

Female Pelvic Anatomy



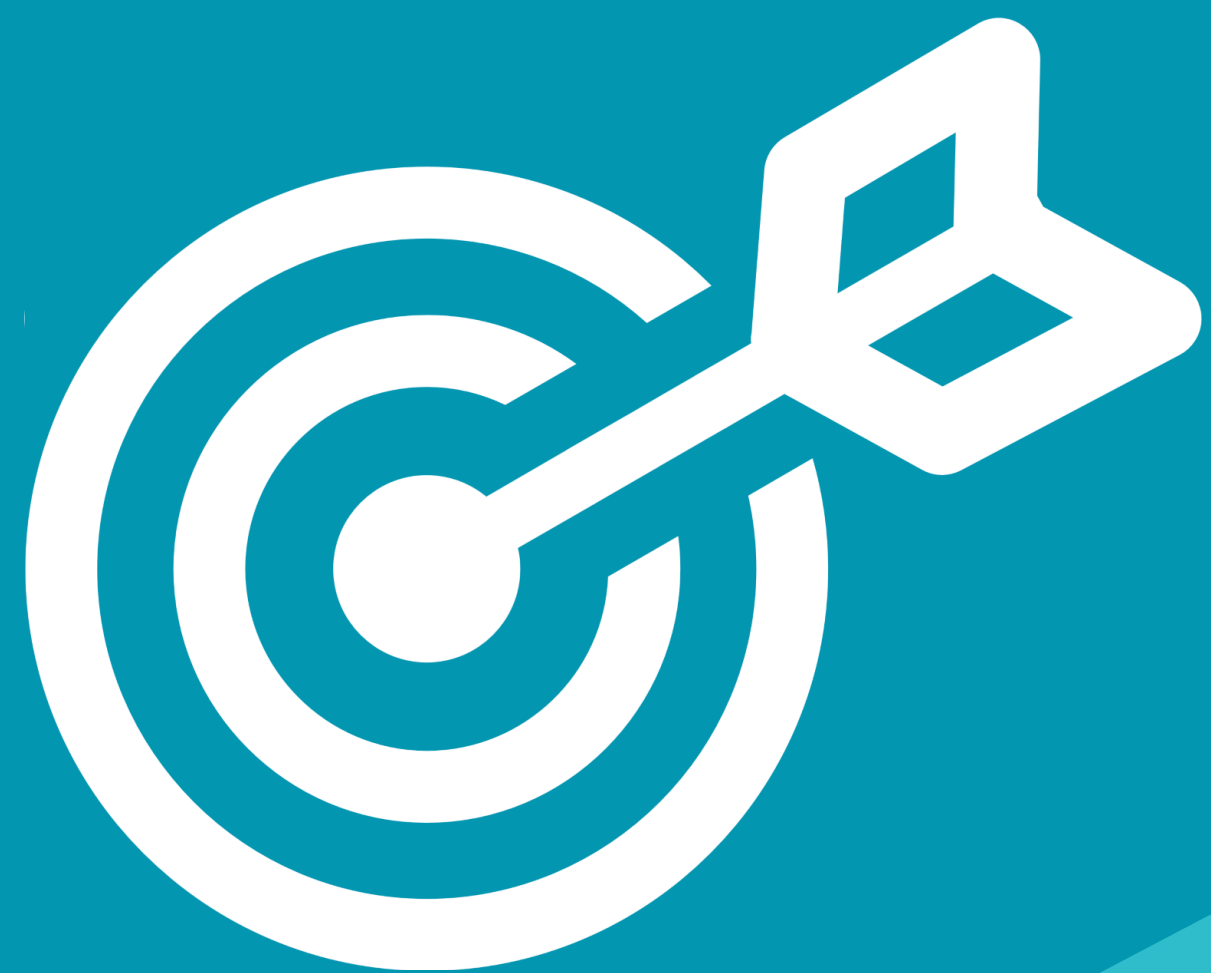
Dr.Sampath Gnanarathne
Senior lecturer in Obstetrics and Gynecology,
Department of Obstetrics and Gynecology,
Faculty of Medicine,
University of Peradeniya, Sri Lanka





Outline

- Importance of Learning Pelvic Anatomy as a Surgeon
 - Sacral Plexus
 - Sacral Sympathetic Trunks
 - Inferior Hypogastric Plexuses
- Pelvic Cavity
 - Bony Pelvis
 - Pelvic Walls
 - Pelvic Floor
- Female Genital Organs and Urethra
 - Uterus
 - Uterine Tubes
 - Ovary
 - Vagina
 - Female Urethra
- Pelvic Vessels and Nerves
 - Pelvic Vessels
 - Pelvic Nerves
- Perineum
 - Perineum
 - Perineal Body
 - Anal Region
- Female Urogenital Region
 - Mons pubis
 - Labia majora
 - Labia minora
 - Clitoris
 - Vestibule
 - The greater vestibular glands
 - Hymen
- Avascular Spaces of Pelvis

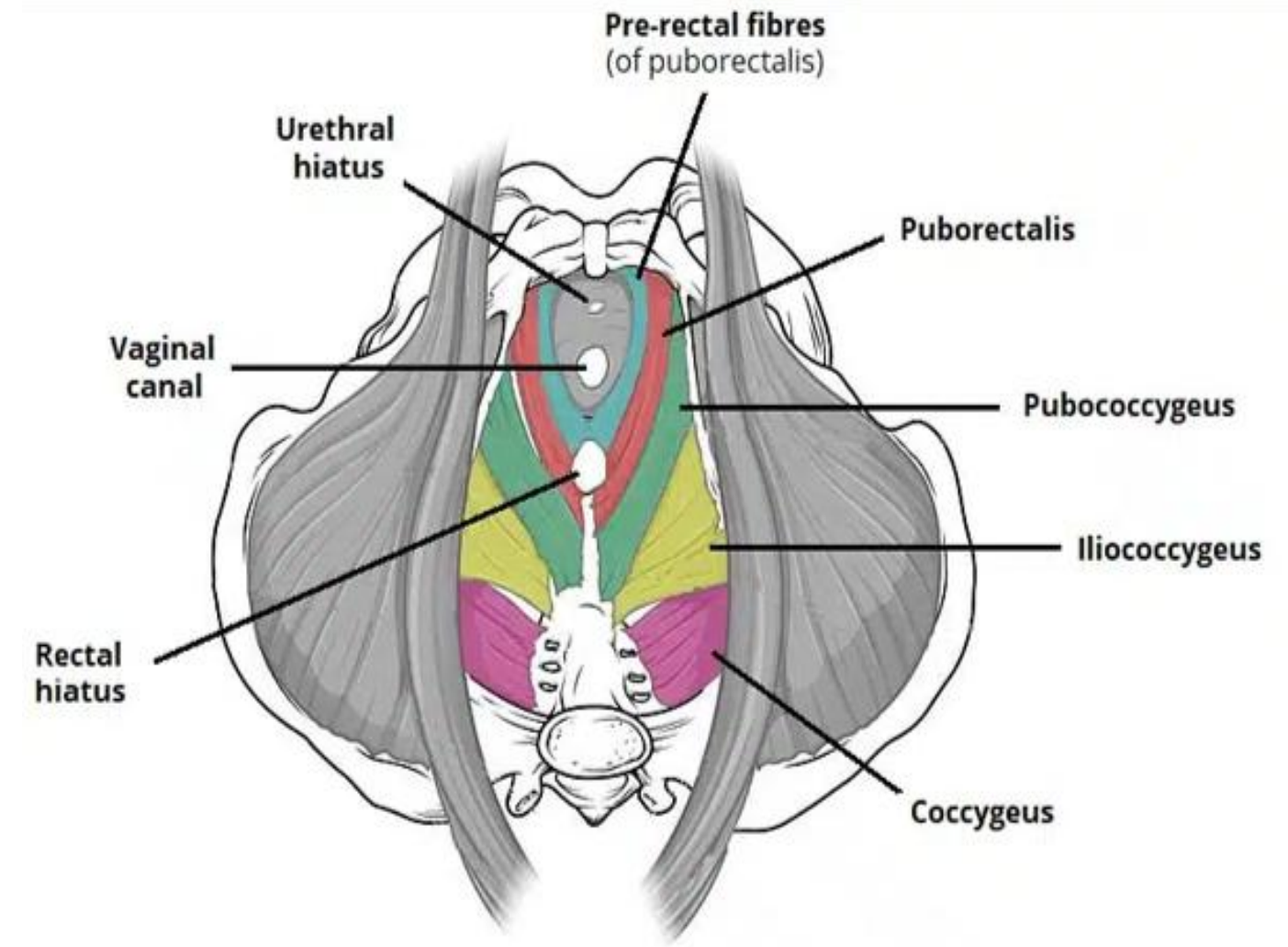


Importance of Learning Pelvic Anatomy as a Surgeon

- Ensures safe and precise surgical dissection in a complex anatomical region.
- Reduces risk of injury to major vessels, ureters, nerves, and reproductive organs.
- Improves ability to identify normal vs. pathological anatomy during procedures.
- Aids in the effective management of surgical complications.
- Supports accurate pre-operative planning and intra-operative decision-making.
- Improves outcomes in urogynecological and pelvic floor reconstructive surgeries.



Pelvic Cavity



1

Bony Pelvis

2

Pelvic Walls

3

Pelvic Floor

Bony Pelvis

- Pelvic Bones: Hip bones (ilium, ischium, pubis), sacrum, coccyx.
- Pelvic Brim: Made of pubic crest → pectineal line → arcuate line → sacral ala + promontory.
- Sex Differences: Female pelvis has a broader, wider subpubic angle, oval (transversely wide) brim for childbirth. The male pelvis has a narrower, acute subpubic angle and, heart-shaped brim.
- Position in Erect Posture: ASIS and the upper border of the pubic symphysis lie in the same vertical plane. Symphysis pubis, ischial spine, coccyx tip, femoral head & greater trochanter apex lie in the same horizontal plane.
- Clinical Relevance: This horizontal plane corresponds to the level reached by a finger during a rectal/vaginal exam. Lower poles of the ovaries (female) and the seminal vesicles (male) lie at this level.

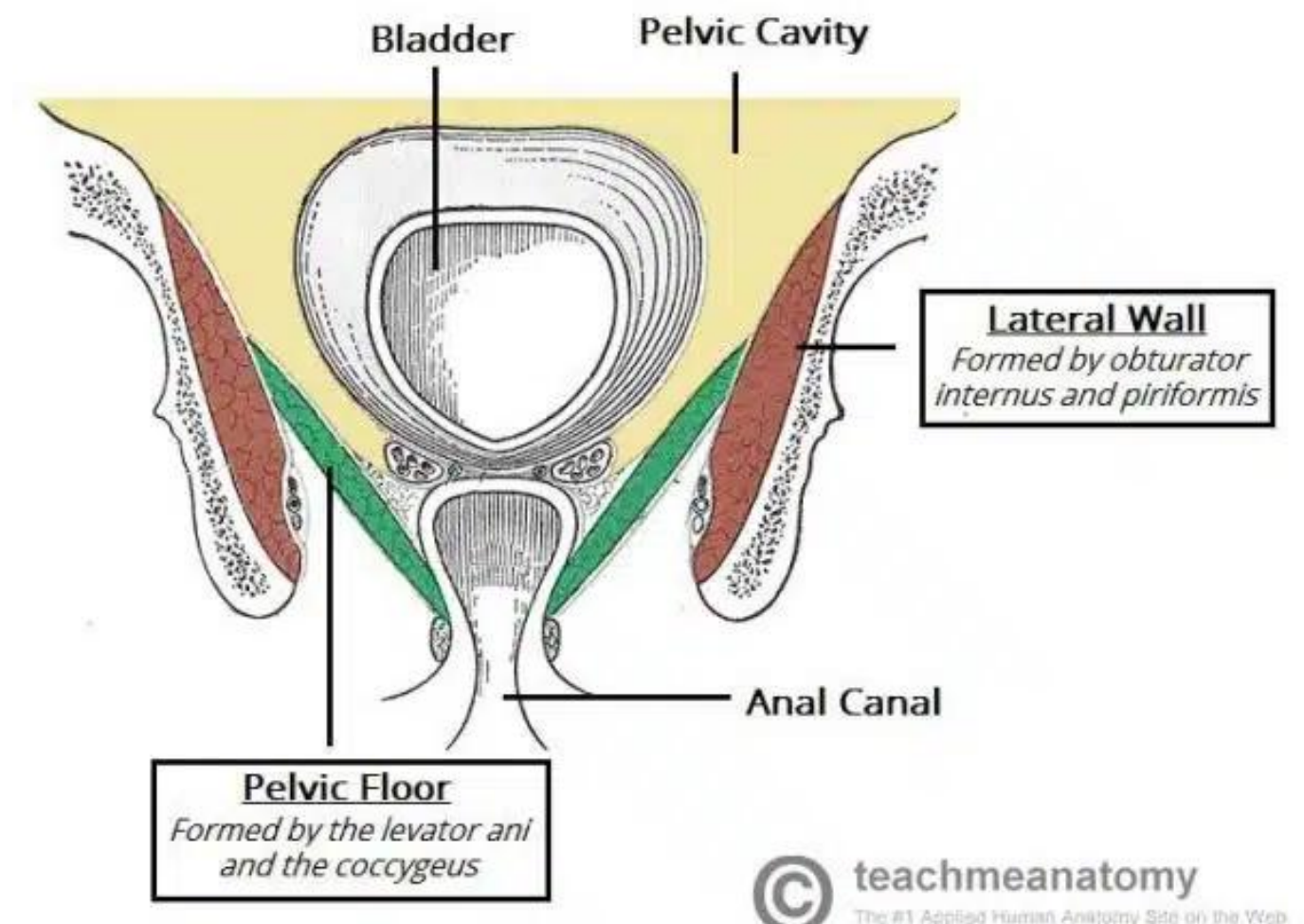


Pelvic Wall

- Muscles of the True Pelvis
 - Obturator internus
 - Piriformis
 - Levator ani
 - Coccygeus

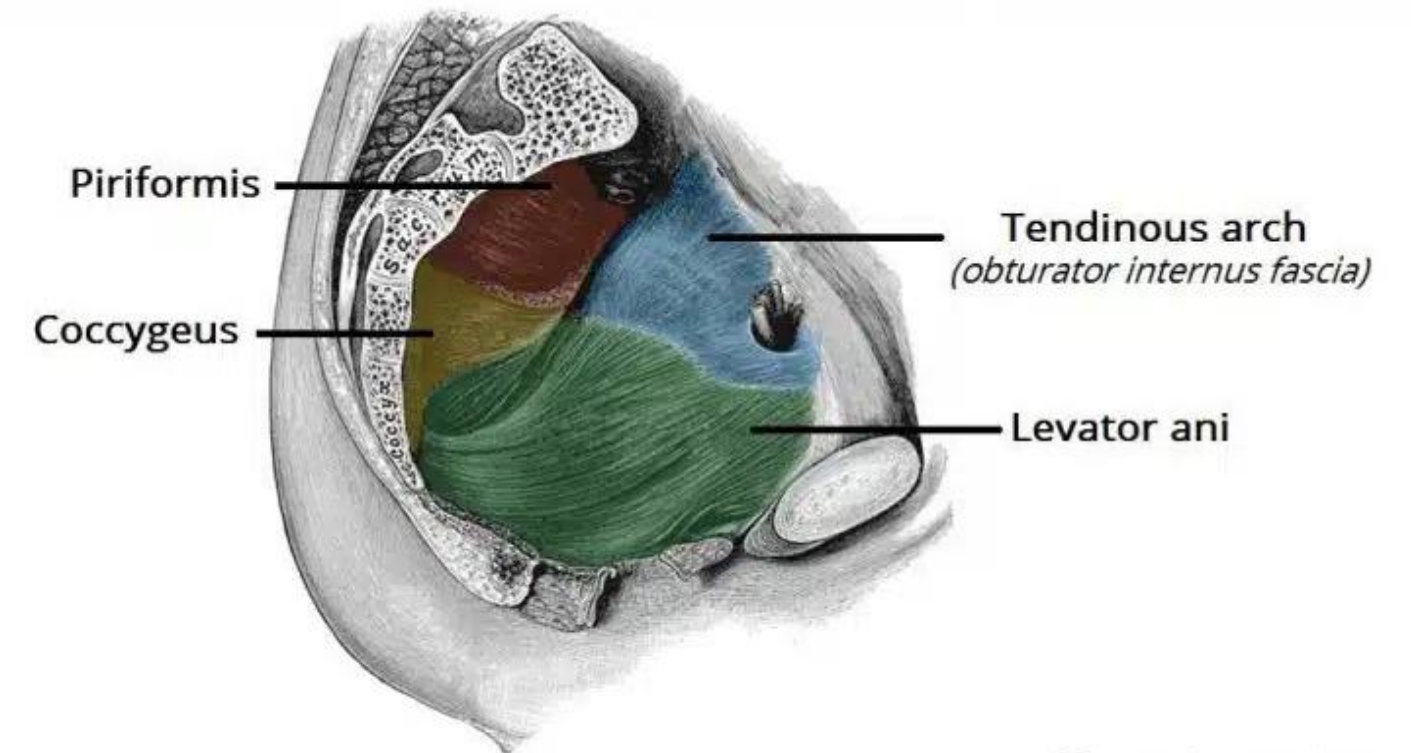
(Levator ani + coccygeus form the pelvic floor/diaphragm.)

- Lateral Wall – Formed by the hip bone, covered by the obturator internus muscle and the obturator fascia.
- Posterior Wall – Formed by the sacrum.
- Piriformis (Pelvic Portion) – Arises from the anterior sacrum between sacral foramina.
- Sacral nerves and plexus lie on its anterior surface.
- Passes through the greater sciatic foramen to the gluteal region.
- Obturator Internus (Pelvic Portion) – Originates from the obturator membrane and margins of the obturator foramen.
- Fibres converge toward the lesser sciatic notch, where the tendon bends at a right angle.
- Covered by the obturator fascia.
- Fascia gives rise to the tendinous arch of the levator ani.



Pelvic Floor

- Formed by the pelvic diaphragm (levator ani + coccygeus), shaped like a forward-facing gutter supporting pelvic viscera.
- Levator ani has two main parts: Pubococcygeus (includes puborectalis, puboanalis, pubovaginalis/pubourethralis), Iliococcygeus (inserts into coccyx & anococcygeal raphe).
- Puborectalis forms a sling holding the anorectal junction forward, which is essential for continence.
- Coccygeus (ischiococcygeus) spans from the ischial spine to the coccyx.
- Nerve supply: Mainly S3–S4, with contributions from pudendal branches for puborectalis and related fibres.
- Actions: Supports pelvic organs & maintains position. Contracts with increased intra-abdominal pressure (coughing, lifting). Relaxes during defecation. Guides the fetal head during childbirth.
- Pelvic fascia: Superior & inferior fascia of pelvic diaphragm reinforce the muscles; tendinous arch provides key origin for levator ani.



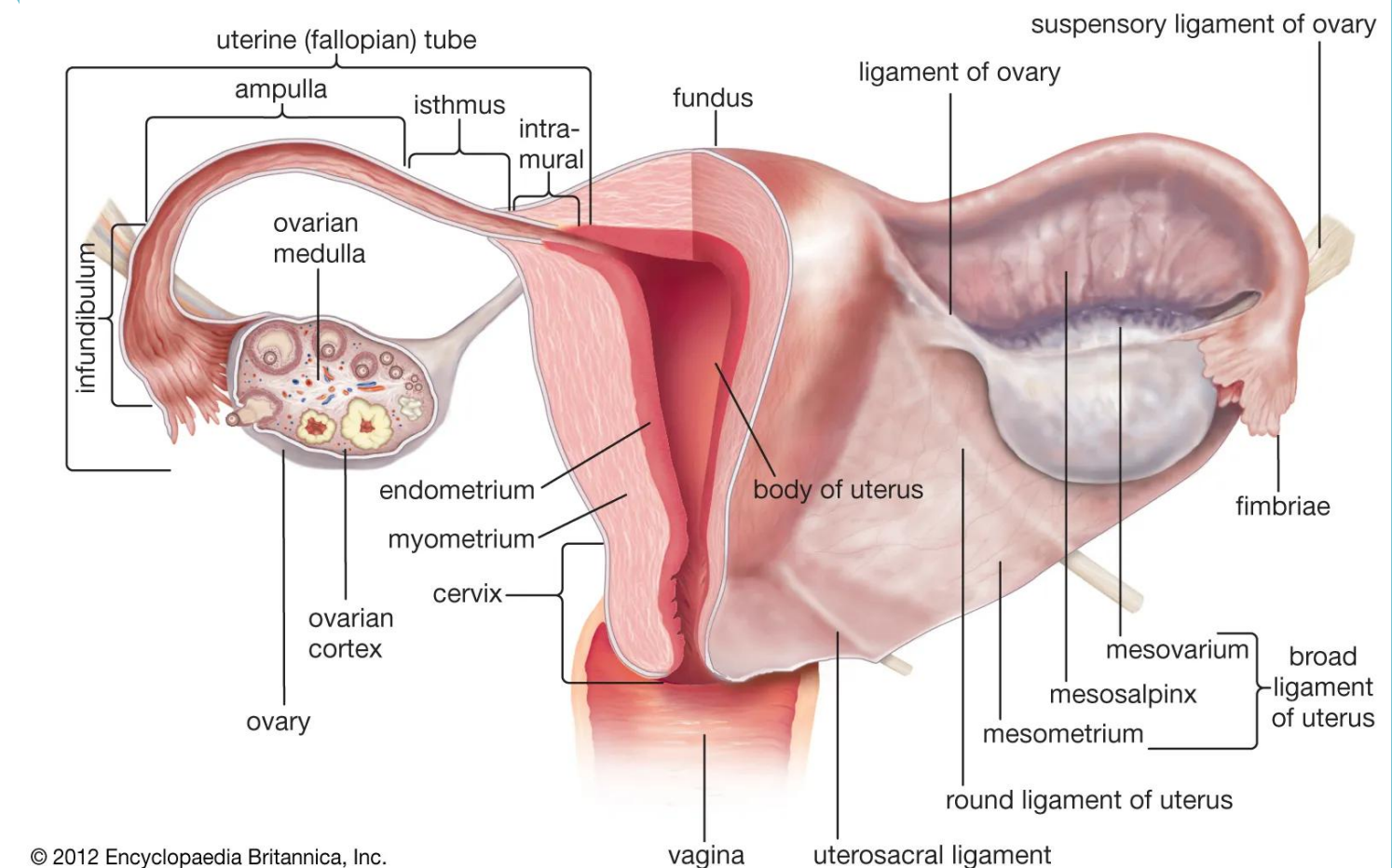
Female Genital Organs and Urethra

- ▶ Uterus
- ▶ Uterine Tubes
- ▶ Ovary
- ▶ Vagina
- ▶ Cervix
- ▶ Female Urethra



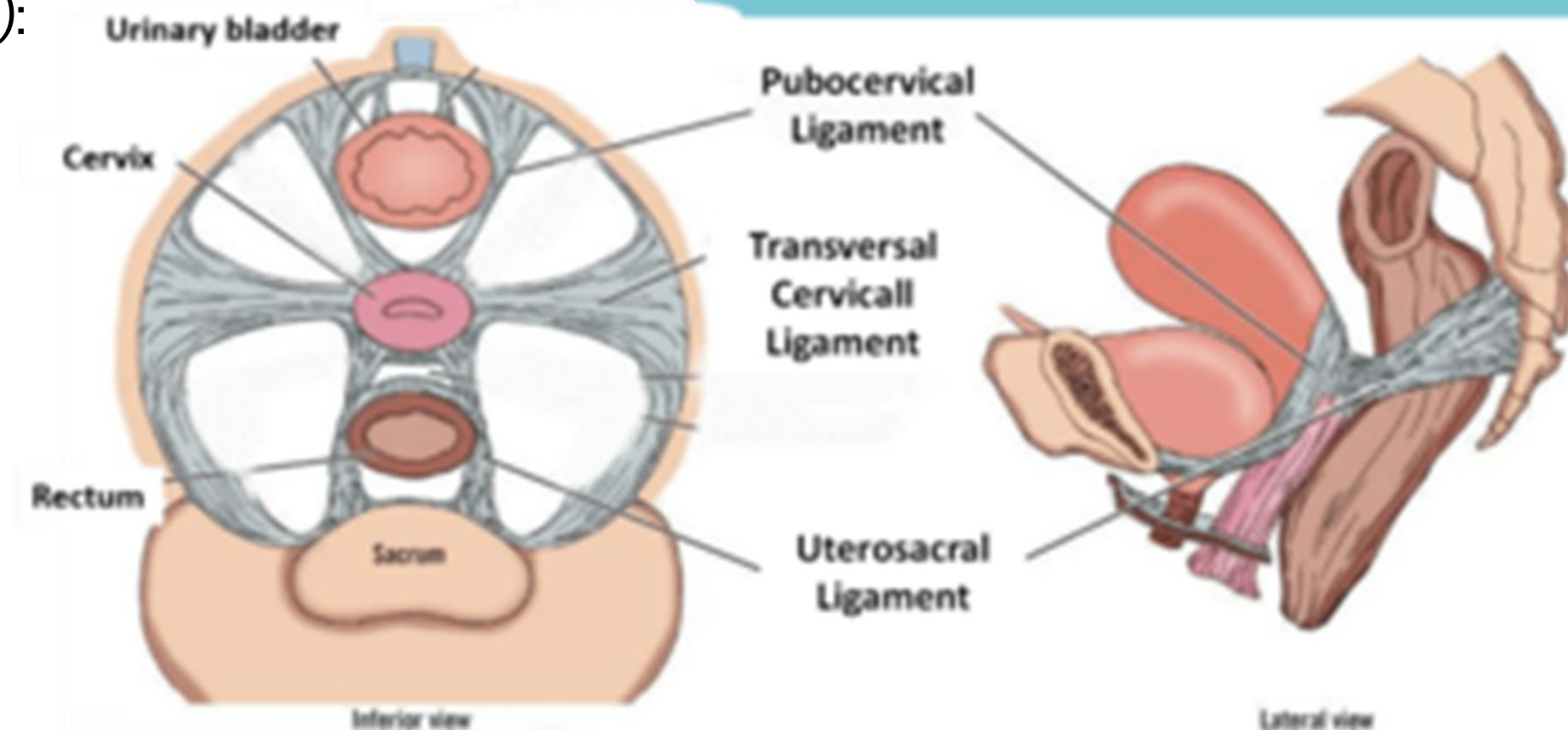
Uterus

- Muscular, pear-shaped organ ~8 × 5 × 3 cm
- Divided into fundus, body, and cervix
- Fundus: Rounded part above the uterine tube openings; covered by peritoneum
- Body: Flattened anteroposteriorly; receives uterine tubes at upper cornua; peritoneum forms broad ligament laterally
- Surfaces: Intestinal surface (superior) – related to bowel
- Vesical surface (inferior) – rests on the bladder
- Cavity is a narrow slit in nulliparous women; expands in pregnancy
- Cervix: Supravaginal + vaginal parts; protrudes into vaginal vault forming fornices (deepest posteriorly)
- Posterior cervix forms the anterior wall of the pouch of Douglas; the anterior surface is attached to the bladder
- Ureter passes ~2 cm lateral to cervix—important surgically
- Internal os – opens to body; external os – opens to vagina (circular in nullipara, slit-like after childbirth)



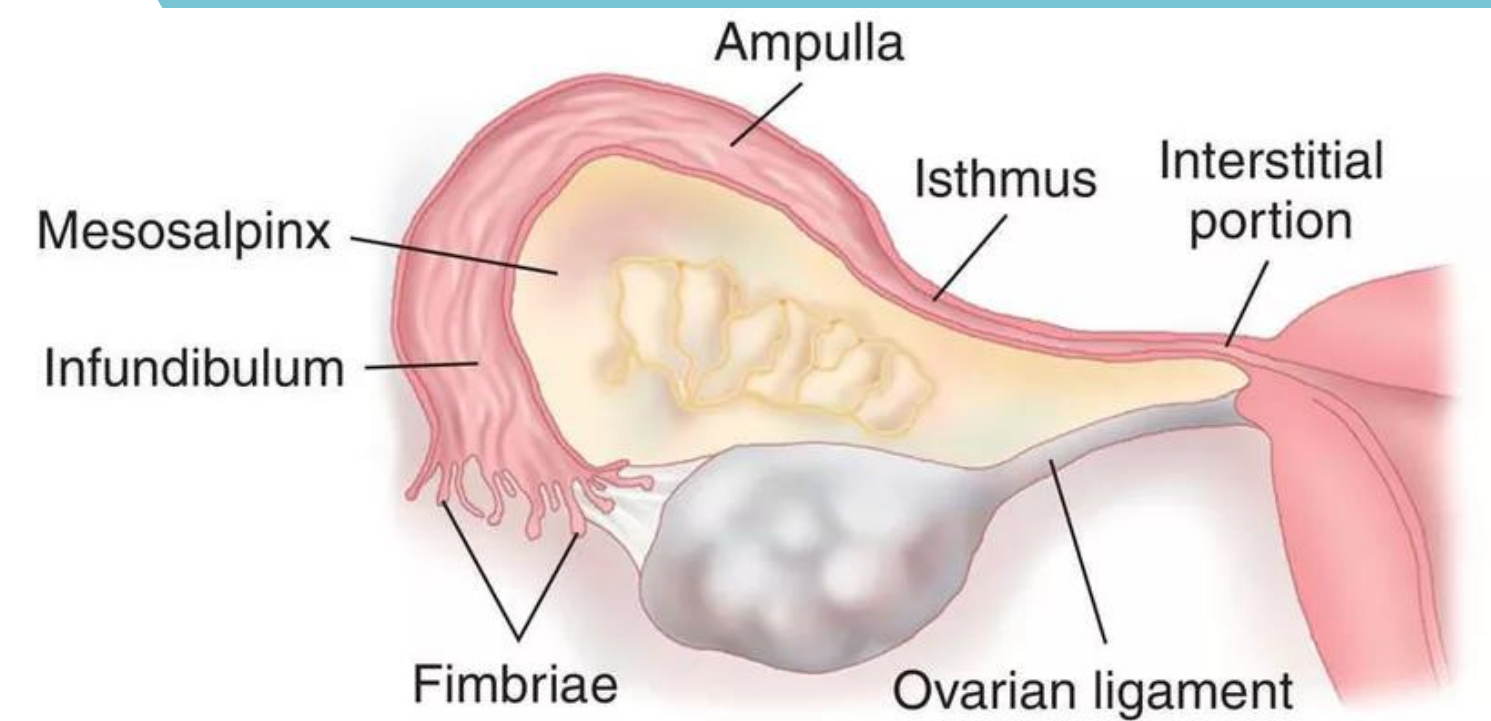
Position and Supports of the Uterus

- Normal Position - Anteverted + anteflexed
- ~20% of nulliparous women have a retroverted uterus (usually asymptomatic)
- Cervix - most fixed part (attached to bladder + vaginal fornix)
- Muscular Support - Levator ani (pubovaginalis) + perineal body
- Broad Ligament - Double fold of peritoneum; minimal role in support
- Round Ligament- From uterine cornu → through inguinal canal → labium majus
- Helps maintain anteversion/anteflexion, opposes backward forces
- Key Supporting Ligaments
 - Transverse cervical (cardinal/Mackenrod's): major support; from cervix to lateral pelvic wall; carries uterine artery & ureter
 - Uterosacral ligaments: run from cervix to sacrum; maintain uterus in anteversion (brace cervix backward)



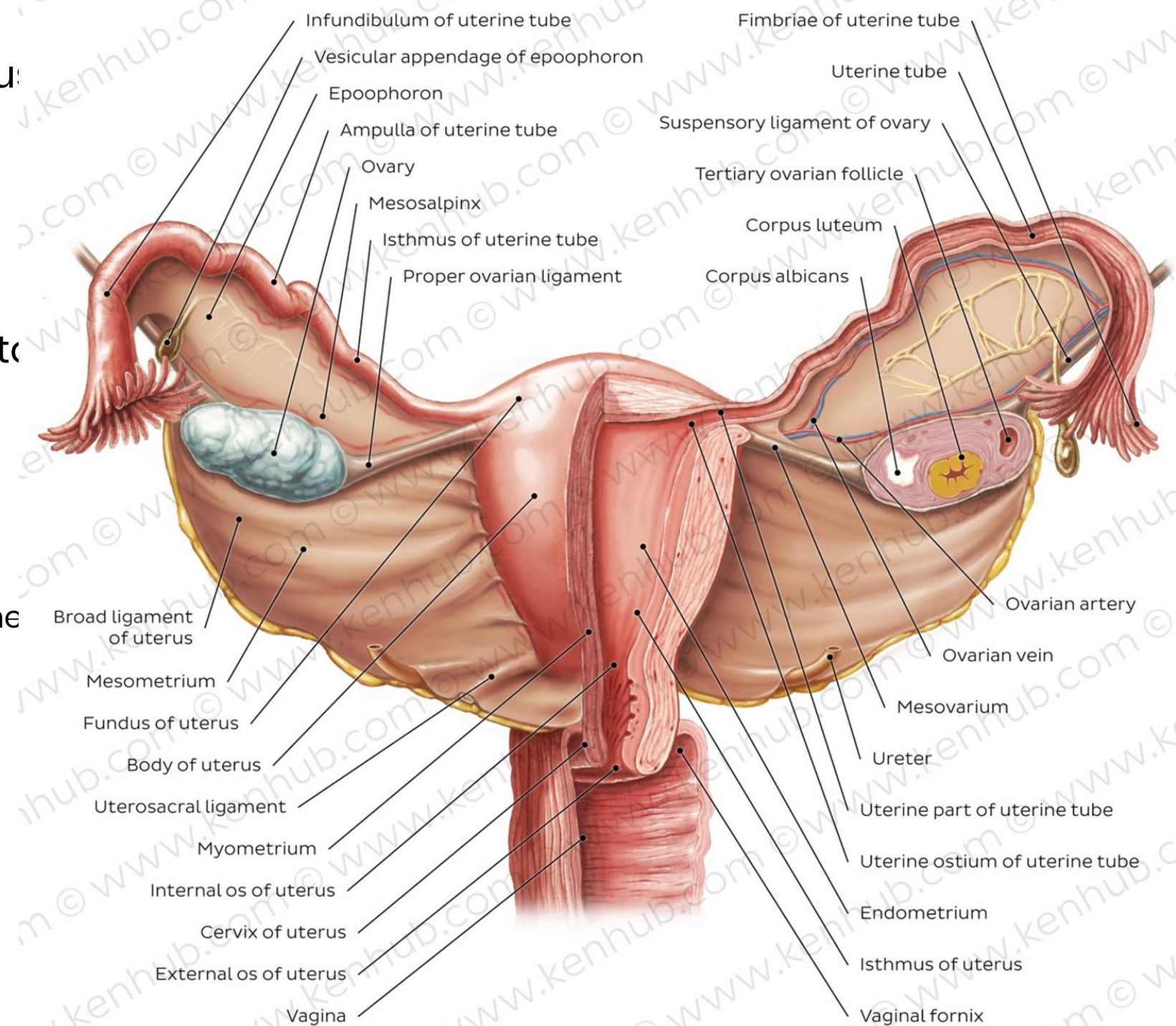
Uterine Tubes

- Length: ~10 cm; medial 1 cm is intramural within the uterine wall
- Runs along the upper edge of the broad ligament within the mesosalpinx
- Four regions:
 - Isthmus: narrow, straight, near the uterus
 - Ampulla: widest and longest segment; common site of fertilization
 - Infundibulum: trumpet-shaped lateral end
 - Fimbriae: finger-like projections; one usually attaches to ovary
- Lateral open end lies behind the broad ligament near the lateral pelvic wall
- Wall has inner circular + outer longitudinal smooth muscle
- Lined by folded mucosa with ciliated & non-ciliated columnar cells
- Cilia beat toward the uterus, aiding the transport of the oocyte/zygote



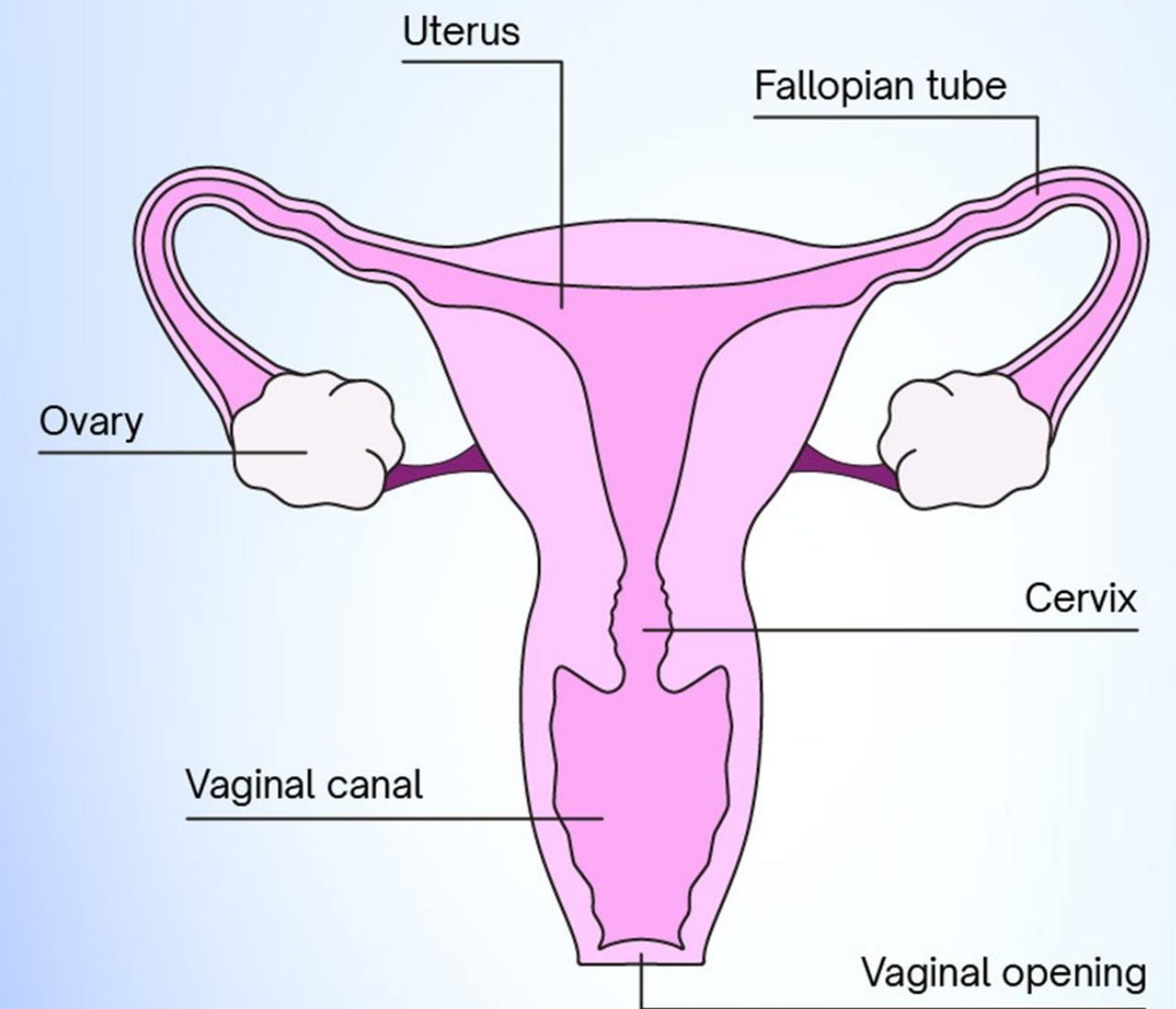
Ovary

- Ovoid; ~3 × 2 × 1 cm; vertical in erect posture
- Upper pole (tubal end) overlapped by fimbriae; lower pole attached to uterus: ovarian ligament (continuous with round ligament → remnant of gubernaculum)
- Attached to the broad ligament by the mesovarium (anterior border)
- Lateral surface lies between internal & external iliac vessels; close to obturator nerve & ureter
- Medial surface related to the uterine tube
- Blood Supply
 - Ovarian artery (from abdominal aorta, below renal artery) → enters suspensory ligament supplies ovary & tube
 - Anastomoses with the uterine artery at the mesosalpinx
 - Ovarian veins form the pampiniform plexus
 - Right → IVC
 - Left → left renal vein
- Lymph Drainage
 - To para-aortic nodes at L2 (along ovarian vessels)
 - Possible secondary drainage: inguinal nodes (via round ligament)
- Nerve Supply
 - Sympathetic fibres (T10–T11) via aortic plexus → pain referred to periumbilical region
 - Parasympathetic fibres are possible via the inferior hypogastric plexus



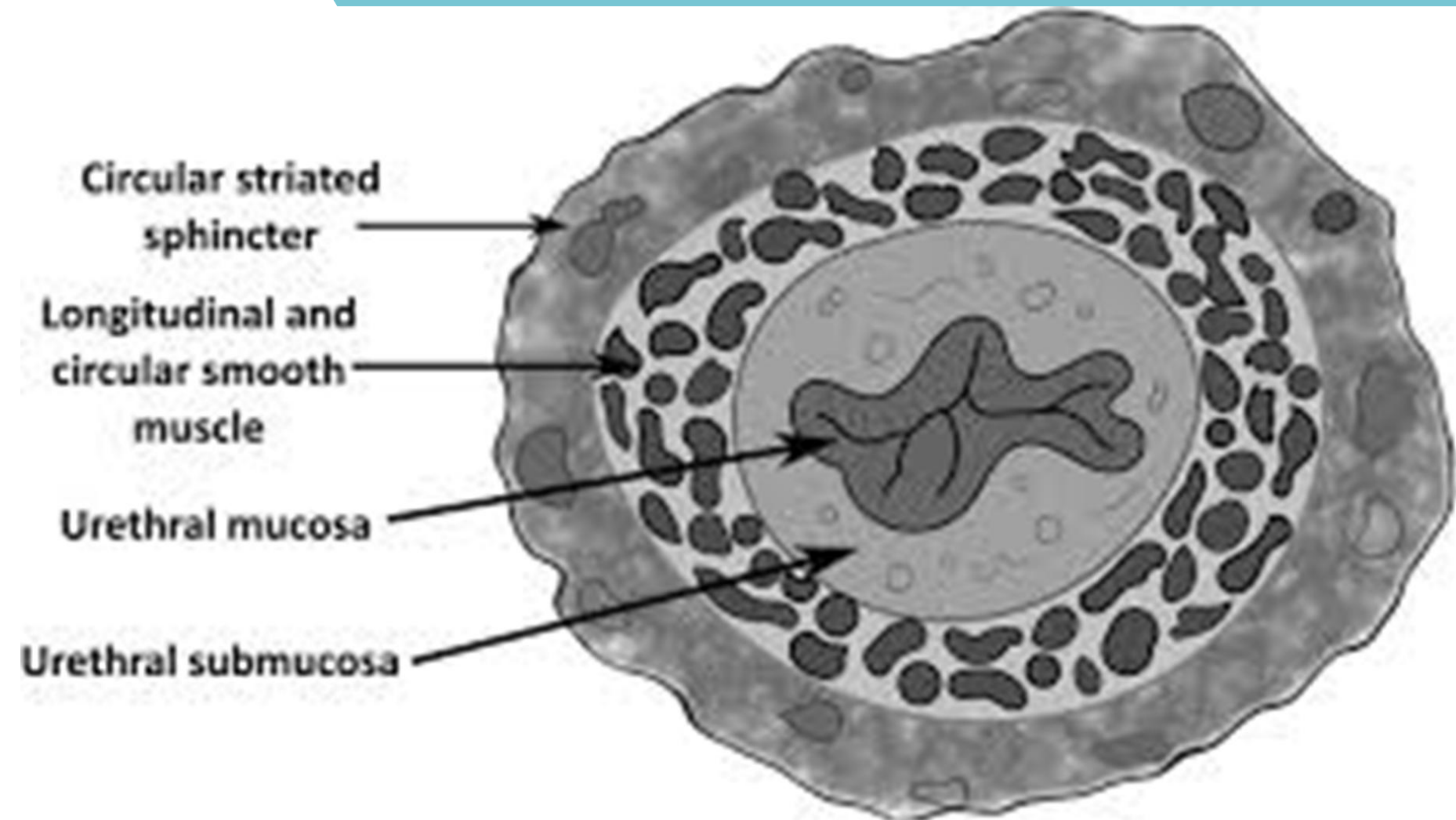
Vagina

- Fibromuscular tube ~10 cm; highly expandable; lumen forms an H-shaped slit.
- Relations:
 - Anterior: bladder & urethra
 - Posterior: rectum, anal canal, perineal body
 - The peritoneum of the pouch of Douglas covers the upper posterior wall
- Receives cervix, forming anterior, posterior, and lateral fornices (posterior fornix deepest).
- Traverses the pelvic floor: between pubovaginalis, through the urogenital diaphragm into the vestibule.
- Openings: urethra opens anteriorly; Bartholin gland ducts open posterolaterally below the hymen.
- Blood supply: vaginal artery + branches from uterine, inferior vesical, and middle rectal arteries.
- Venous drainage: pelvic venous plexuses → internal iliac vein.
- Lymph drainage:
 - Upper & middle vagina → external & internal iliac nodes
 - Lower 1/3 (below hymen) → superficial inguinal nodes
- Innervation:
 - Lower vagina: pudendal nerve (somatic, sensory)
 - Upper vagina: autonomic, sensitive mainly to stretch



Female Urethra

- Short (~4 cm), fibromuscular tube.
- Lined proximally by urothelium and distally by non-keratinized stratified squamous epithelium.
- Embedded in anterior vaginal wall; external meatus in vestibule.
- The urethral smooth muscle is orientated mainly longitudinally.
- Its contraction during micturition shortens the urethra and widens its lumen.
- Outside the smooth muscle is the striated circular muscle of the sphincter urethrae.
- Risk of urinary tract infection high in females due to shorter urethra



Pelvic Vessels and Nerves

- ▶ Pelvic Vessels
- ▶ Pelvic Nerves
- ▶ Sacral Plexus
- ▶ Sacral Sympathetic Trunks
- ▶ Inferior Hypogastric Plexuses



Pelvic Vessels

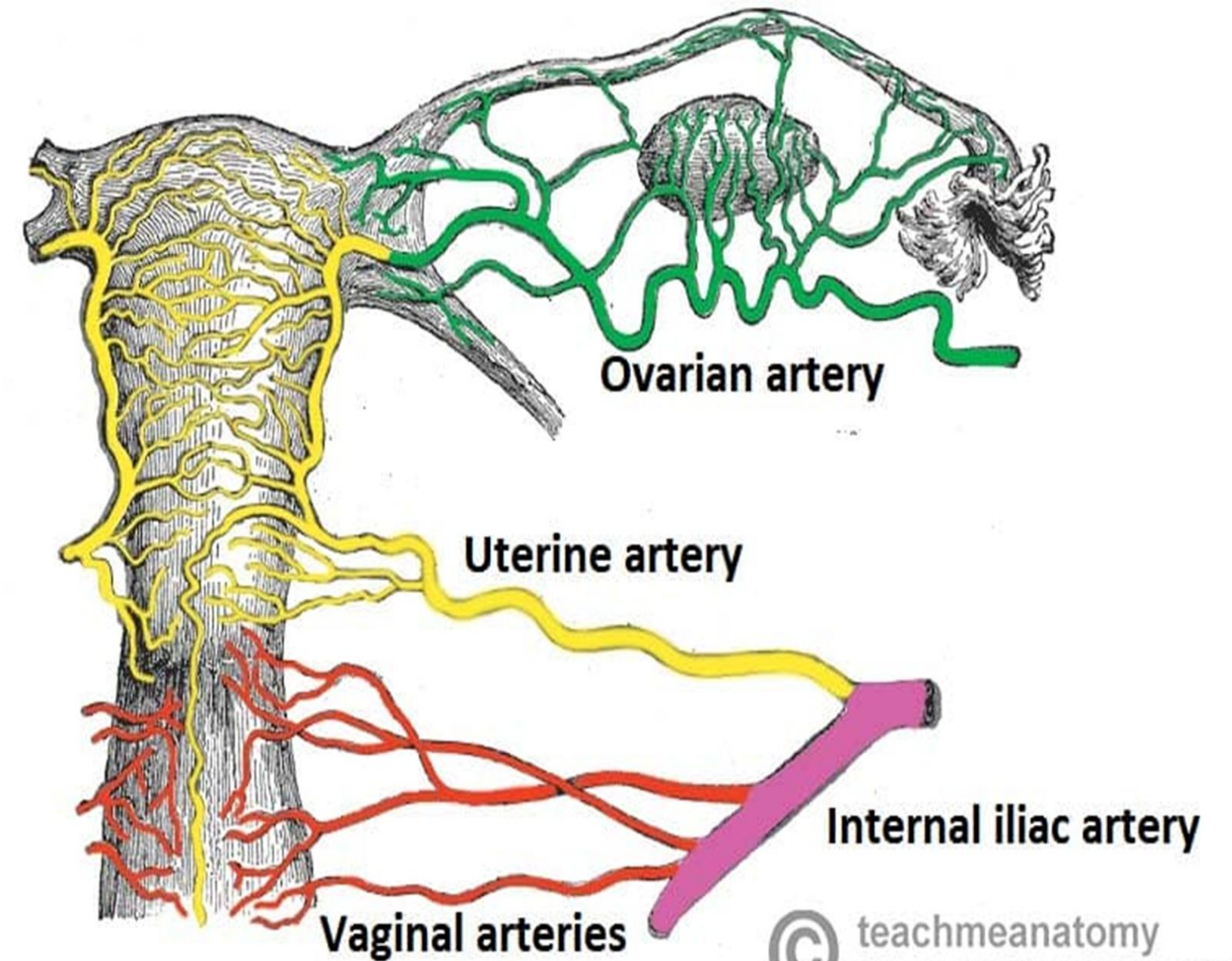
- **Internal Iliac Artery**

- **Origin & Course**

- The internal iliac artery arises from the common iliac bifurcation at the pelvic brim.
- Divides into posterior division (parietal) and anterior division (visceral + parietal).
- Posterior Division – 3 Parietal Branches
 - Iliolumbar artery – psoas, quadratus lumborum, iliacus; L5 spinal branch.
 - Lateral sacral arteries – sacral nerve roots, meninges; enter sacral foramina.
 - Superior gluteal artery – exits pelvis via greater sciatic foramen above piriformis.
- Anterior Division – 9 Branches (variable)
 - Bladder-related: superior vesical, obliterated umbilical; inferior vesical.
 - Visceral: middle rectal, uterine, vaginal.
 - Parietal: obturator, internal pudendal, inferior gluteal (terminal branches).
 - Uterine artery crosses above the ureter (“water under the bridge”).

- **Internal Iliac Vein**

- Formed by convergence of gluteal & visceral venous plexuses.
- Receives veins from rectal, vesical, prostatic, uterine, vaginal plexuses.
- Communicates with vertebral venous plexus via lateral sacral veins (pathway for metastasis).
- No valves → ↑ abdominal pressure can cause reflux through vertebral system.
- Rich plexuses → risk of massive retroperitoneal bleeding after pelvic fractures.



Pelvic Nerves

- Origin: From lumbar plexus (L2–L4 anterior divisions) within psoas major.
- Pelvic course:
 - Emerges from the medial border of psoas, runs along the lateral pelvic wall.
 - Lies between the internal iliac vessels and the obturator internus fascia.
 - Reaches thigh through the obturator foramen.
- Relations:
 - Crosses pelvic brim medial to sacroiliac joint.
 - Lies close to the ovary, separated only by the parietal peritoneum → ovarian pathology may cause medial thigh referred pain.
- At the obturator canal:
 - Nerve lies highest, with artery then vein below it.
 - Divides into anterior & posterior divisions.
 - *Anterior*: passes anterior to obturator externus.
 - *Posterior*: pierces the obturator externus and supplies it.
- Function:
 - Nerve of the adductor compartment of the thigh.
- Variant:
 - Accessory obturator nerve (10–30%): passes over the superior pubic ramus → supplies pectineus.



Sacral Plexus

- Location: On piriformis, lateral to sacral foramina, under parietal pelvic fascia.
- Formation: Lumbosacral trunk (L4–L5) + anterior rami of S1–S4.
- Key Points: Divides into anterior & posterior divisions for flexors/extensors.
- Supplies muscles, skin, and pelvic organs.
- Parasympathetic fibers control viscera & erection.

Nerve	Roots	Function / Target
Sciatic	L4–S3	Posterior thigh, leg, foot
Superior gluteal	L4–S1	Gluteus medius & minimus
Inferior gluteal	L5–S2	Gluteus maximus
Pudendal	S2–S4	Perineum, anal canal, external genitalia
Nerve to obturator internus	L5–S2	Obturator internus, superior gemellus
Nerve to quadratus femoris	L4–S1	Quadratus femoris, inferior gemellus, hip joint
Posterior femoral cutaneous	S1–S3	Skin of posterior thigh & buttock
Perforating cutaneous	S2–S3	Skin over lower buttock
Pelvic splanchnic	S2–S4	Parasympathetic → pelvic viscera, distal colon

Sacral Sympathetic Trunk

- Location: Cross pelvic brim behind common iliac vessels, descend along medial sacral margins.
- Structure: Usually 4 ganglia per side, converge at ganglion impar anterior to coccyx.
- Branches:
 - Somatic: To sacral nerves → lower limb & perineum
 - Vascular: Small filaments to lateral & median sacral vessels
 - Visceral: Join inferior hypogastric plexuses → pelvic viscera



Inferior Hypogastric Plexus

- Location: Lateral pelvis, beside rectum, cervix/bladder (female) or rectum, seminal vesicle/prostate/bladder (male).
- Structure: Rectangular, fenestrated nerve plaque (~5 × 2 cm).
- Inputs:
 - Sympathetic: From superior hypogastric plexus & sacral sympathetic ganglia
 - Parasympathetic: Pelvic splanchnic nerves (S2–4)
- Function:
 - Parasympathetic: Motor to bladder detrusor & distal colon (splenic flexure → rectum), secretomotor to gut, vasodilation of erectile tissue
 - Sympathetic: Motor to the bladder neck, internal anal sphincter, vas deferens, seminal vesicles, prostate; facilitates uterine contraction
 - Sensory: Distension of bladder & rectum via parasympathetic; pain via both sympathetic & parasympathetic
- Pathways: Visceral branches run with internal iliac vessels as neurovascular bundles



Perineum



- ▶ Perineum
- ▶ Perineal Body
- ▶ Anal Region



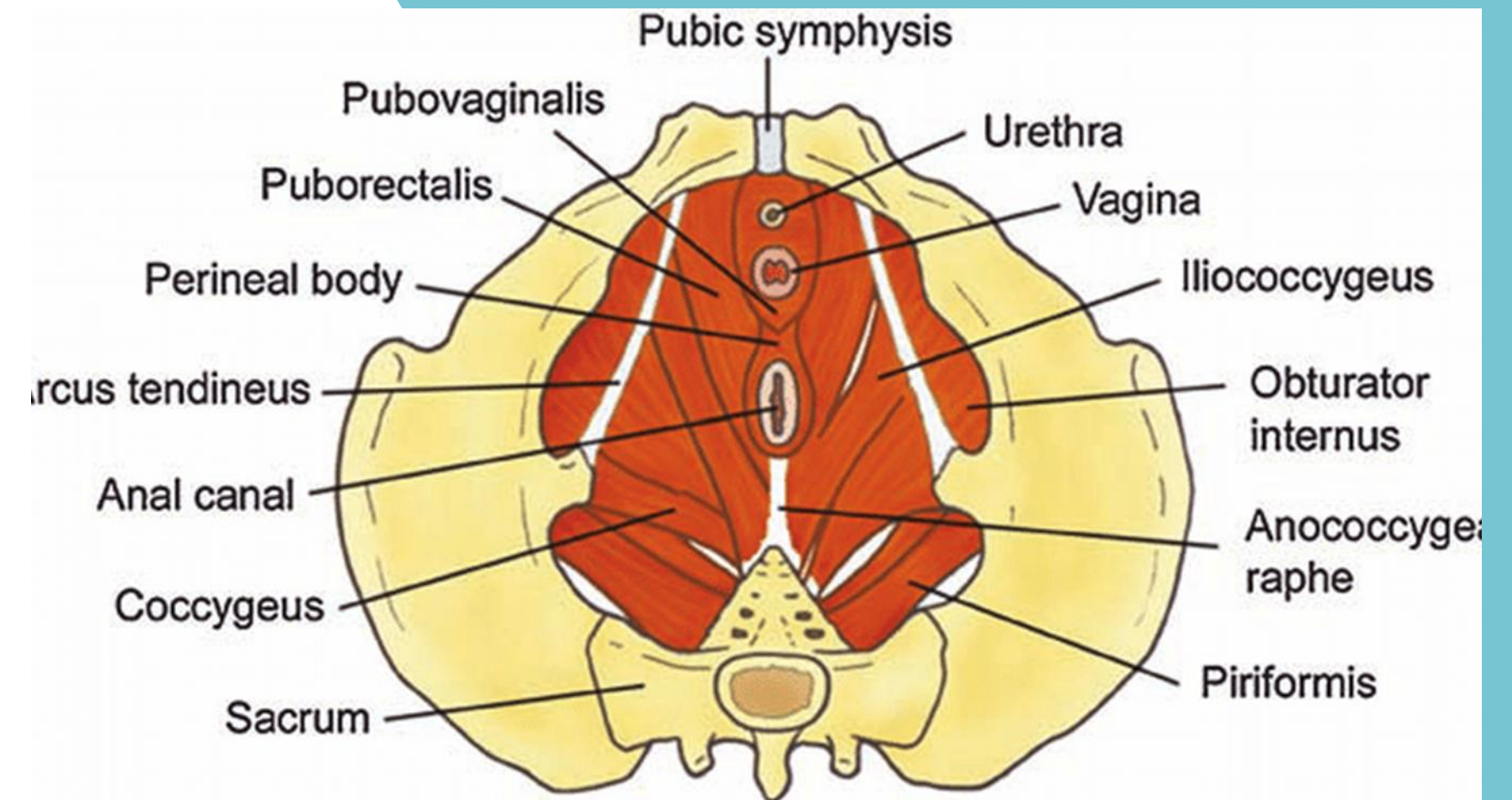
Perineum

- Definition: Region caudal to pelvic diaphragm (levator ani & coccygeus).
- Shape: Diamond-shaped; divided by a line between anterior ischial tuberosities:
 - Anal region (posterior, larger): Anal canal + ischioanal fossae; sides = sacrotuberous ligaments
 - Urogenital region (anterior, smaller): External genitalia; bounded by ischiopubic rami
- Clinical note: Pudendal nerve block may not fully anesthetize the vulva; anterior/lateral parts need local infiltration.

Region	Nerve Supply
Anal region	Inferior rectal (S3–4), perineal branch of S4, coccygeal plexus (S5)
Urogenital region	Ilioinguinal (L1) – anterior third of scrotum/labium majus; Dorsal nerve of penis/clitoris (S2); Perineal branch of posterior femoral cutaneous – posterior/lateral scrotum; Labial branches of perineal pudendal (S3) – medial labium minus

Perineal Body

- Location: Midline, between anal canal and vagina (or bulb of penis)
- Attachments / Muscles:
 - External anal sphincter
 - Pubovaginalis / puboprostaticus (levator ani)
 - Bulbospongiosus
 - Superficial & deep transverse perineal muscles
- Function: Decussation of muscles
- Stabilizes pelvic & perineal structures
- Clinical significance: Childbirth injury → weakens pelvic floor → vaginal or uterine prolapse



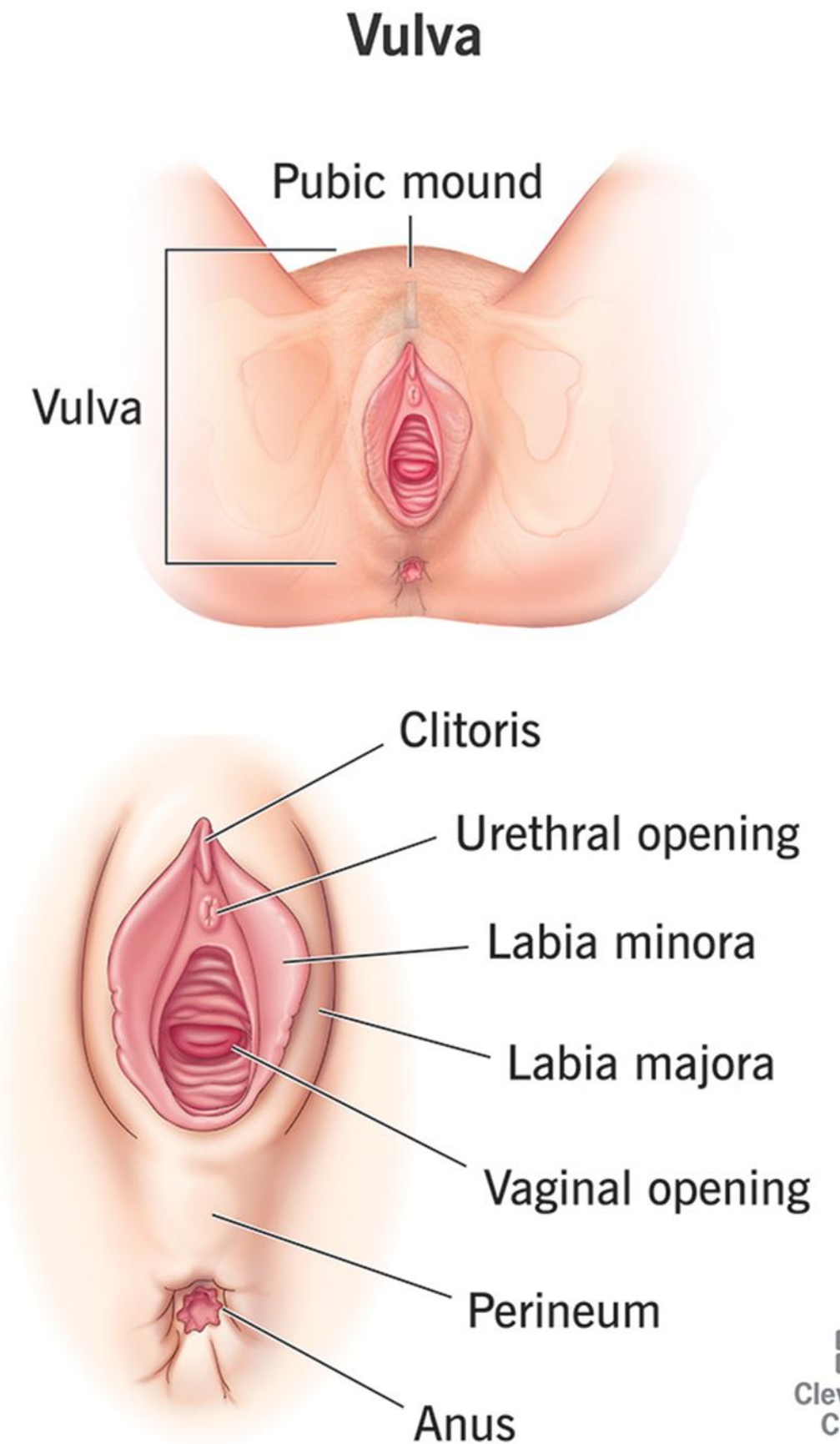
Anal Region

- Anal Canal (4 cm)
- Sphincters:
 - Internal: smooth muscle, involuntary, upper $\frac{3}{4}$, sympathetic = contract, parasympathetic = relax
 - External: skeletal muscle, voluntary, tonic contraction via pudendal nerve (S2–4)
- Anorectal ring: puborectalis + external sphincter; palpable
- Mucosa: anal columns, valves, sinuses; pectinate line = endoderm → ectoderm
- Anal cushions: aid continence; excess → haemorrhoids
- Blood: upper = superior rectal (portal), lower = inferior rectal (systemic)
- Lymph: upper = internal iliac/rectal, lower = superficial inguinal
- Innervation: internal = autonomic, external = pudendal; sensory above pectinate line = autonomic, below = somatic
- Defecation: coordinated relaxation of puborectalis & external sphincter, straightening anorectal angle, rectum accommodates content



Female Urogenital Region

- ▶ Mons pubis
- ▶ Labia majora
- ▶ Labia minora
- ▶ Clitoris
- ▶ Vestibule
- ▶ The greater vestibular
- ▶ Glands
- ▶ Hymen



Mons Pubis and Labia Majora

- Mons pubis: fatty, hairy mound over pubic symphysis
- Labia majora: fat-containing skin folds forming pudendal cleft; join anteriorly (anterior commissure) and posteriorly (posterior commissure)
- Round ligaments of uterus end in anterior labia





Labia Minora

- Thin folds inside labia majora, boundary of vestibule
- Anterior ends form clitoral prepuce & frenulum; posterior ends unite as frenulum of labia





Clitoris

- Corpora cavernosa + anterior bulbs of vestibule
- Glans: highly sensitive, overlapped by prepuce





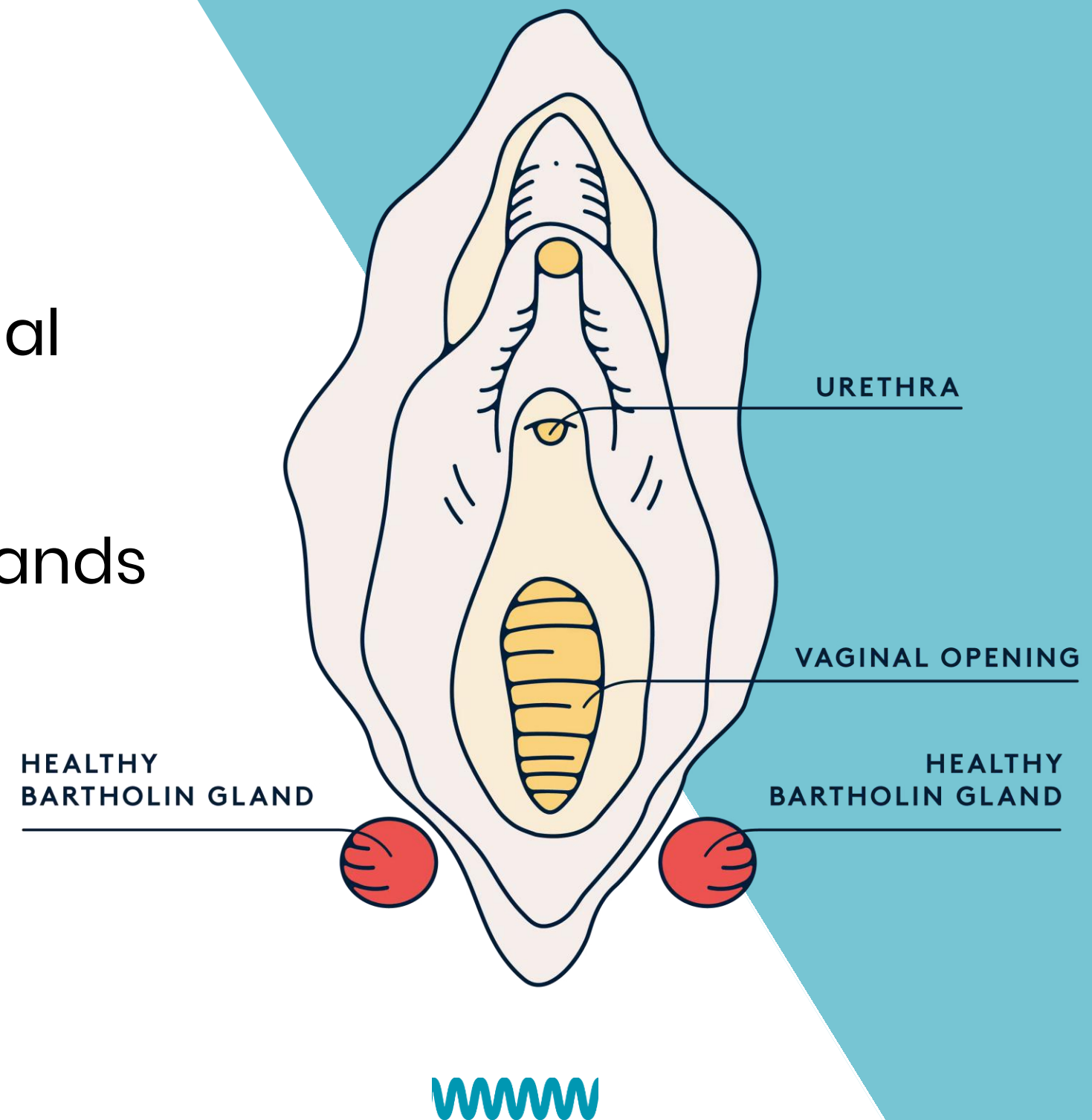
Vestibule

- Bounded by labia minora
- Contains: urethral meatus, vaginal orifice, ducts of greater vestibular glands



Greater vestibular Gland (Bartholin's)

- Pea-sized, posterolateral to vaginal opening, ducts 2 cm; lubricate & susceptible to cyst/infection; homologous to male Cowper's glands





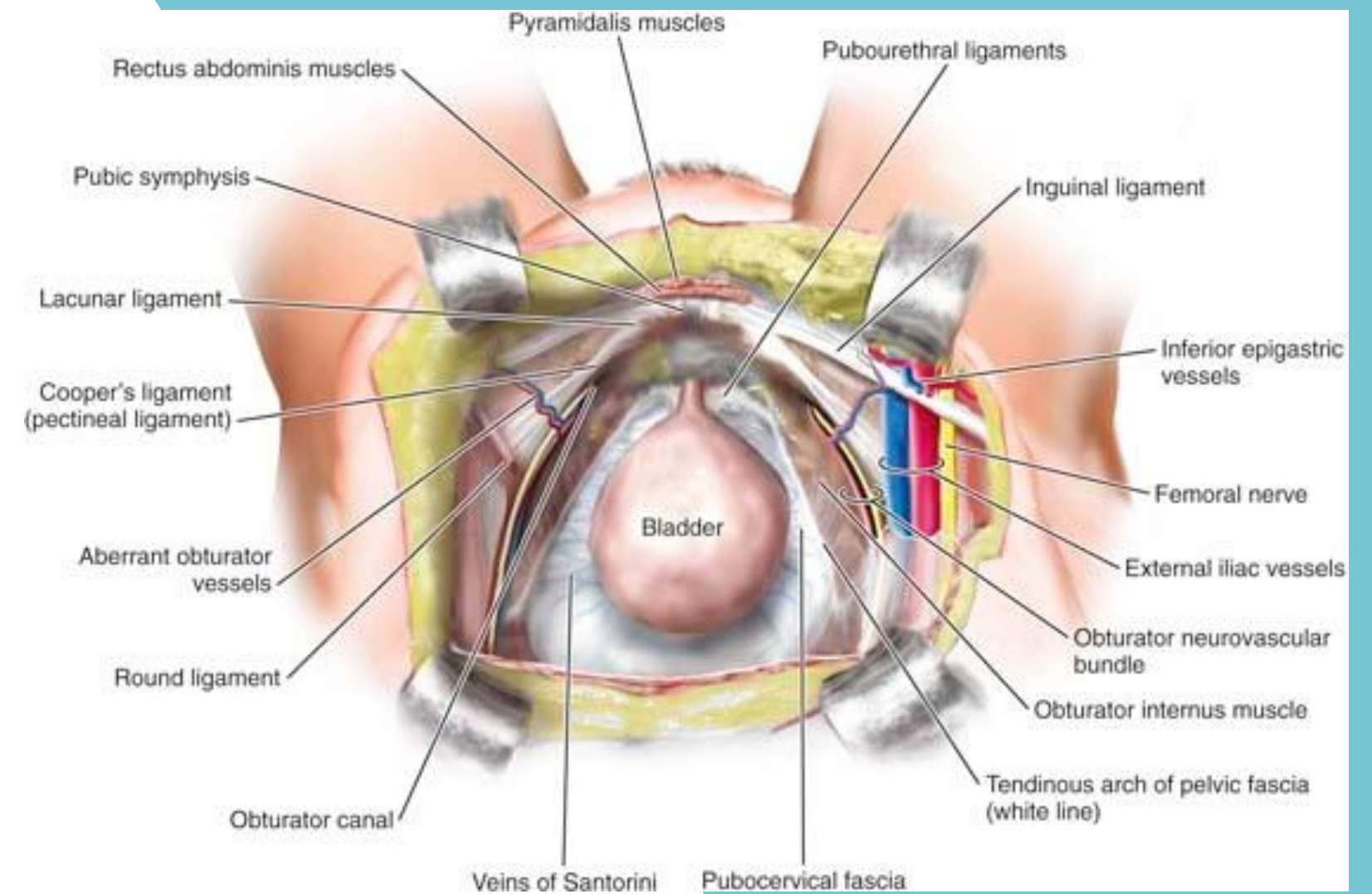
Hymen

- Mucosal fold at vaginal opening; variable, may form carunculae after rupture



Avascular Spaces of Pelvis

- Retropubic (Retzius) space: anterior to bladder; surgical access site.
- Paravesical space: between bladder & pelvic wall.
- Pararectal space: between rectum & lateral wall.
- Used in gynecologic & oncologic surgery for safe dissection.



Retropubic Space of Retzius



Join With Us

Become a competent laparoscopic surgeon

📌 Get Registered Today

🌐 Website: <https://kandyvog.lk/register/>

📄 Facebook: [KandyVOG Facebook](#)

▶ YouTube: [KandyVOG YouTube](#)



***Leading Laparoscopic Training
Institute in Sri Lanka***

