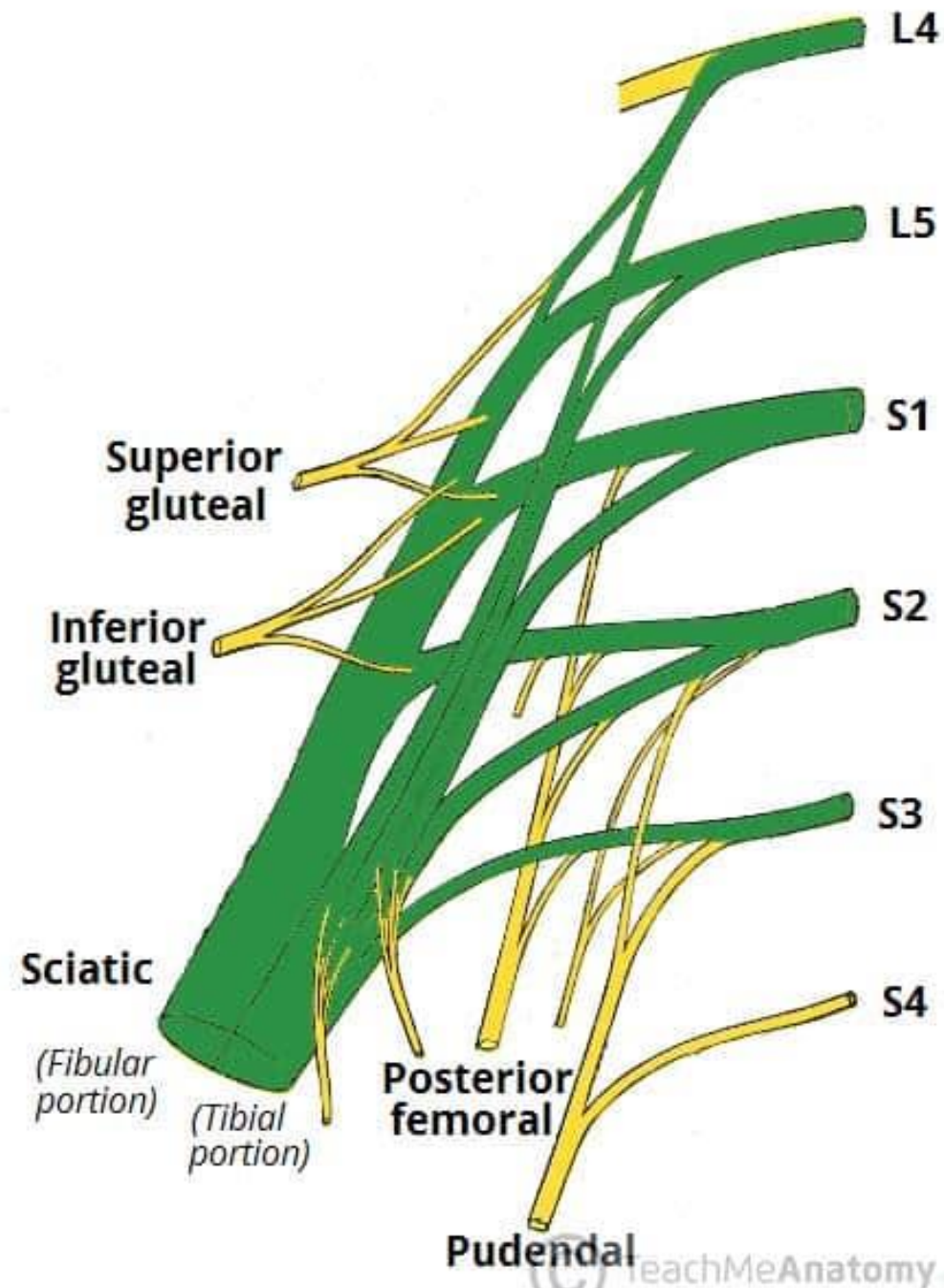
- Most sacral plexus branches exit the pelvis through the greater sciatic foramen.

Provides motor and sensory innervation to:

- Gluteal region
- Posterior thigh
- Most of the leg and foot
- Perineum

## Major Branches

- Sciatic nerve (L4-S3)
- Pudendal nerve (S2-S4)
- Superior gluteal nerve (L4-S1)
- Inferior gluteal nerve (L5-S2)
- Posterior femoral cutaneous nerve



# Sciatic Nerve

## Sciatic Nerve

- Largest nerve in the human body
- Arises from L4-S3 (sacral plexus)

## Course

- Leaves pelvis through the **greater sciatic foramen inferior to piriformis**
- Travels through the **gluteal region and posterior thigh**

## Major Divisions

- Tibial nerve
- Common fibular (peroneal) nerve
- Division usually occurs near the **popliteal fossa**.

## Motor Supply

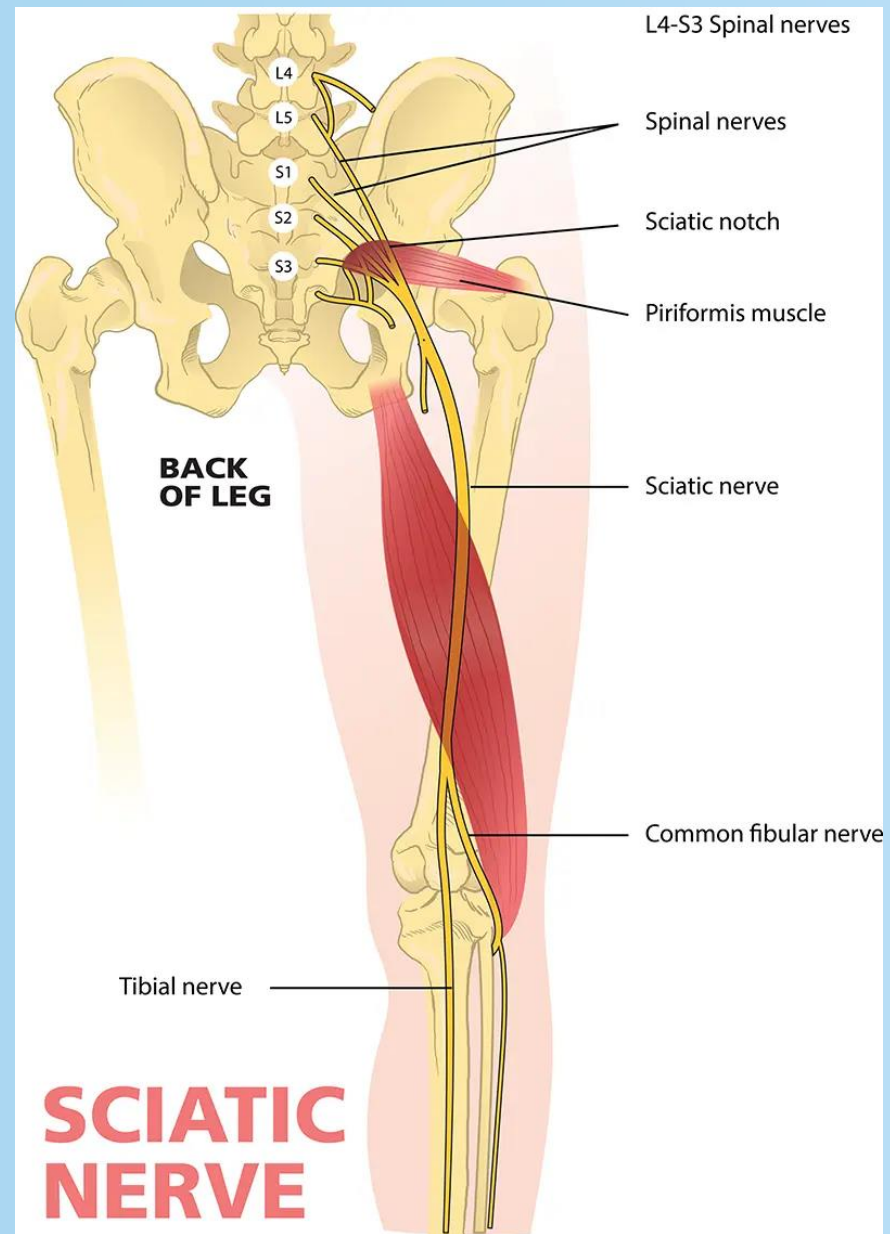
- Posterior thigh muscles (hamstrings)
- Semitendinosus
- Semimembranosus
- Biceps femoris (long head)
- **Most muscles of the leg and foot (via its branches)**

## Important Actions

- Hip extension
- Knee flexion

## Exam Trap

- Injury to the **sciatic nerve weakens hip extension** due to paralysis of the **hamstring muscles**.



# Gluteal Nerves

## Superior Gluteal Nerve (L4-S1)

- Exits pelvis through **greater sciatic foramen above piriformis**

### Innervates:

- **Gluteus medius**
- **Gluteus minimus**
- **Tensor fasciae latae**

### Function

- **Hip abduction**
- **Stabilizes pelvis during walking**

## Inferior Gluteal Nerve (L5-S2)

- Exits pelvis through **greater sciatic foramen below piriformis**

### Innervates:

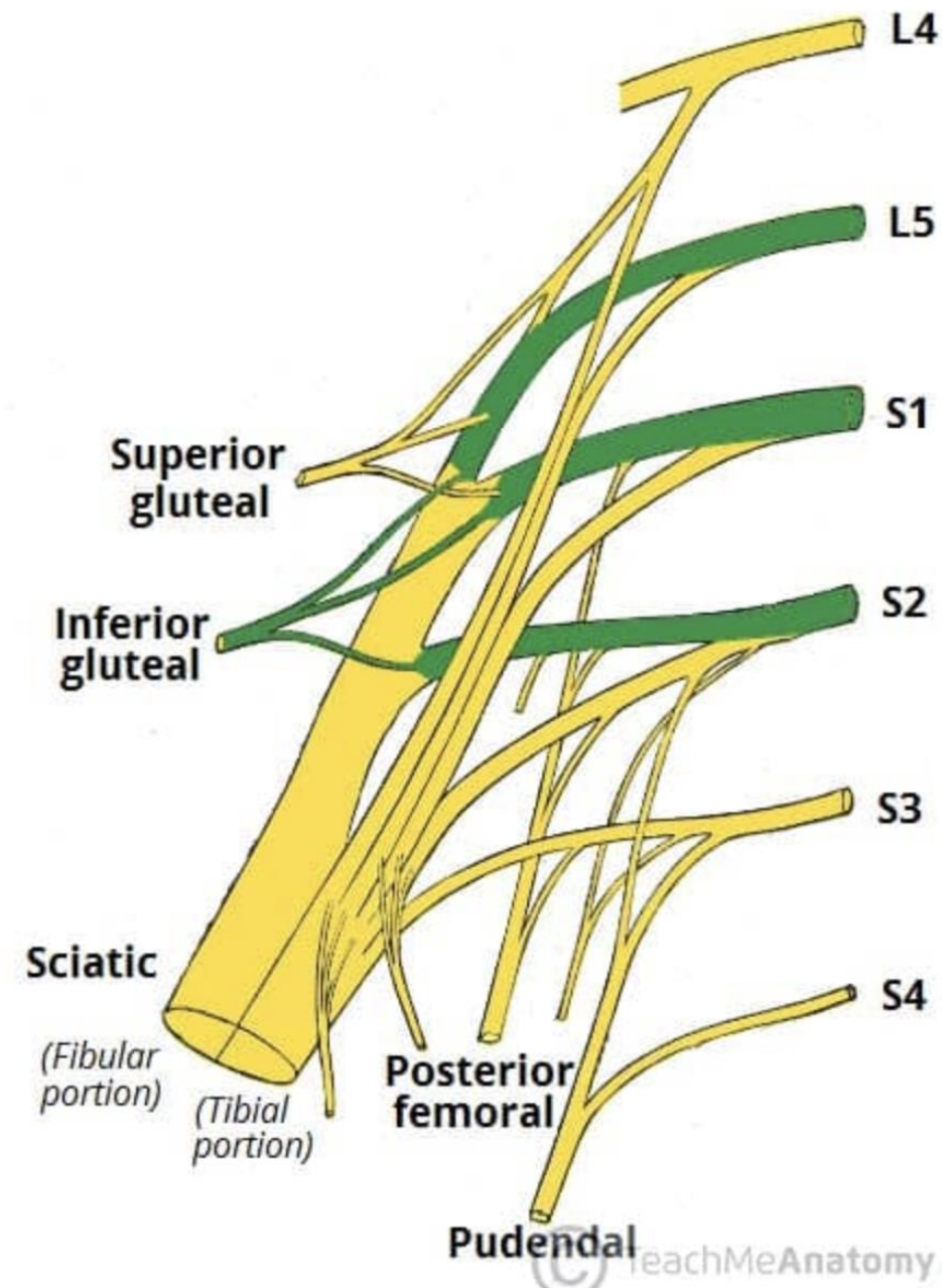
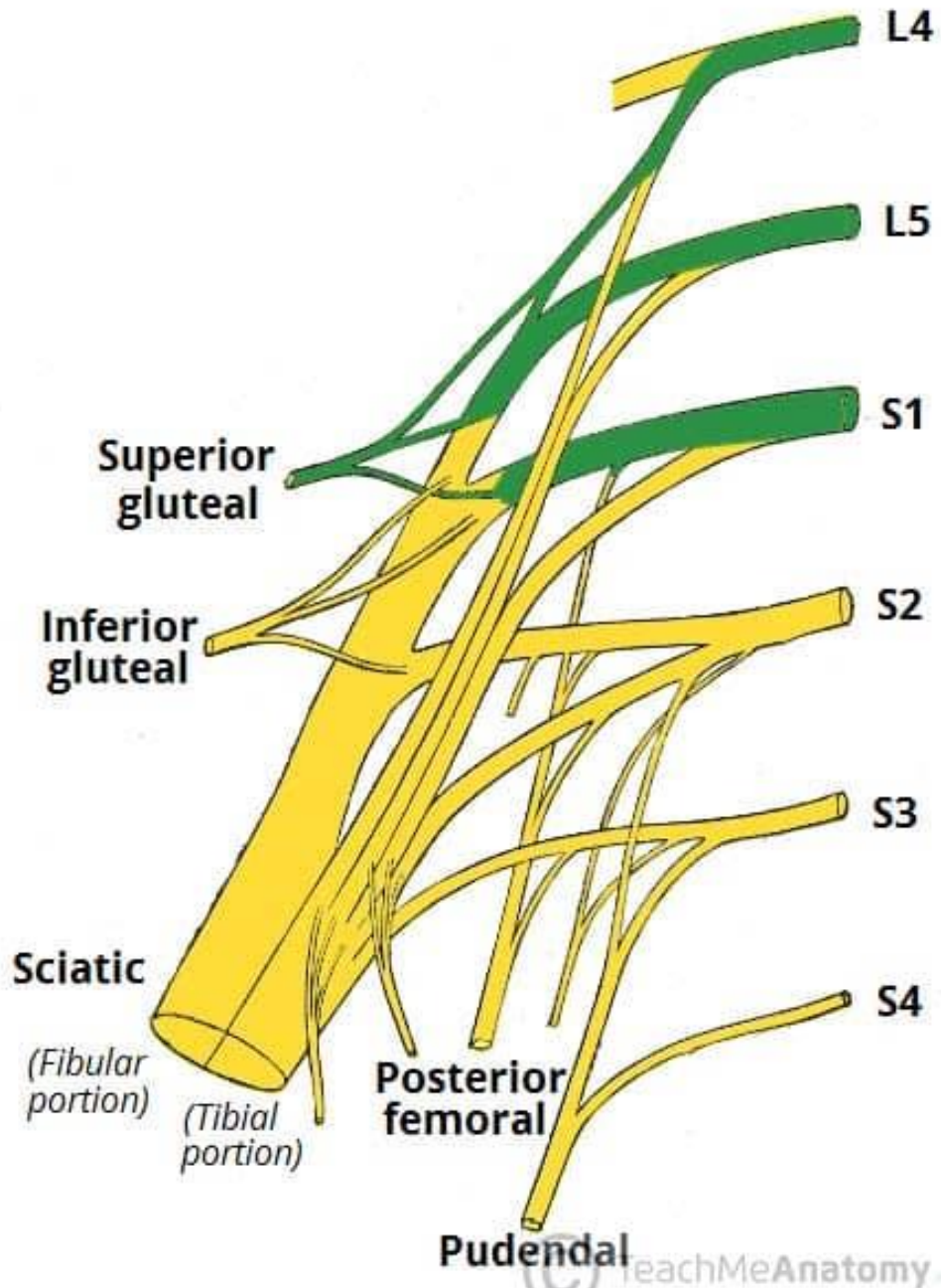
- **Gluteus maximus**

### Function

- **Powerful hip extension**
- **Important for standing up, climbing stairs, running**

### Clinical Correlation

- **Injury to the inferior gluteal nerve is best seen when??**



# Pudendal Nerve

- **Roots**
  - S2-S4 (ventral rami of sacral spinal nerves)

## Functions

### Motor:

- **External urethral sphincter** → voluntary control of urination
- **External anal sphincter** → voluntary control of defecation
- **Perineal muscles**

### Sensory:

- **External genitalia**
- **Perineal skin**

## Course

- Exits pelvis via **greater sciatic foramen below piriformis**
- Loops around **sacrospinous ligament** near **ischial spine**
- Re-enters perineum via **lesser sciatic foramen**

## Clinical / Exam Tip

- **Pudendal nerve block:** injection near **ischial spine** for anesthesia during childbirth or perineal surgery
- Knowledge of **ischial spine landmark** is **high-yield** for exams

