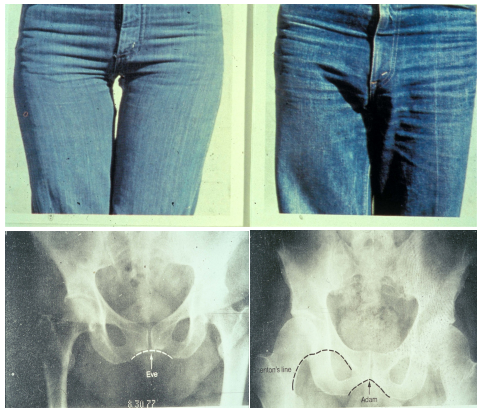
Pelvis and Perineum
M1 Tutorial

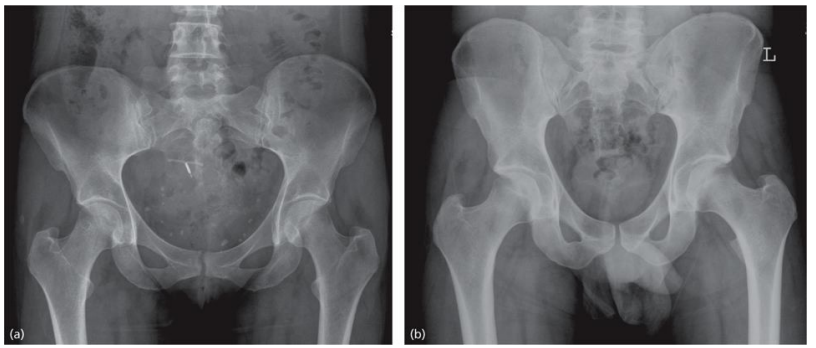


E.T ANG
Anatomy Tutor,
NUS YLLSoM

JEAN INGRES, *Le Source* 1820-1856, oil on canvas

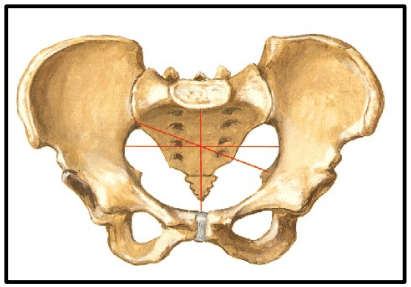
X-ray of the Pelvis

Female vs Male



Public angle (Arch)?

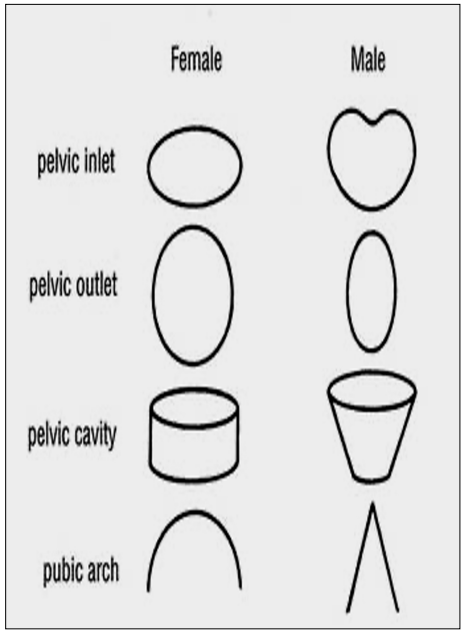
Lateral dimensions?

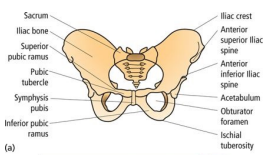


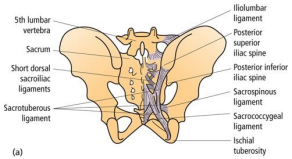
Relevant for O&G placement

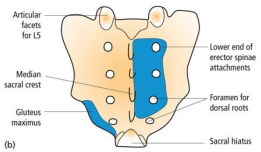
Revise the pelvic bone

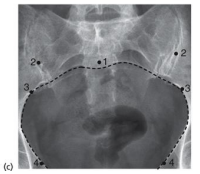
Know the Sacroiliac joint

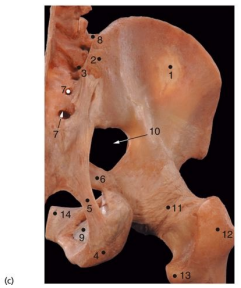




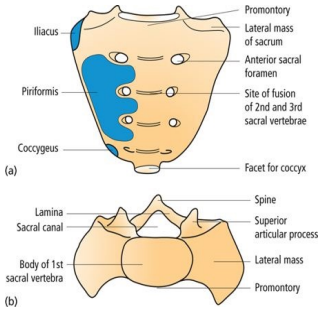








Revise all these structures! + sacrum



Pointers for the wet lab

Pelvic floor (muscles) – **Levator Ani** (what are the components?)

With prosections, most of the muscles are dried up and hence difficult to differentiate the components of the **Levator Ani** muscles.

These are:

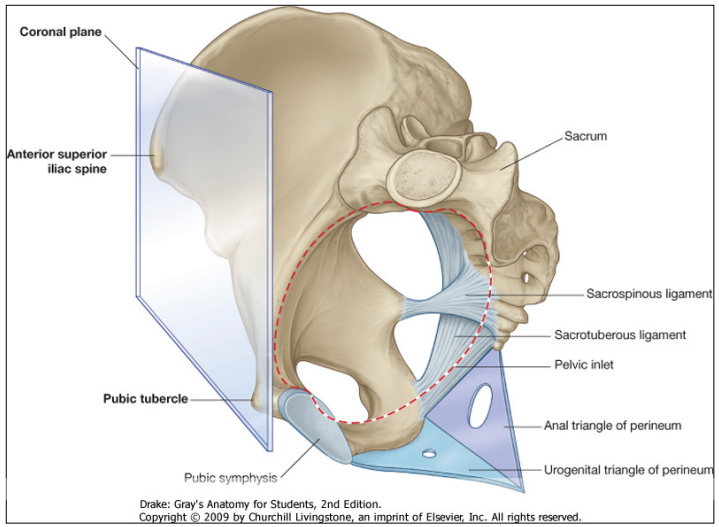
iliococcygeus, pubococcygeus, puborectalis

Pelvic diaphragm = Levator Ani + Coccygeus

Further confusions for the student:

Need to separate female from male features, what are the homologs?

Anatomical position



Drake: Gray's Anatomy for Students, 2nd Edition.

Obvious features are the perineal perforations:

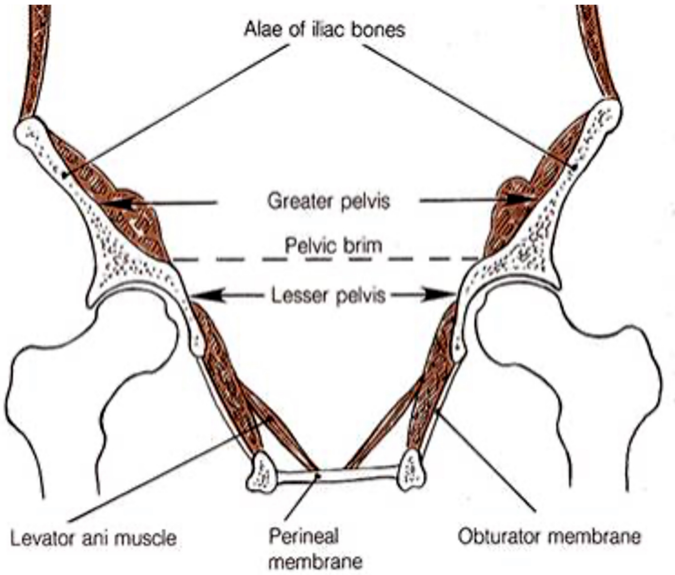
Female = 3
Male = 1 (excluding the urethra)

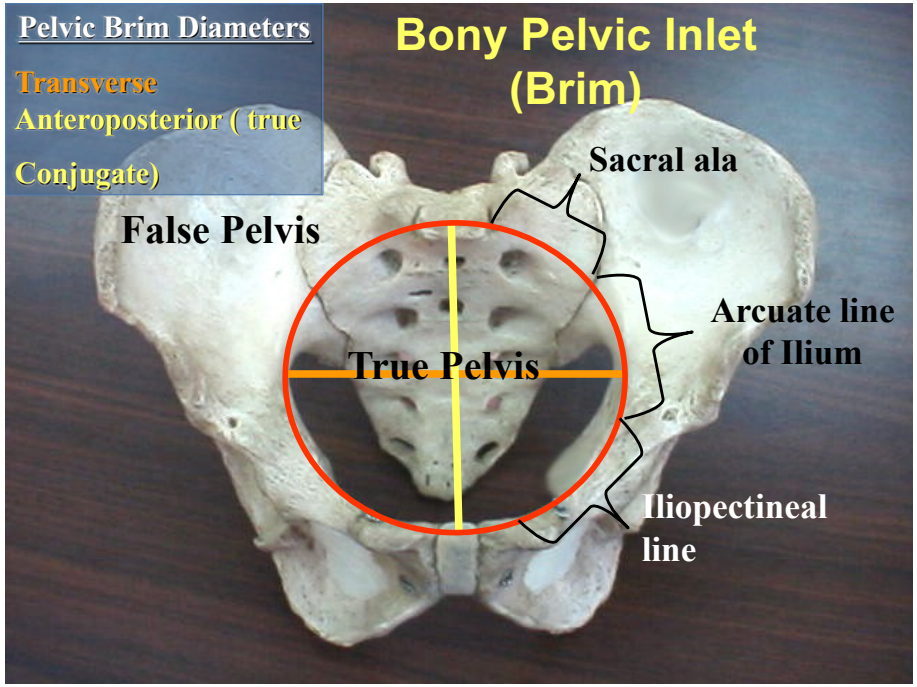
Need to know these structures to be great clinicians, why?

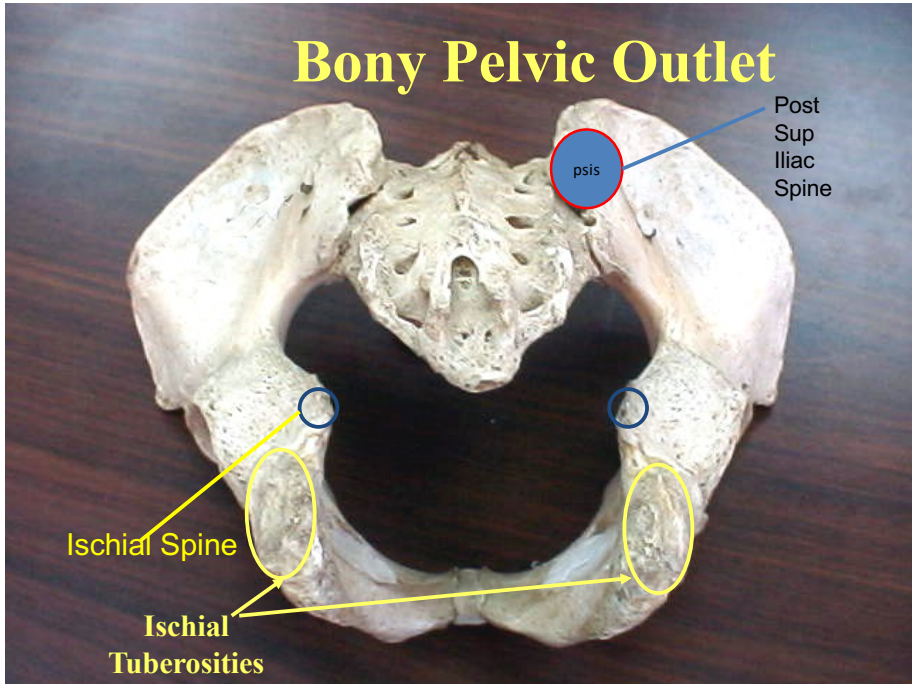
Finger into the anus, vaginal, palpate the perineal body…….

Other matters

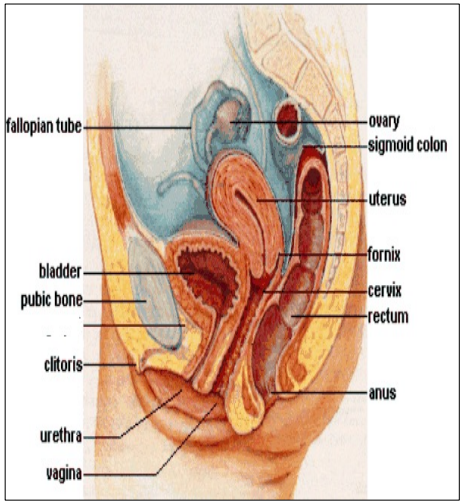
Difficult to appreciate the Perineal pouches (Deep + superficial) and perineal membrane etc. (all dried up).







Uterus



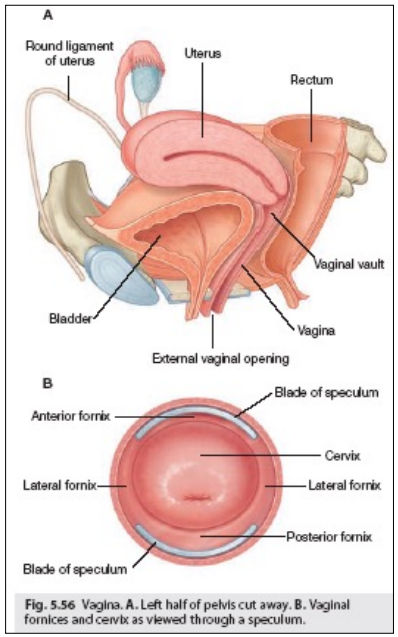
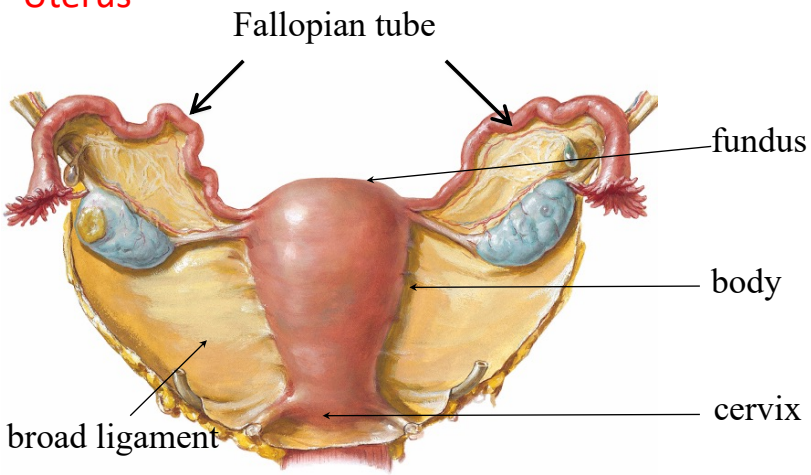
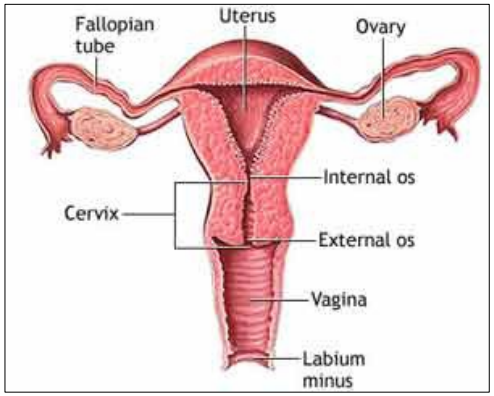


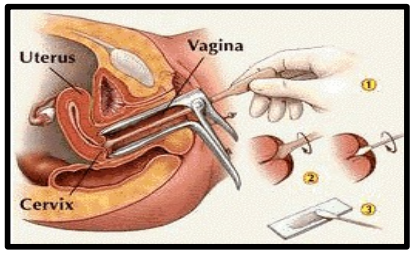
Fig. 5.56 Vagina. A. Left half of pelvis cut away. B. Vaginal fornices and cervix as viewed through a speculum.

Uterus



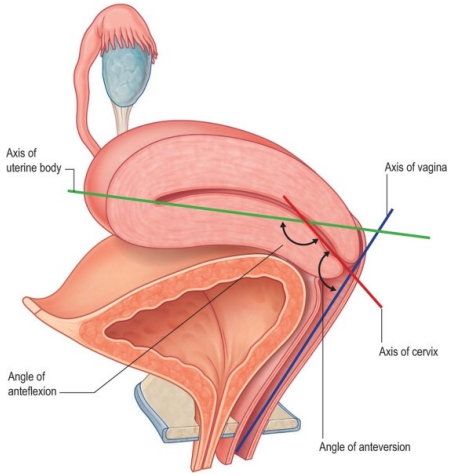
Content of the broad ligament?

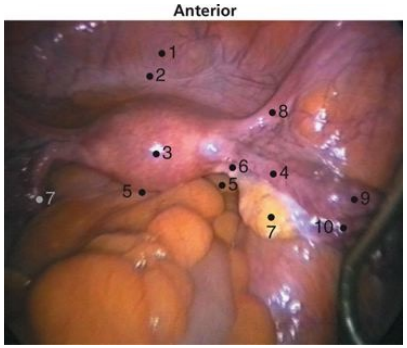




Prolapsed Uterus

Uterus



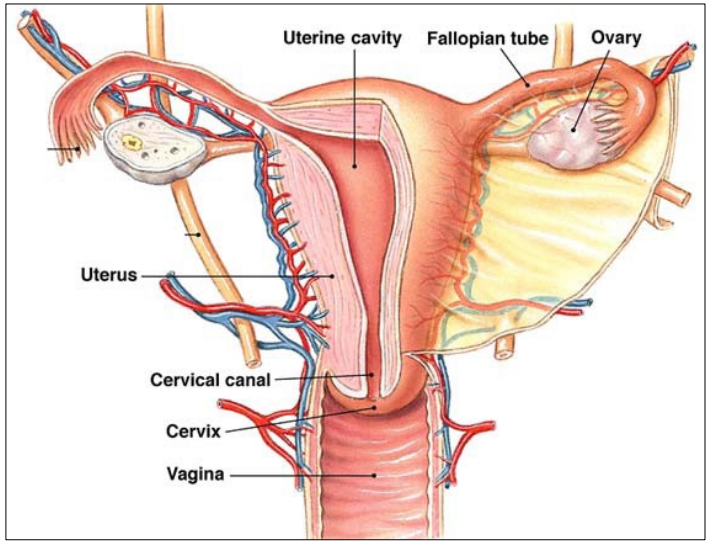


8 – Round ligament

4- Fallopian tube

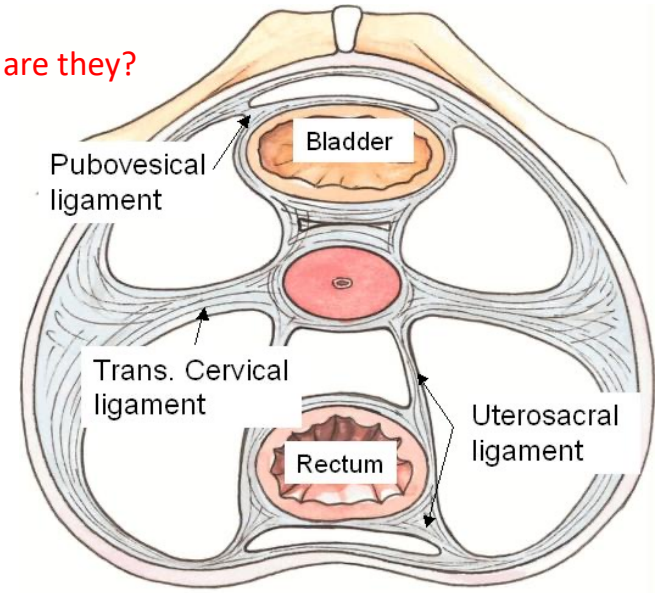
Anteverted versus Retroverted position?

Uterus – Blood supply



Support for the uterus

What are they?

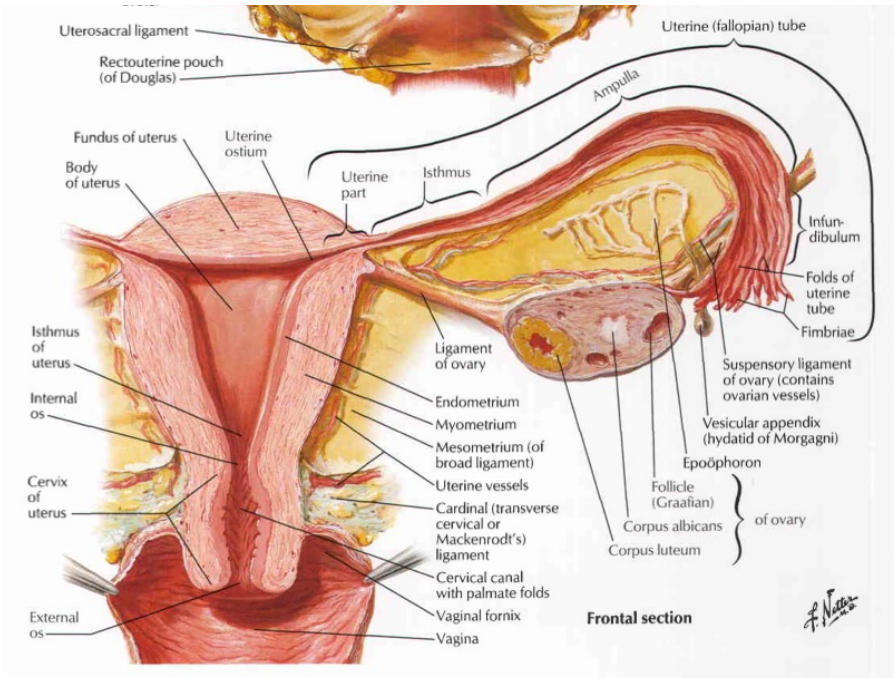


In summary, you must know these:

- Parts of the Uterus
- Blood Supply
- Nerve Supply
- Relations
- Ligaments
  - Broad Ligament

The Uterus

- Hollow
- Pear-shaped organ
- Thick muscular walls
- Young nulliparous adult: 8 cm long, 5 cm wide, 2.5 cm thick



Blood Supply

- Mainly: Uterine artery
  - Branch of internal iliac artery
  - Crosses over the ureter at base of broad ligament
  - Reaches cervix at the level of the internal os
  - Ascends along the lateral margin of the uterus
  - Ends by anastomosing with the ovarian artery
  - Small descending branch supplying cervix and vagina

Blood Supply

- Ovarian artery
  - Arises from the abdominal aorta
  - In the suspensory ligament of the ovary
- Uterine vein
  - Drains into internal iliac vein
- Ovarian vein
  - Right: drains into IVC
  - Left: drains into left renal vein

Nerve Supply

- Sympathetic and Parasympathetic nerves from branches of the inferior hypogastric plexuses (Mixed).

Relations

- Anteriorly: Uterovesical pouch, Superior surface of bladder
- Posteriorly: Rectouterine Pouch of Douglas, Ileum/Sigmoid colon
- Laterally: Broad ligament, Uterine vessels, Ureter, Round ligaments of ovary and uterus

Broad Ligament of the Uterus

- Two-layered fold of peritoneum
- Extend from lateral margins of uterus to lateral pelvic walls
- Superiorly: two layers are continuous
- Inferiorly: layers separate to cover the pelvic floor
- Ovary attaches to posterior layer by mesovarium

Broad Ligament of the Uterus

Superior

Contents:

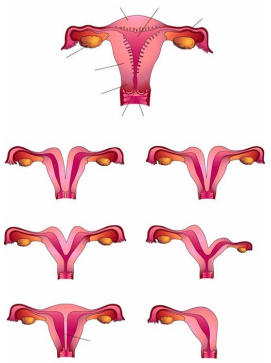
- Uterine Tube
- Suspensory ligament of ovary/Ovarian blood vessels
- Round ligament of the ovary
- Round ligament of the uterus
- Uterine blood vessels

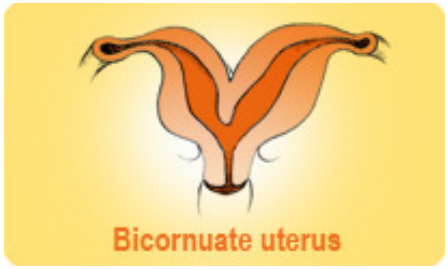
Inferior

Other Ligaments

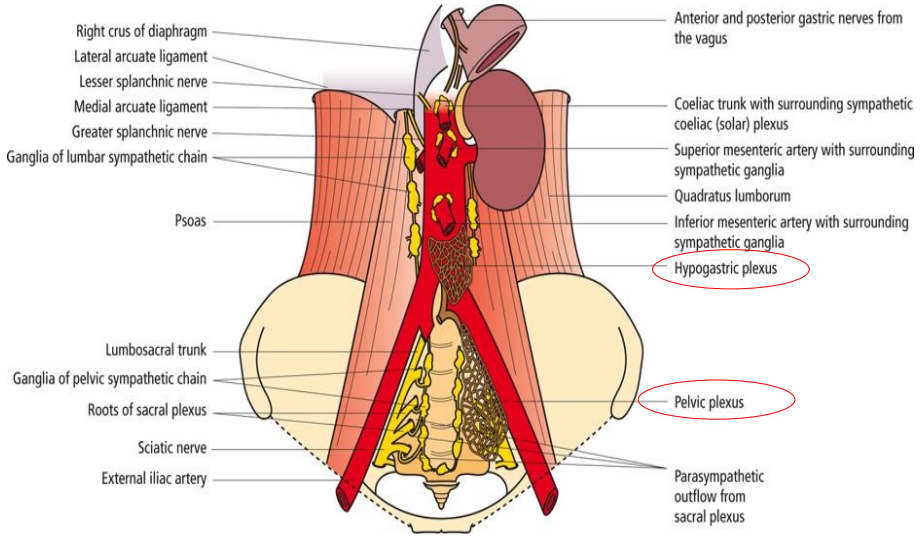
- Round ligament of the uterus
- Transverse cervical/cardinal ligaments
- Pubocervical ligaments
- Sacrocervical ligaments

Bicornuate Uterus

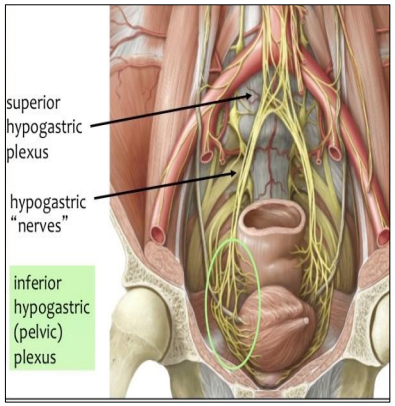




Pelvic /Inferior Hypogastric Plexus

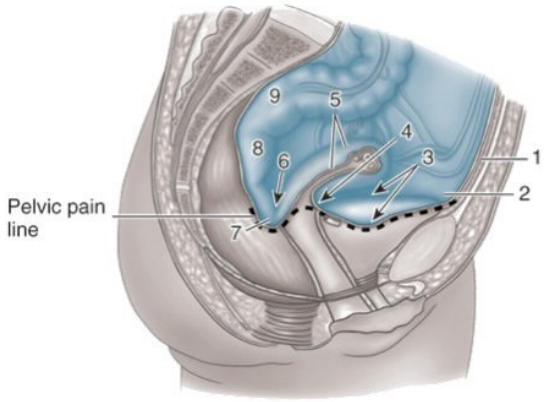


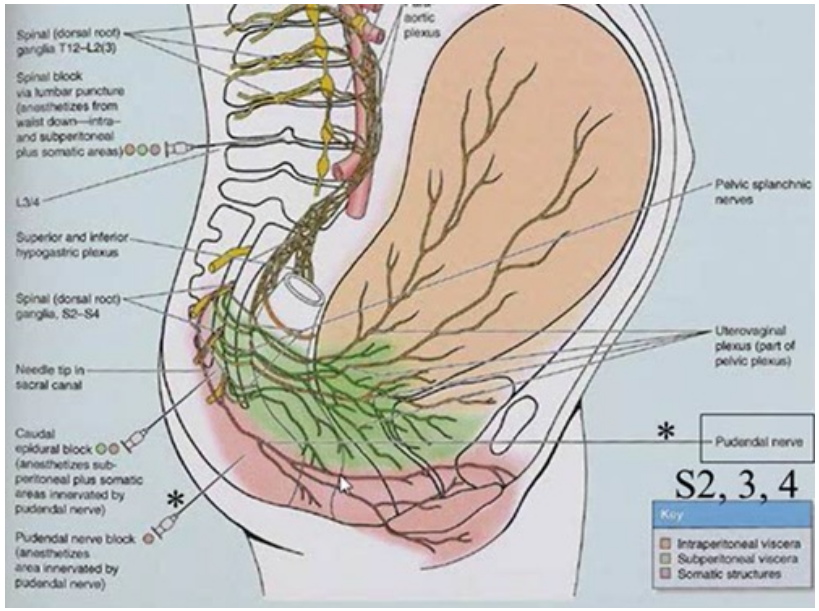
Pelvic Autonomic Plexuses



Pelvic Pain Line

- Inferior limit of peritoneum
- In contact with peritoneum is superior to pain line
- Significance in anesthesia
- E.g. Childbirth





Autonomic innervations of pelvic viscera

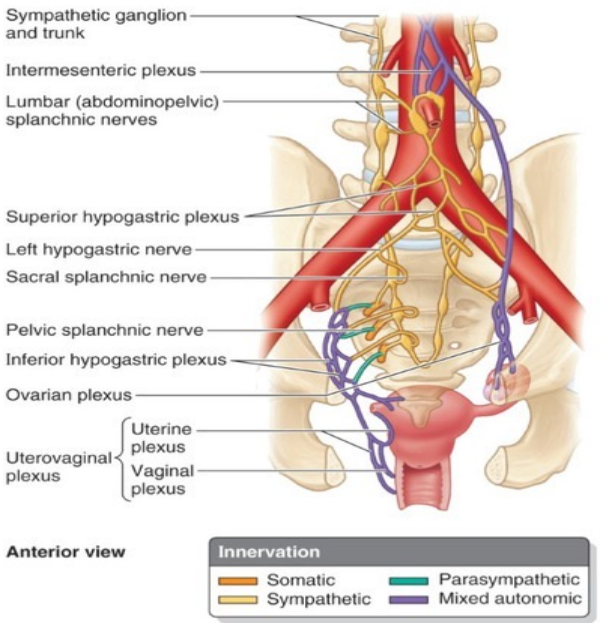
Viscera	Main autonomic innervation
Urinary bladder	**Sympathetic fibers** from inferior thoracic to upper lumbar spinal cord levels through hypogastric plexus (T10-L2) **Parasympathetic** from pelvic splanchnic (S2-S4) and inferior hypogastric plexus; motor to detrusor, inhibitory to internal sphincter Reflex afferent & inferior bladder follow parasympathetic Superior bladder follows sympathetic (pain line)
Rectum	**Sympathetic** from lumbar splanchnic nerves (L1, L2) and hypogastric plexuses and peri-arterial plexus (inferior mesenteric and superior rectal arteries) **Parasympathetic** from pelvic splanchnic (S2-S4) and inferior hypogastric plexus **Afferent Pain** follows para (inf to pain line)

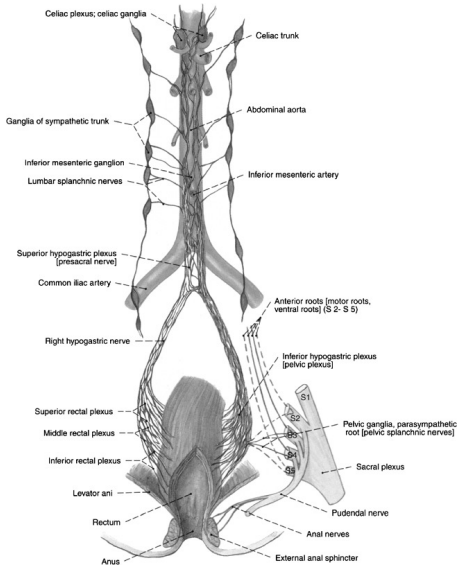
Autonomic innervations of pelvic viscera

Viscera	Main autonomic innervation
Male Genitalia	Sympathetic (T12-L2) lumbar splanchnic, hypogastric, pelvic plexuses Parasympathetic (S2, S3) pelvic splanchnic, inf hypogastric
Female Genitalia	-Inferior ¼ somatic innervation by deep perineal nerve -Autonomic nerves to rest of vagina and uterus derived from uterovaginal nerve plexus (*pelvic plexus from inf hypo plexus) -Sympathetic (T12-L2) pass through lumbar splanchnic nerves -Parasympathetic (S2-S4) pelvic splanchnic and inf hypo -Visceral afferent follow sympathetic for fundus and body of uterus

Distribution of pelvic autonomic plexuses

- Superior hypogastric plexus: located inferior to bifurcation of aorta on sacral promontory
- Inferior hypogastric plexus: on either side of rectum, accompanies branches of internal iliac artery
- Ganglion impar: anterior to coccyx

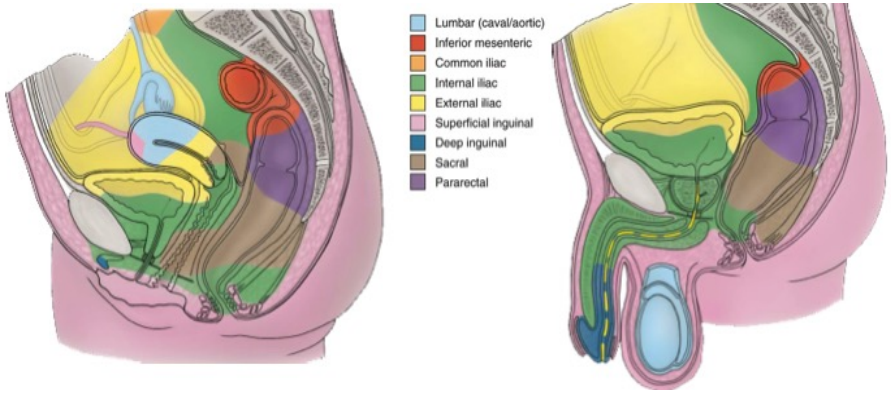




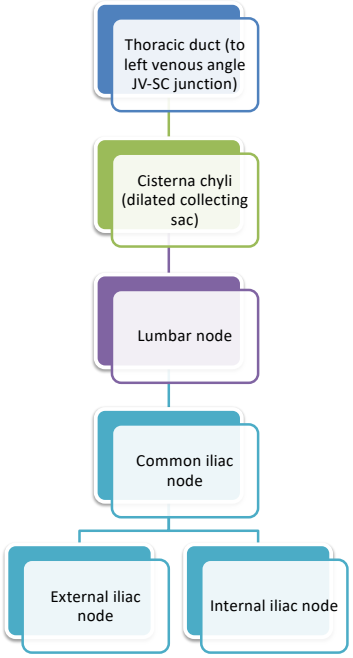
Lymphatic drainage to pelvic viscera

Viscera	Main Lymphatic drainage
Urinary bladder	**External iliac nodes**: superior part of pelvic part of ureters, superolateral aspect of bladder **Internal iliac nodes**: inferior part of pelvic part of ureters, fundus & neck of bladder, female urethra, proximal male urethra
Rectum	**Pararectal nodes**: superior rectum **Sacral nodes**: inferior rectum **Internal iliac nodes**: distal ampulla
Male Genitalia	**External iliac nodes**: vas deferens, ejaculatory ducts **Internal iliac** nodes: inferior part of seminal glands, prostate
Female Genitalia	**Lumbar nodes**: ovaries, uterus fundus, superior body **Superficial inguinal nodes**: entrance of uterine tubes to uterus (via round ligaments), vagina (external orifice) **External iliac nodes**: uterine body, vagina (superior) **Internal iliac nodes**: cervix (via transverse cervical ligaments), vagina (middle) **Sacral nodes**: cervix (via uterosacral ligaments), vagina (inferior)

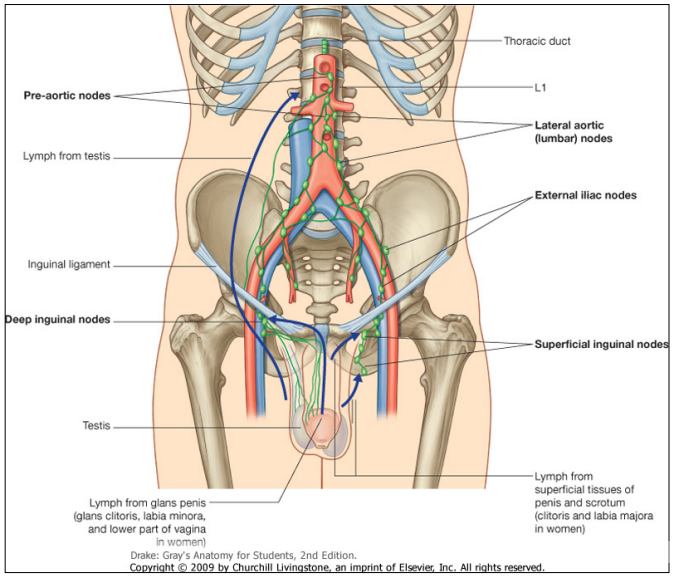
- Rule of thumb: more medial – internal iliac mostly
- Lymphatic vessels follow venous system in pelvis, drain into internal and external iliac nodes



- Zones of drainage

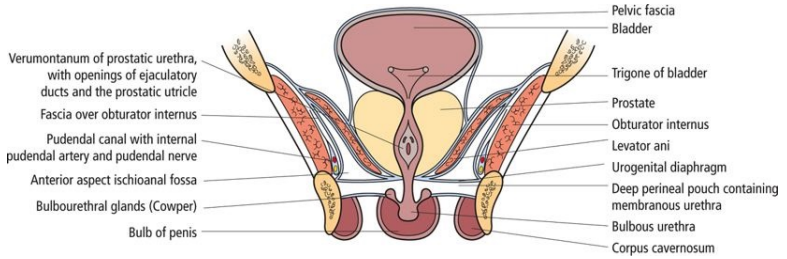


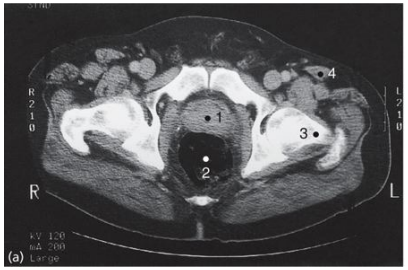
Lymphatic drainage of Pelvis



Break time !

Prostate

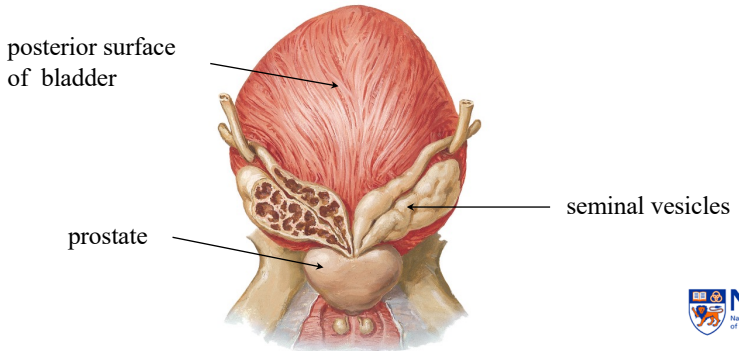




Seminal vesicles

Features

(1) The seminal vesicles are paired lobulated glands situated behind the bladder.
(2) They secrete 60% of the volume of semen. The secretion contains nutrients for the spermatozoa.

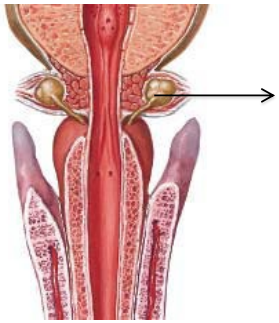


Prostate gland

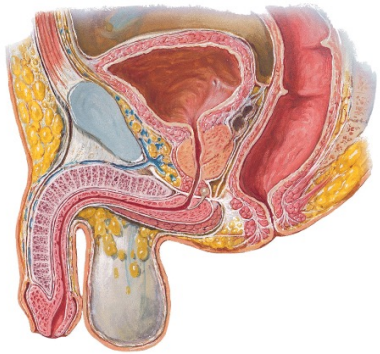
Features

The prostate gland is a chestnut shaped fibromuscular organ which encircles the upper part of the urethra.

The prostate gland produces about 20-30% of the volume of semen. The prostate secretes seminal plasmin (an antibiotic) into the semen which helps to prevent infection.



Male: Sagittal section



Male : Posterior aspect of bladder

Semen

Volume: 2-5 mls

Spermatozoa: 20-100 million per ml

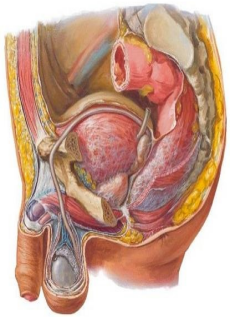
Seminal fluid: mixture of glandular secretions with distinctive ionic and nutrient composition (fructose)

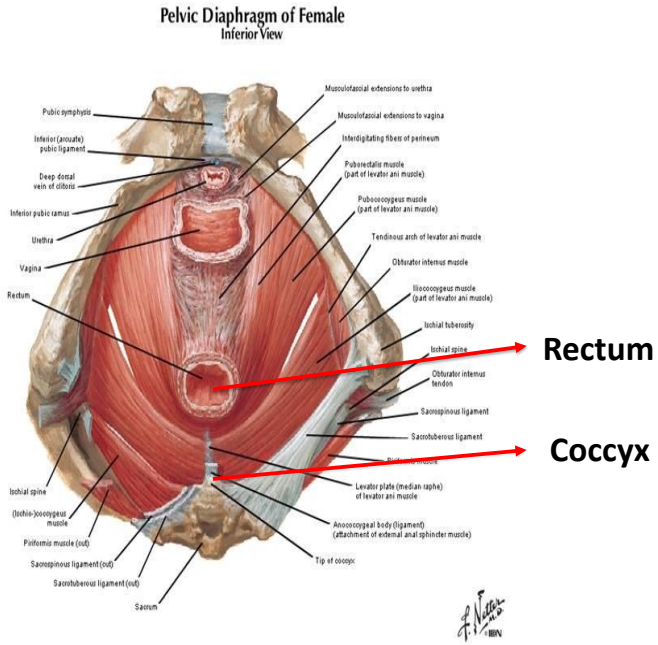
Enzymes: help to dissolve mucus secretions in vagina and have antibacterial functions

Rectum

- Split into thirds: upper 1/3, middle 1/3 and lower 1/3
- Peritoneum covers entire upper 1/3 and only ***anterior*** portion of middle 1/3

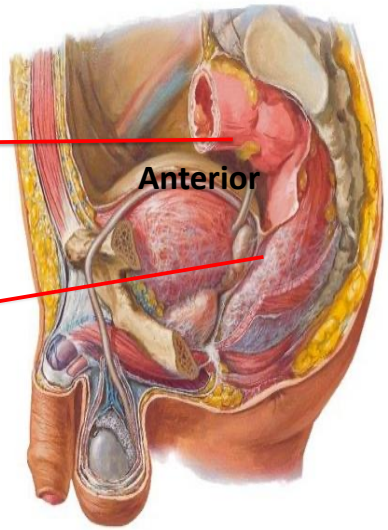
- Length- 12cm long
- Course
  between Sigmoid colon and Anal Canal
  Pierces pelvic diaphragm (levator Ani + coccygeus) anterior of coccyx





Relations for males

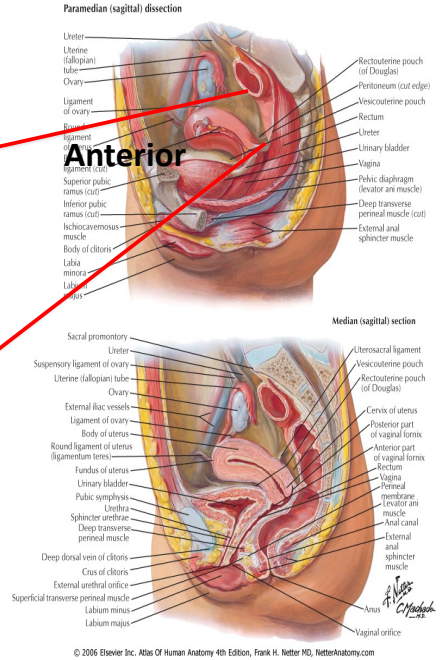
Upper portion
- continuous with the sigmoid colon
- Forms recto-vesicle pouch



Lower portion
- Posterior surface of bladder
- Termination of vas deferens
- Seminal vesicles
- Prostate gland

Relations for females

Upper portion
- Continuous with sigmoid colon
- Recto-uterine pouch i.e Pouch of Douglas



Lower portion
- Posterior surface of vagina
- Posterior fornix

Posterior relations

- Similar for both men and women
  - Sacrum
  - Coccyx
  - Coccygeus
  - Levator ani → **Pelvic diaphragm**

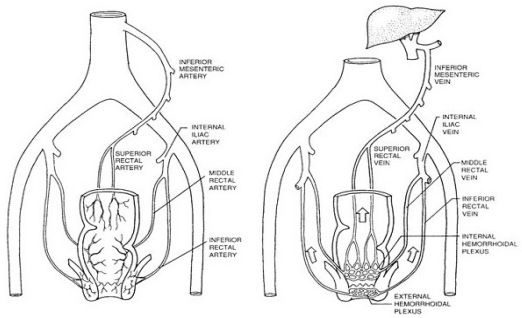
  (pubococcygeus, illiococcygeus and puborectalis)
  - Sacral plexus
  - Pelvic splanchnic nerves (S2-S4)
  - Sympathetic trunk (starts at T1 ends at L2)
  - Median sacral & rectal vessels

Internal features of rectum

- Lower part dilated to form rectal ampulla
- Transverse folds-formed by mucous membrane of rectum and circular muscle layer

Blood supply of rectum

- Arterial supply
- Superior rectal artery (branch of inferior mesenteric artery)
- Middle rectal artery (branch of internal iliac artery)
- Inferior rectal artery (branch of internal iliac artery)



Contrast this to the blood supply to the anal canal

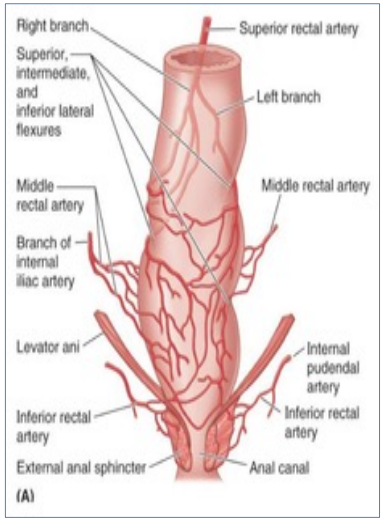
Blood supply

Venous drainage mirrors the arteries

Anastomosis between systemic and portal system !!

Contrast this to the blood supply to the anal canal.....

The anal canal above the pectinate line is supplied by the terminal branches of the superior rectal (hemorrhoidal) artery, which is the terminal branch of the inferior mesenteric artery. The middle rectal artery (a branch of the internal iliac artery) and the inferior rectal artery (a branch of the internal pudendal artery) supply the lower anal canal.



Clinical application

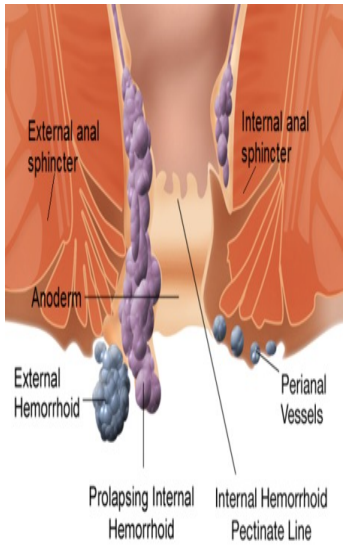
- Haemorrhoids what are they?

Vascular structures in the anal canal.

(Many people have haemorrhoids!)

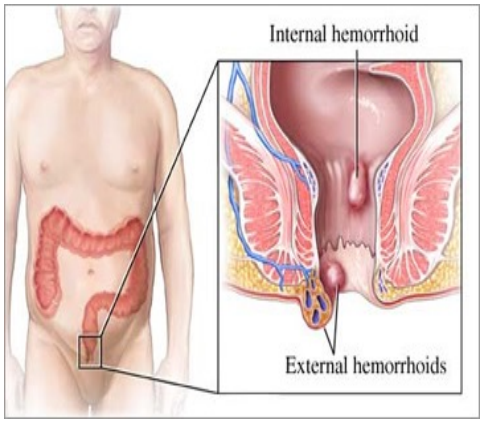
They are made up of connective tissue and arterio-venous channels.

(Superior rectal vein)
Pathology occurs only when they become inflamed or enlarged



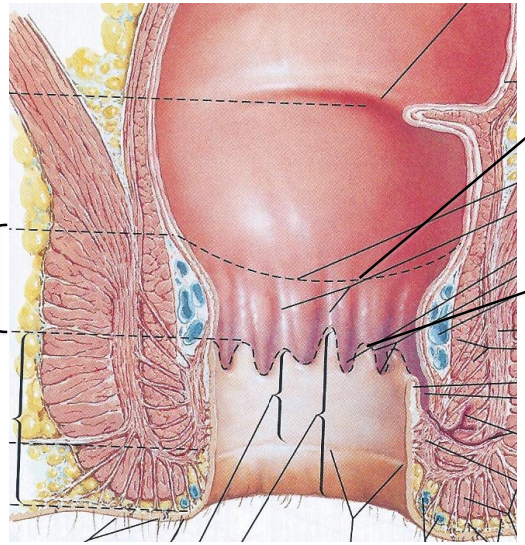
Clinical application

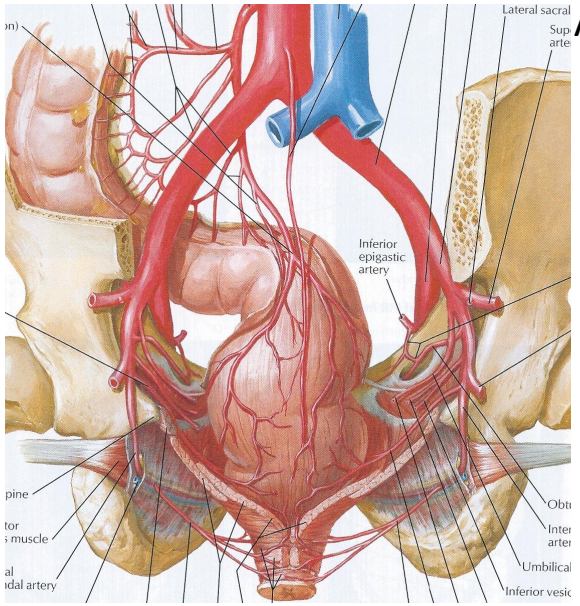
- Classification:
- can be internal (inside the rectum) or external (outside the rectum)



Anal Canal (4cm)

Passes downwards and backwards from the rectal ampulla to the anus

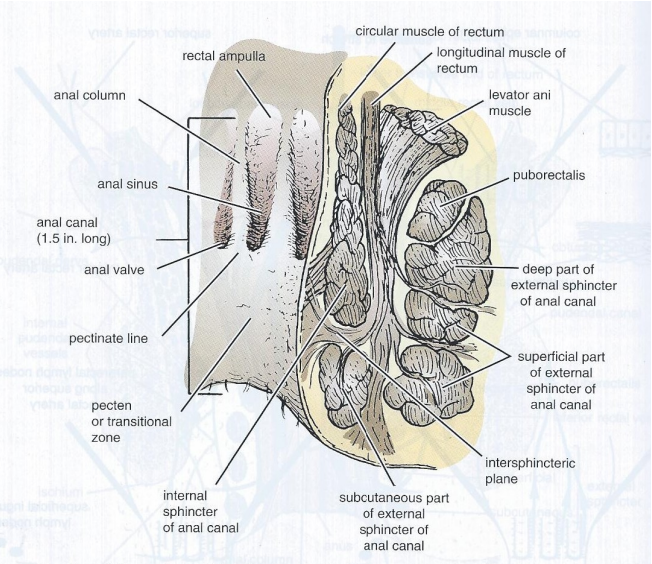




Arterial supply

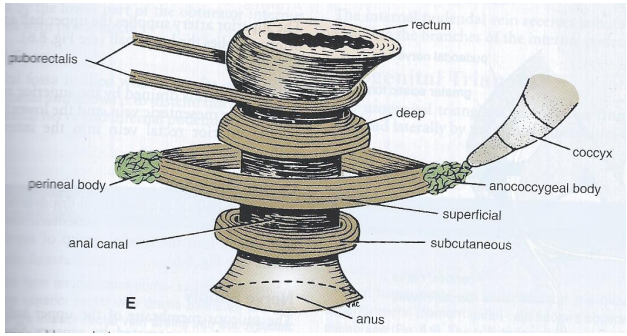
The anal canal above the pectinate line is supplied by the terminal branches of the superior rectal (hemorrhoidal) artery, which is the terminal branch of the inferior mesenteric artery. The middle rectal artery (a branch of the internal iliac artery) and the inferior rectal artery (a branch of the internal pudendal artery) supply the lower anal canal.

Anal sphincters

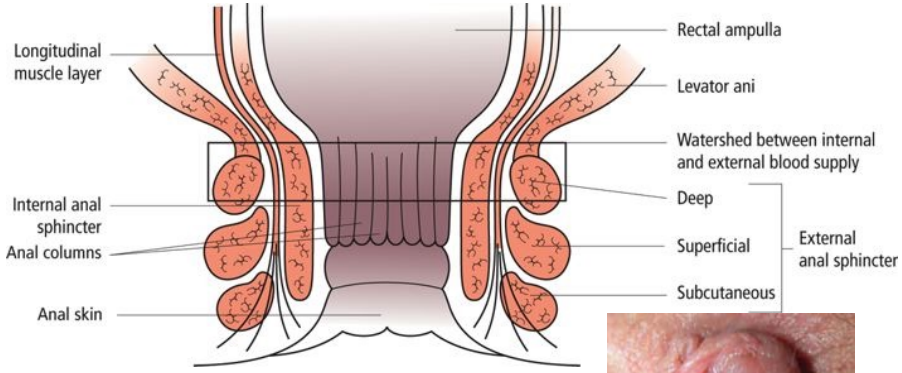


Internal sphincter
- involuntary
- Thickening of smooth muscle of circular coat

External sphincter
- voluntary
- 3 parts (subcutaneous, superficial, deep)
- puborectalis (part of levator ani/ pelvic diaphragm) joins with deep part to form a sling around the junction btw rectum and anal canal

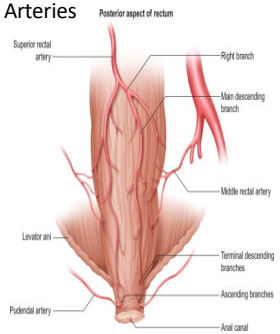


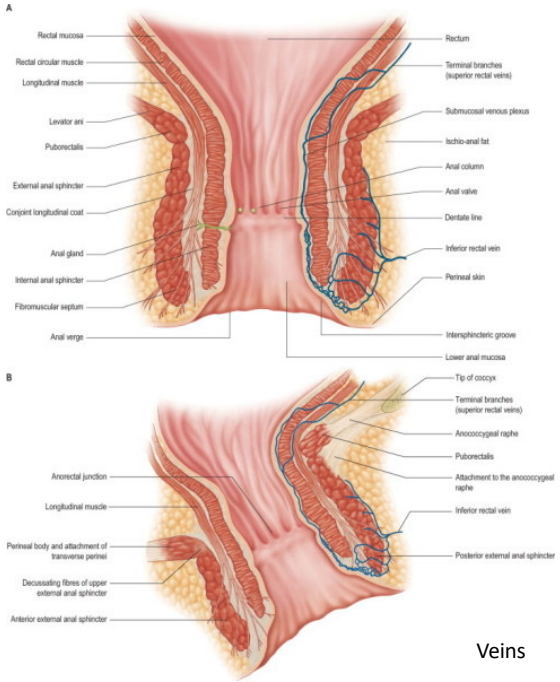
Terminal rectum and anal canal



Hemorrhoids

Arteries





Veins

Haemorrhoids (Piles)

- Venous varicosities, covered with mucous membrane.
- Internal – superior rectal vein, varying degrees, often aching rather than pain (autonomic innervation), causes include strains + constipation, pregnancy, Portal hypertension due to liver cirrhosis.
- External – Inferior rectal veins, may be associated with int. haemorrhoids, innervated by internal rectal nerves (somatic) therefore is painful.

Clinically, what you see…….

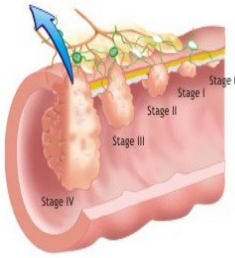
Hemorrhoids

Clinical application

- Causes: Excessive force due to defecation or parturition(giving birth) causing strain on the bowel. (things that increase intra-abdominal pressure, think constipation…..)
- Blocked blood flow enlarges the vessels!

Colorectal cancer!

- Most prevalent form of cancer in men in Singapore!
- Staging of colorectal cancer (TNM system)
- Risk factors (meat heavy diet, physical inactivity, genetics, smoking, alcohol)



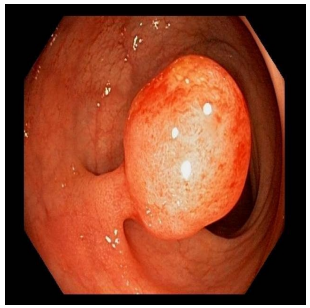
AJCC/TNM Staging		Tumor
Stage 0	Tis (carcinoma in-situ)	Superficially involves the mucosa. Has not grown beyond the mucosa
Stage I	T1N0 T2N0	Invades through mucosa Invades through submucosa
Stage II	T3N0 T4N0	Invades through muscle layers Invades nearby tissues or organs
Stage III	Any T, N1-N3	Lymph nodes involved
Stage IV	Any T, Any N, M1	Distant Spread

Staging the cancer

- **T**: describes how far the main (primary) tumour has grown into the wall of the intestine and whether it has grown into nearby areas.
- **N**: describes the extent of spread to nearby (regional) lymph nodes.
- **M**: indicates whether the cancer has spread (metastasized) to other organs of the body. (Colorectal cancer can spread almost anywhere in the body, but the most common sites of spread are the liver and lungs.)

Diagnosis

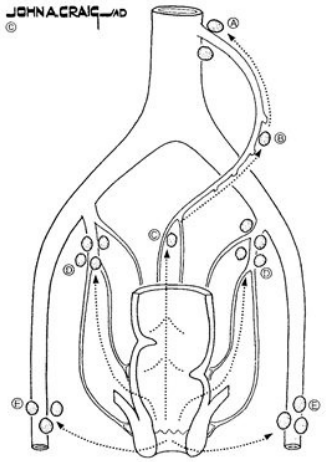
- Colonoscopy (tube inserted into the anus)
- Stool test (check for blood caused by polyps)



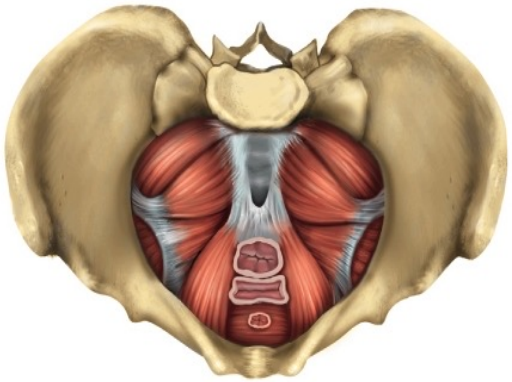
Treatment

- By the stage of the cancer
- Stage 0 (tumour contained within mucosa): surgical removal of tumour)
- Stage 1 (tumour spread through the walls of the intestine): surgical removal with possibility of recurrence
- Stage 2 (spread to nearby tissues): surgery with chemotherapy to prevent recurrence.
- Stage 3 (spread top lymph nodes): Surgical removal of everything nearby + chemotherapy
- Stage 4 (spread to other organs e.g lungs, liver) : Surgery, chemotherapy + “Pray”

Rectum (lymphatic's) – follow the blood vessels!!



PELVIC DIAPHRAGM



IMPORTANCE OF PELVIC DIAPHRAGM

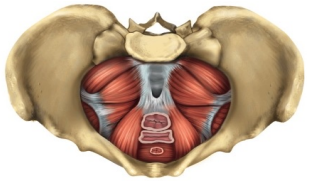
Forms the muscular part of pelvic floor, which separates the pelvic cavity from the perineum.

Provides support for pelvic viscera (eg.Bladder) – think of consequences if it is weak.

Think of pelvic organs prolapse.

COMPONENTS OF PELVIC DIAPHRAGM

LEVATOR ANI

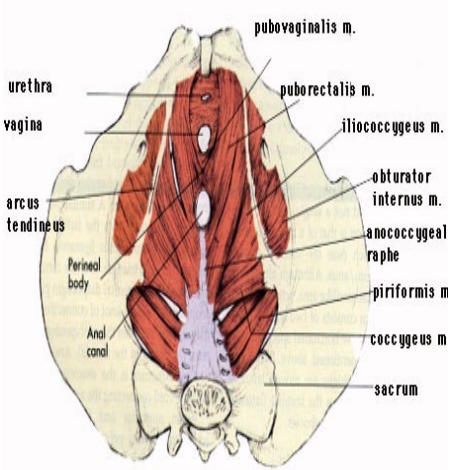


Pubococcygeus	Puborectalis	Iliococygeus
Originates from body of pubis and courses posteriorly to attach along the midline until the coccyx	Originates from pubis and passes inferiorly on each side to form a sling around the terminal part of the GI tract, creating the perineal flexure at anorectal junction	Originates from fascia covering the obturator externes muscle

COMPONENTS OF PELVIC DIAPHRAGM

Levator Ani

-Originates from a line around the pelvic wall, post to pubic bone and extending across obturator internus muscle, to ischial spine
-Ant part attached to sup surface of perineal membrane
-Post part attached to perineal body, around the anal canal and along anococcygeal ligament



COMPONENTS OF PELVIC DIAPHRAGM

INNERVATION: BRANCHES FROM ANT RAMUS OF S4,

INF RECTAL BRANCH OF PUDENDAL NERVE(S2-S4)

PART OF THE PELVIC FLOOR, SUPPORTING PELVIC VISCERA

MAINTAINS ANGLE BETWEEN RECTUM AND ANAL CANAL

REINFORCES EXT ANAL SPHINCTER, ACTS AS VAGINAL SPHINCTER

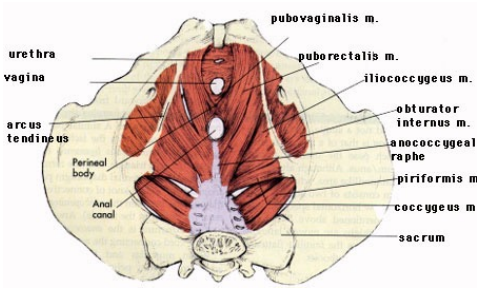
COMPONENTS OF PELVIC DIAPHRAGM

COCCYGEUS

TRIANGULAR SHAPED, OVERLYING SACROSPINOUS LIGAMENT, FORMING POST PART OF DIAPHRAGM ORIGINATES FROM ISCHIAL SPINE(L&R) AND PELVIC SURFACE OF SACROSPINOUS LIGAMENT INSERTS INTO LATERAL MARGIN OF COCCYX AND RELATED BORDER OF SACRUM

COMPONENTS OF PELVIC DIAPHRAGM

INNERVATED BY BRANCHES OF ANT RAMI OF S3 AND S4
ESSENTIAL IN SUPPORTING POST ASPECT OF PELVIC FLOOR
PULLS COCCYX FORWARD DURING DEFECATION

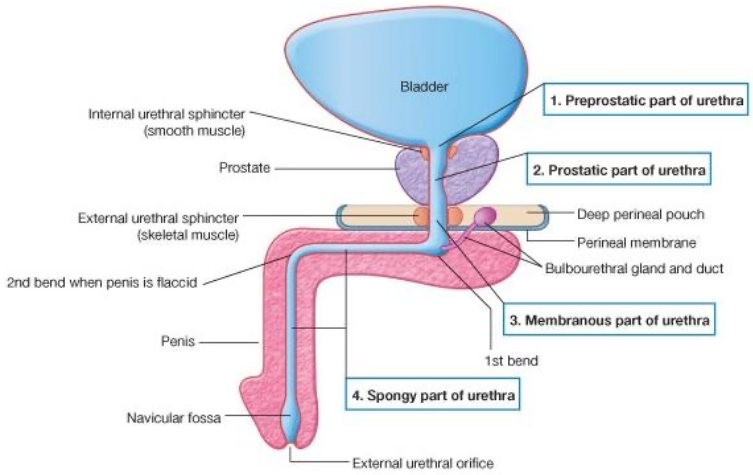


Perineum

Thank you !

Will cover the Perineum next lesson

4 Parts



Where are the bends?

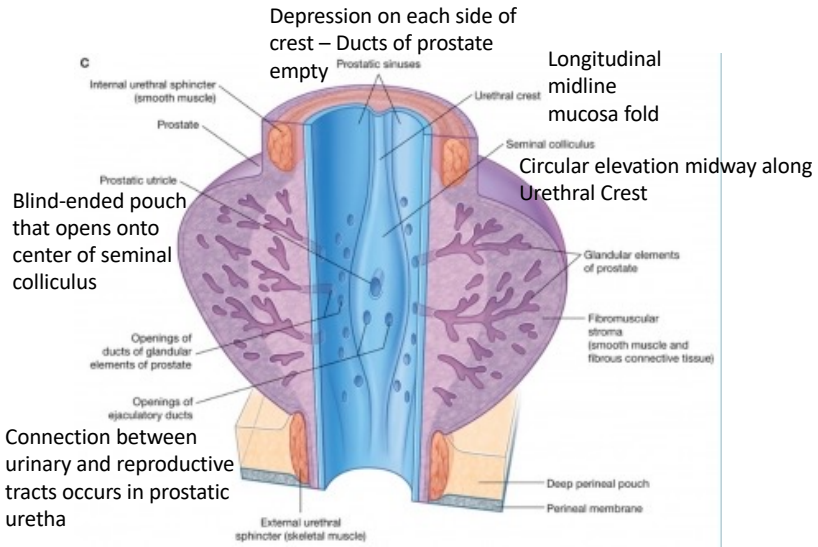
Preprostatic Part

- Base of bladder → Prostate
- About 1cm
- Surrounded by Internal Urethral Sphincter (Circular cuff of smooth muscle) → Contraction of sphincter prevents retrograde movement of semen into bladder during ejaculation

Prostatic Part

- Surrounded by prostate from base to apex
- About 3 to 4 cm

Prostatic Part



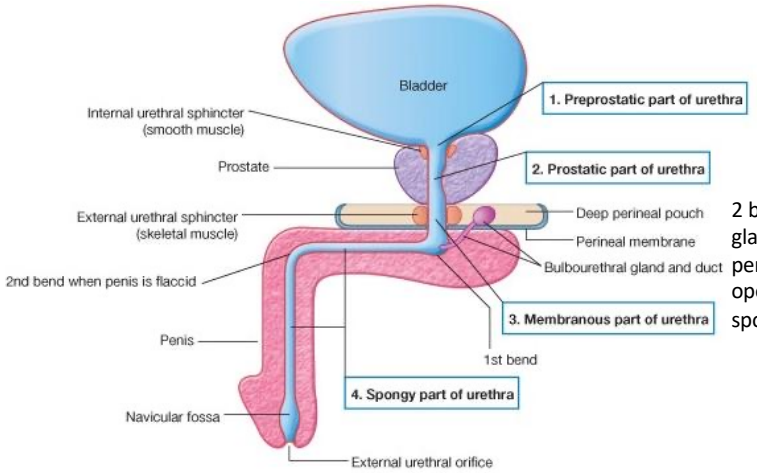
Membranous Part

- Passes through deep perineal pouch
- About 1.25cm
- Surrounded by External Urethral Sphincter (Skeletal muscle)

Penile/Spongy Part

- Surrounded by erectile tissue of penis
- About 15.75cm

Penile/Spongy Part



2 bulbo-urethral glands in deep perineal pouch open into bulb of spongy urethra

Internal Urethral Sphincter

- Constricts internal urethral orifice (Junction of urethra and bladder)
- Smooth muscle → Involuntary control
- Sympathetic: Inferior Hypogastric plexus
- Parasympathetic: Pelvic plexus S2 to S4

- During micturition → Relax via parasympathetic NS
- Not urinating → Contract via sympathetic NS
- During ejaculation → Contract to prevent reflux of semen into bladder

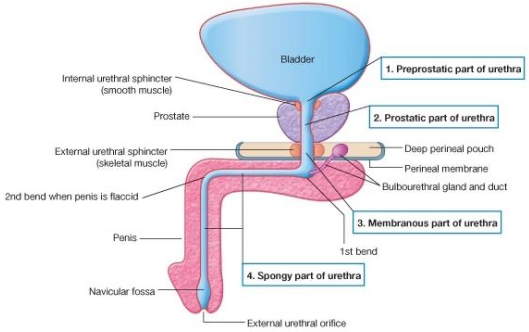
External Urethral Sphincter

- Somatic: Perineal branch of Pudendal nerve

- Duing micturition → Relax voluntarily
- Not urinating → Contract, Can voluntarily stop micturition

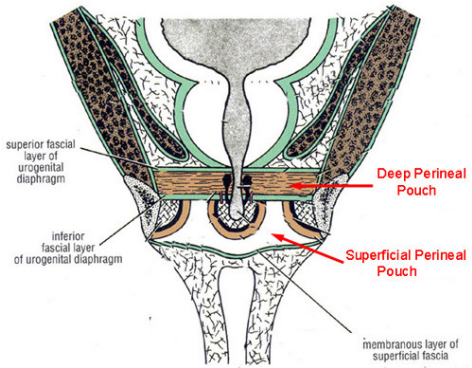
How does urine leaking from ruptured urethra spread (from the superficial perineal pouch)?

Common site for rupture: Within bulb of penis just below perineal membrane



If bulb of penis just below perineal membrane ruptures:

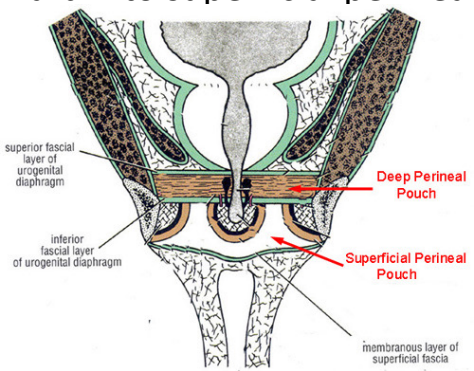
- Urine flows into superficial perineal pouch → And then passes forward over scrotum beneath membranous layer of superficial fascia



If membranous part of urethra ruptures:

Urine escapes into deep perineal pouch and flows upward around prostate and bladder

OR downward into superficial perineal pouch



Innervation of the perineum

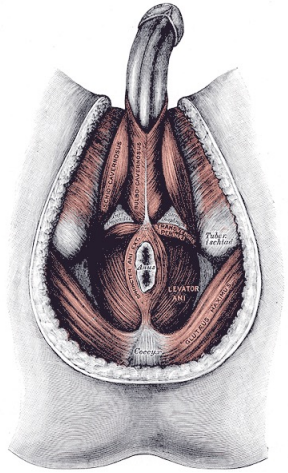
Which nerves are responsible for sensory innervations of the perineum?

- Pudendal Nerve
- Inferior hypogastric plexuses

Pudendal Nerve

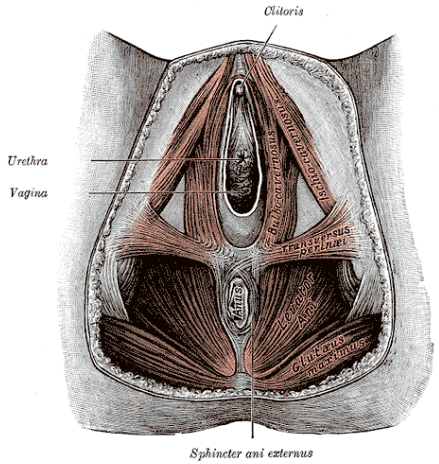
- Main nerve of perineum
- Chief sensory nerve to external genitalia
- Branch of sacral plexus (anterior rami of S2-S4)
- Supplies Structures in perineum:
  - Perineal muscles
  - External Urethral sphincter
  - External anal sphincter
  - Skin of perineum

Perineal Muscles



- Deep Transverse Perineal Muscles
- Superficial Transverse Perineal Muscles
- Bulbospongiosus
- Levator Ani

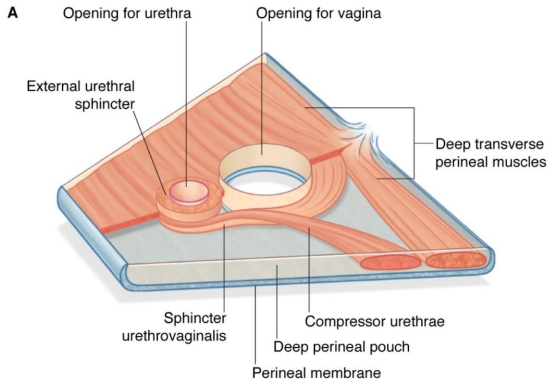
Perineal Muscles



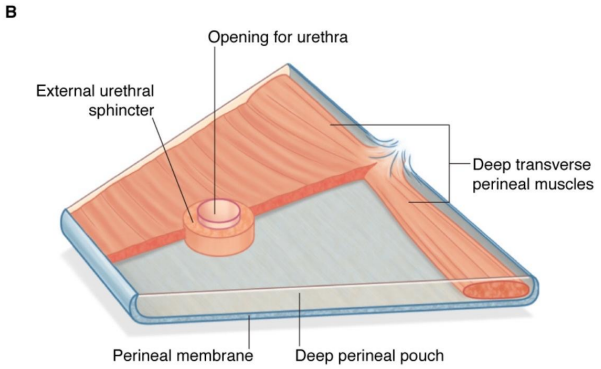
- Deep Transverse Perineal Muscles
- Superficial Transverse Perineal Muscles
- Bulbospongiosus
- Levator Ani

Perineal Muscles

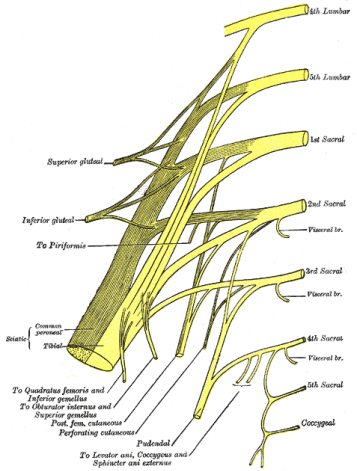
Fig. 5.36 Muscles in the deep perineal pouch. A. In women. B. In men



Perineal Muscles

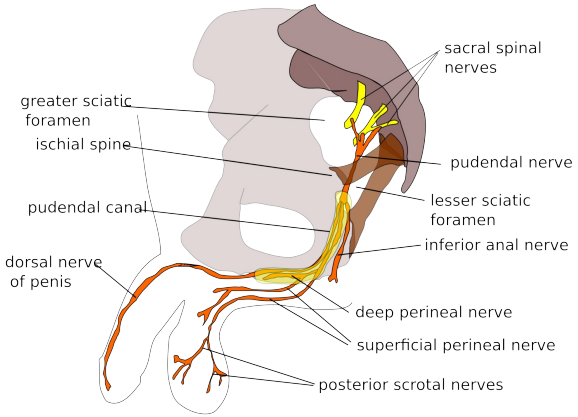


Outline the course and distribution of the pudendal nerve



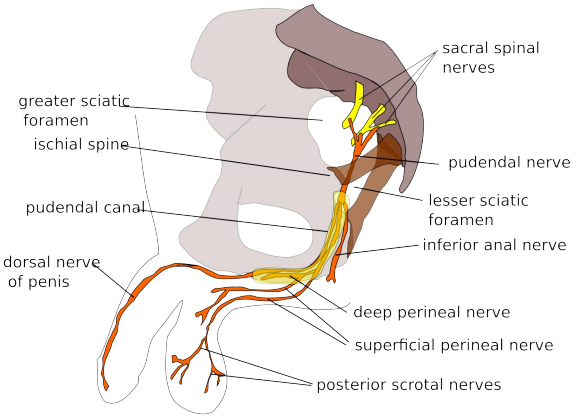
- Branch of sacral plexus
- Anterior division of ventral rami of S2-S4

Course and distribution of the pudendal nerve



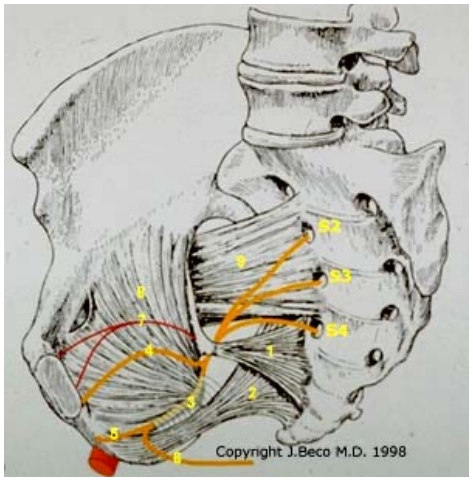
- Leaves main pelvic cavity through greater sciatic foramen
- Briefly courses through gluteal region

Course and distribution of the pudendal nerve



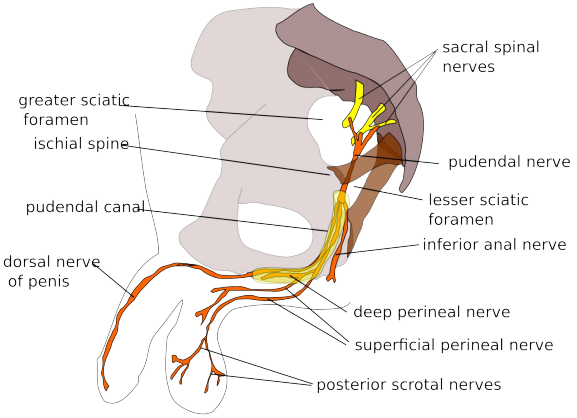
- Enters perineum through lesser sciatic foramen
- Passes through pudendal canal
- Accompanied by internal pudendal vessels
- Branches

Pudendal Canal



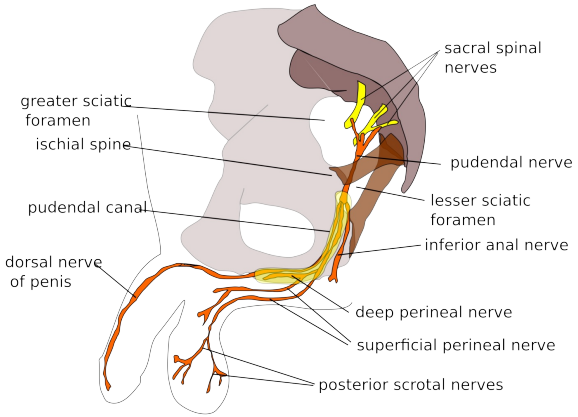
- 3
- Obturator membrane

Distribution of the pudendal nerve



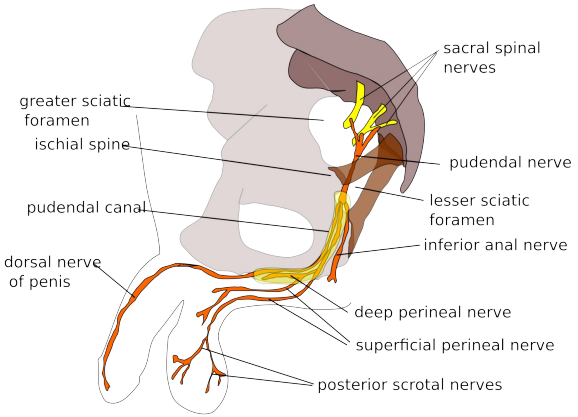
- Inferior rectal nerve
- Runs medially across ischiorectal fossa
- Supplies external anal sphincter, lower half of anal canal, perianal skin

Distribution of the pudendal nerve 1



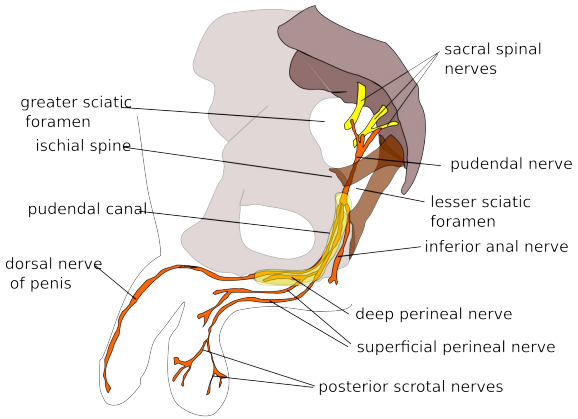
- Inferior rectal nerve
- Runs medially across ischiorectal fossa
- Supplies external anal sphincter, lower half of anal canal, perianal skin

Distribution of the pudendal nerve 2



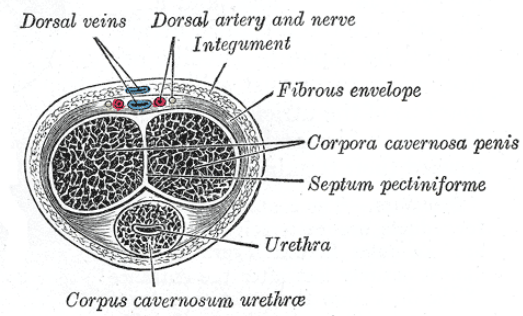
- Superficial & deep perineal nerve
- Innervate superior and deep perineal muscles, external urethral sphincter, bulbospongiosus
- Posterior scrotal branch: supply scrotal skin

Distribution of the pudendal nerve 3



- Dorsal nerve of penis (or clitoris)
- Supplies skin of penis and glans (or clitoris)
- Supplies corpora cavernosum

Distribution of the pudendal nerve 3



- Dorsal nerve of penis (or clitoris)
- Supplies skin of penis and glans (or clitoris)
- Supplies corpora cavernosum

The perineal region often requires to be anaesthetised for repair of tears, circumcision and haemorrhoidectomy.

- Pudendal Block Anesthesia
- Injection is given where the pudendal nerve crosses the sacrospinous ligament near the ischial spine
- Finger inserted into the vagina to palpate the ischial spine
- Infiltration is performed and the perineum is anesthesised.

Lymphatic Drainage of Perineal Structures

<u>Superficial inguinal nodes</u>

Follow superficial external pudendal blood vessels

Lie in superficial fascia, deep to Camper's fascia

Parallel inguinal ligament, extends inferiorly along great saphenous vein

<u>Superficial inguinal nodes</u>

Receive lymph from:

Skin of perineum

♂ Superficial tissues of penis and scrotum

♀ Superficial tissues of clitoris and labia majora

Anal canal inferior to pectinate line

Drain into deep inguinal nodes

Deep inguinal nodes

Located medial to femoral vein in the femoral triangle

Receive lymph from:

♂ Glans penis

♀ Glans clitoris, labia minora, terminal inferior end of vagina

Drain into the external iliac nodes

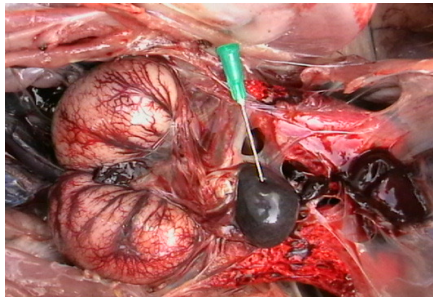
Swollen Inguinal Lymph Nodes

1) Infection in lower extremities

Eg. orchitis in males –inflammation of the testes

Caused by:

- STDs chlamydia and gnorrhoea
- Active mumps
- Epididymis infection

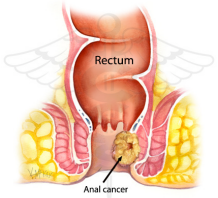


Swollen Inguinal Lymph Nodes

2) Anal cancer

Anal squamous cell carcinoma near squamocolumnar junction

Often linked to Human Papillomavirus (HPV) infection

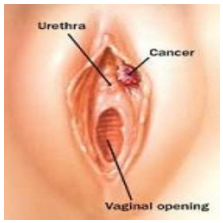


3) Vulvar cancer

Typically affects older women

Mostly labia majora affected, followed by labia minora

90% squamous cell carcinoma



Internal iliac nodes

Surround internal iliac artery

Receive lymph from:

Pelvic viscera

Deep structures of penis♂/clitoris♀

Lateral aortic (lumbar) nodes

Receive lymph from testes

Through channels that ascend in spermatic cord ➔ inguinal canal

➔ posterior abdominal wall

➔ lateral aortic (lumbar) nodes and pre-aortic nodes (LI-LII)

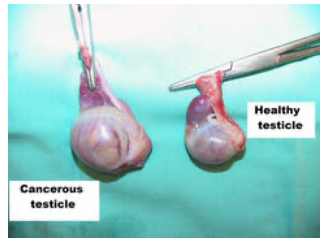
Testicular Cancer

Symptoms:

- Lump in one testes (may or may not be painful)
- Sharp pain or dull ache in lower abdomen (spread to preaortic lymph nodes) or scrotum
- Breast enlargement (from elevated β-hCG hormone)

May be mistaken as:

- Epididymitis
- Hematocele
- Varicocele



Perineum

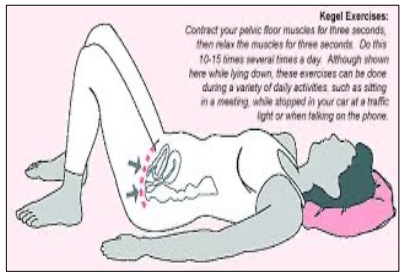
- Lowest part of the trunk
- The roof is the pelvic diaphragm (pelvic floor)
- The borders are the symphysis pubis, the inferior ischiopubic rami, the ischial tuberosity, the sacrotuberous ligament, and the tip of coccyx.
- Anteriorly is the urogenital triangle and posteriorly, the anal triangle.

Pelvic floor exercise

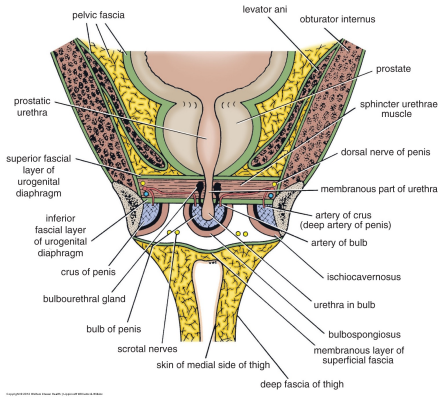
Also known as KEGEL exercises

Can be done discreetly, anytime , anywhere and in any position.

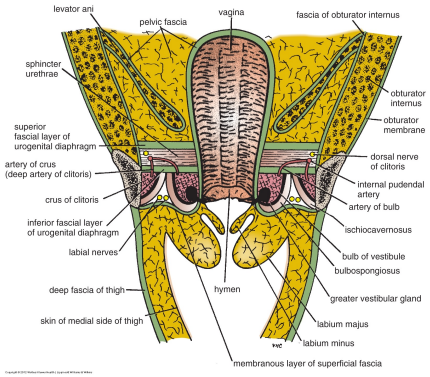
Clinically, able to manage urinary incontinence, prevent prolapse of pelvic viscerals (Cystocele, Rectocele, enterocele etc) or reduce its severity.



Ischiorectal (Ischioanal) fossa



MALE

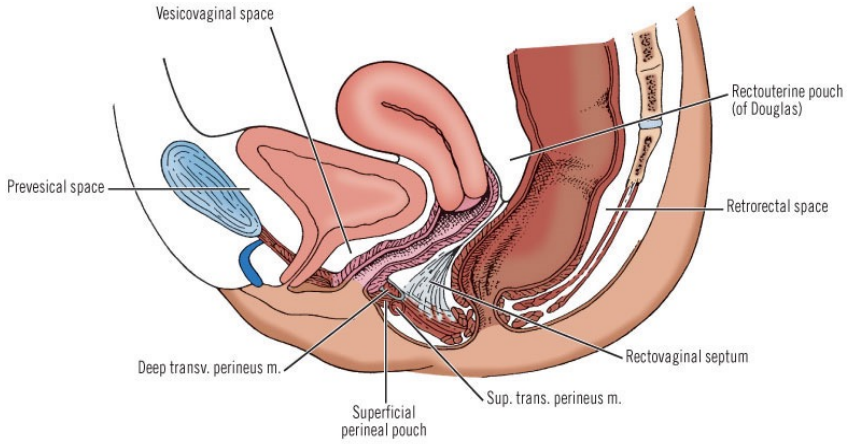


FEMALE

Vagina

- 3 inches long
- Superiorposteriorly from vulva to uterus
- Upper half within pelvis
- Lower half within perineum
- Collapsed except at superior end
- Presence of fornix

Major relations of vagina



Major relations

Anterior	Bladder, urethra
Posterior	Upper ⅓: Pouch of Douglas Middle ⅓: Rectal ampulla Lower ⅓: Perineal body; anal canal
Lateral	Upper: Ureter Middle: Ant. fibers of levatores ani Lower part: Urogenital diaphragm and bulb of vestibule

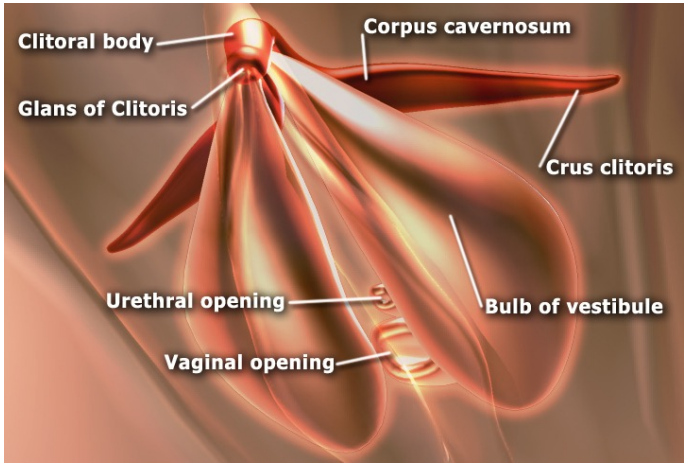
Others

- Blood supply- Vaginal artery, vaginal branch of uterine artery; vaginal vein
- Lymphatic drainage- internal and external iliac nodes, superficial inguinal nodes
- Innervation- Inferior hypogastric nerve

Salient features of female external genitalia (Components)

Vulva (Collective term for female external genitalia)
Includes:

-mons pubis
-labia majora and minora
-clitoris
-vestibule of vagina
-vestibular bulb
-greater vestibular glands
-vaginal orifice



clitoris

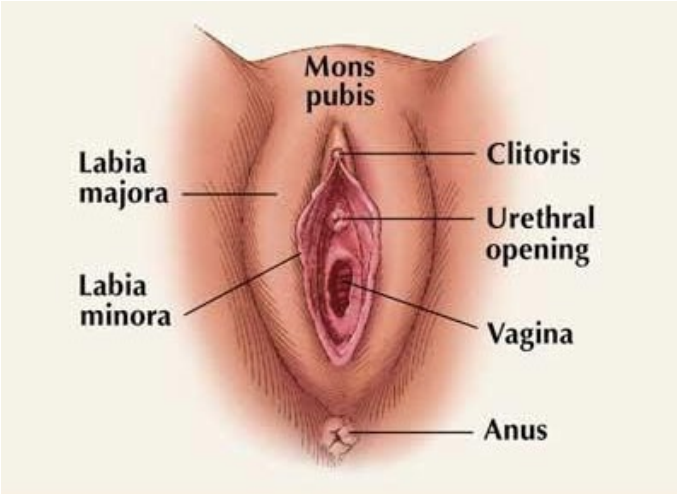
Root
- Bulb (covered by bulbospongiosus muscle)
- Crura (covered by ischiocarvenosus muscle)

Body
- 2 corpora cavernosa

Glans
- Numerous sensory endings
- Partly hidden by prepuce

Clitoris

- Blood supply- deep artery of clitoris, artery of the bulb, dorsal artery of clitoris (branches of internal pudendal artery; internal pudendal vein
- Lymphatic drainage- skin: superficial inguinal nodes; deep structures: internal iliac nodes
- Innervation- Pudendal nerve, pelvis plexus



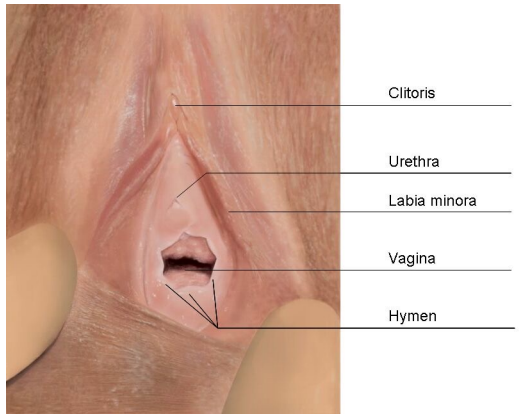
Others

- Mons pubis- skin anterior to pubis
- Labia majora- hair bearing folds of skin posterior to mons pubis
- Labia minora- hairless folds of skin between labia majora, anterior prepuce (lateral fold), posterior frenulum (medial fold), posterior unite to form fourchette
- Vestibule- bounded laterally by labia minora
- Vaginal orifice- protected in virgins by hymen
- Greater vestibular gland- under posterior parts of bulb of vestibule and labia majora

Imperforate hymen

A half moon of thin membrane normally surrounds the opening of a young girl's vagina.

?????? extends all the way across the area of the hymen, blocking the vaginal opening.

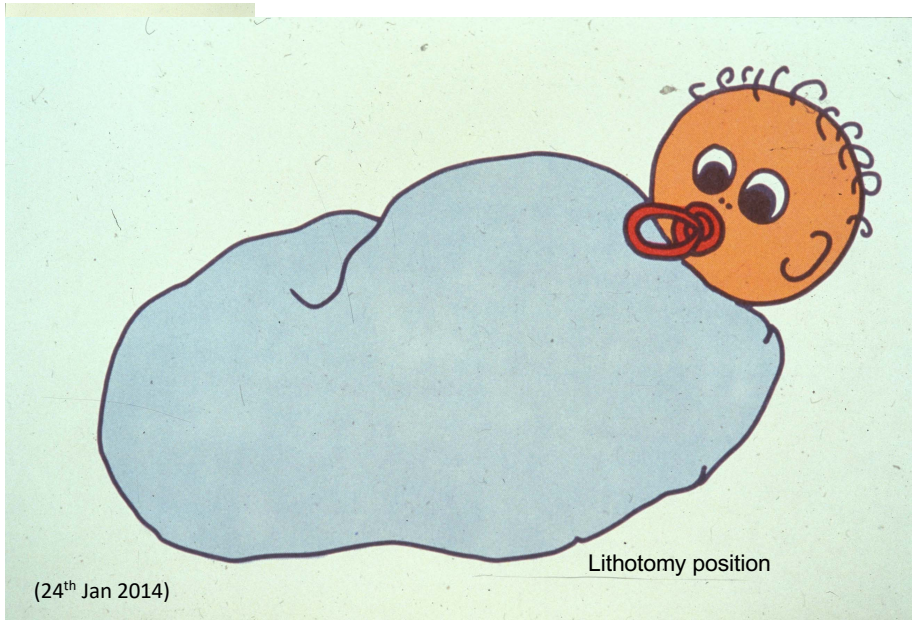


Nerve supply

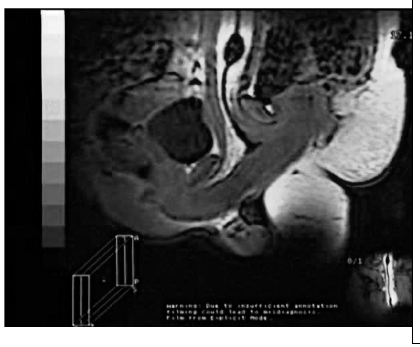
For upper part:
- autonomic supply from inferior hypogastric plexus
- sensitive only to stretch

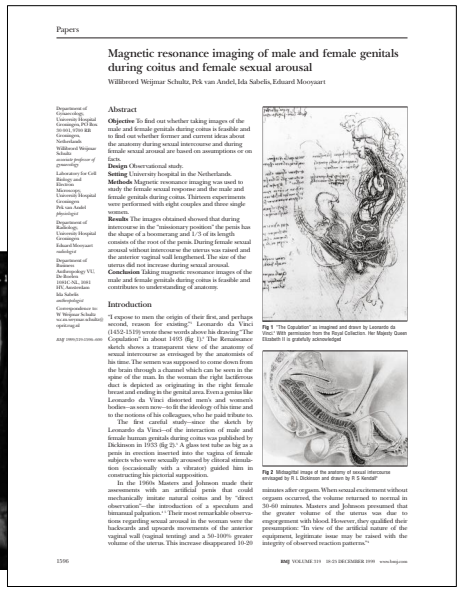
For lower part:
- somatic supply from inferior rectal nerve, which is a branch of the pudendal nerve
- sensitive to normal sensations of pain, temperature, touch, pressure.

In the beginning…….



Sexual Intercourse (Coitus) captured by MRI





Papers

Magnetic resonance imaging of male and female genitals during coitus and female sexual arousal

Willibrord Weijmar Schultz, Pek van Andel, Ida Sabelis, Eduard Mooyaart

Abstract

Objective To find out whether taking images of the male and female genitals during coitus is feasible and to find out whether former and current ideas about the anatomy during sexual intercourse and during female sexual arousal are based on assumptions or on facts.

Design Observational study.

Setting University hospital in the Netherlands.

Methods Magnetic resonance imaging was used to study the female sexual response and the male and female genitals during coitus. Thirteen experiments were performed with eight couples and three single women.

Results The images obtained showed that during intercourse in the "missionary position" the penis has the shape of a boomerang and 1/3 of its length consists of the root of the penis. During female sexual arousal without intercourse the uterus was raised and the anterior vaginal wall lengthened. The size of the uterus did not increase during sexual arousal.

Conclusion Taking magnetic resonance images of the male and female genitals during coitus is feasible and contributes to understanding of anatomy.

Introduction

"I expose to men the origin of their first, and perhaps second, reason for existing." Leonardo da Vinci (1452-1519) wrote these words above his drawing "The Copulation" in about 1493 (fig 1).[1] The Renaissance sketch shows a transparent view of the anatomy of sexual intercourse as envisaged by the anatomists of his time. The semen was supposed to come down from the brain through a channel which can be seen in the spine of the man. In the woman the right lactiferous duct is depicted as originating in the right female breast and ending in the genital area. Even a genius like Leonardo da Vinci distorted men's and women's bodies—as seen now—to fit the ideology of his time and to the noticeable of his colleagues, who he paid tribute to.

The first careful study—since the sketch by Leonardo da Vinci—of the interaction of male and female human genitals during coitus was published by Dickinson in 1933 (fig 2).[2] A glass test tube as big as a penis in erection inserted into the vagina of female subjects who were sexually aroused by clitoral stimulation (occasionally with a vibrator) guided him in constructing his pictorial supposition.

In the 1960s Masters and Johnson made their assessments with an artificial penis that could mechanically imitate natural coitus and by "direct observation"—the introduction of a speculum and bimanual palpation.[3,4] Their most remarkable observations regarding sexual arousal in the woman were the backwards and upwards movements of the anterior vaginal wall (vaginal tenting) and a 50–100% greater volume of the uterus. This increase disappeared 10-20 minutes after orgasm. When sexual excitement without orgasm occurred, the volume returned to normal in 30-60 minutes. Masters and Johnson presumed that the greater volume of the uterus was due to engorgement with blood. However, they qualified their presumption: "In view of the artificial nature of the equipment, legitimate issue may be raised with the integrity of observed reaction patterns."[4]

Fig 1 "The Copulation" as imagined and drawn by Leonardo da Vinci.[1] With permission from the Royal Collection. Her Majesty Queen Elizabeth II is gratefully acknowledged

Fig 2 Midsagittal image of the anatomy of sexual intercourse envisaged by R L Dickinson and drawn by R T Hertzler[2]

1596

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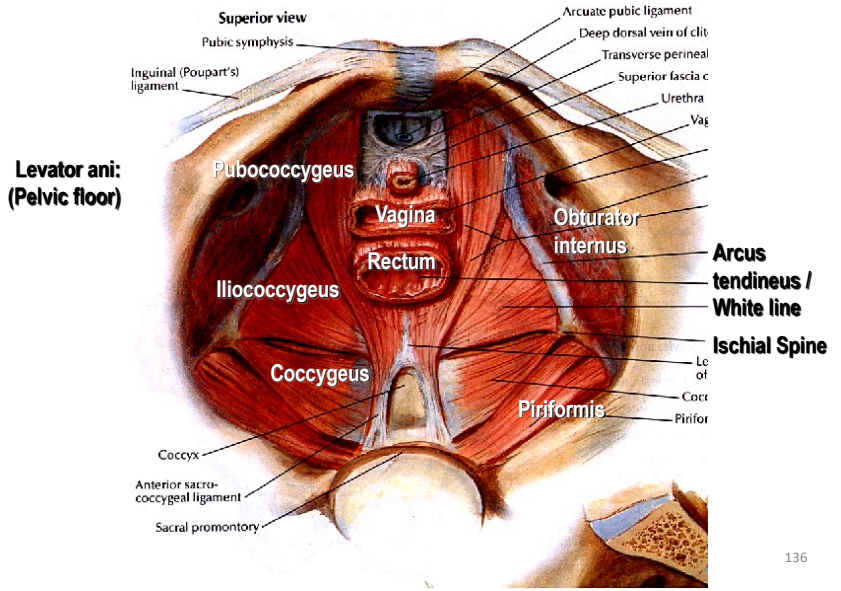
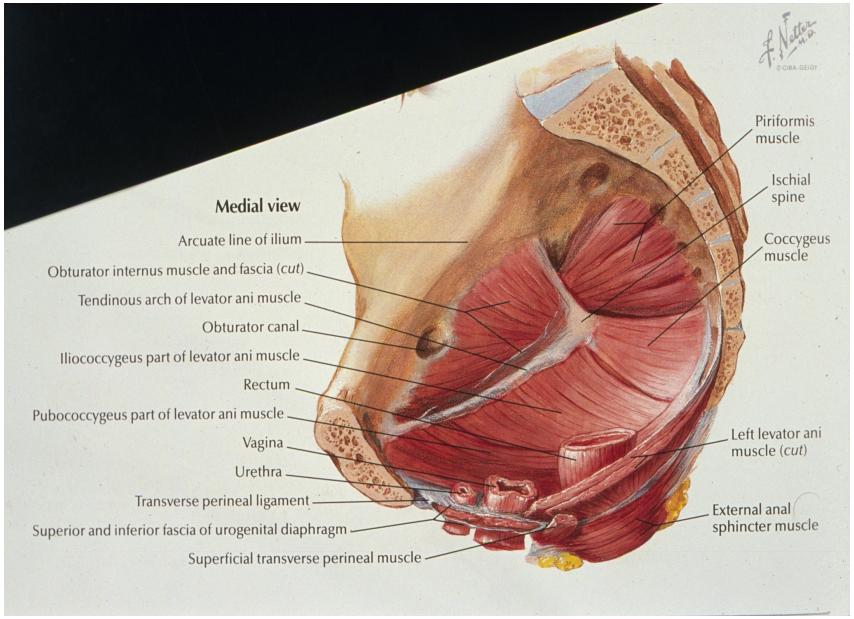
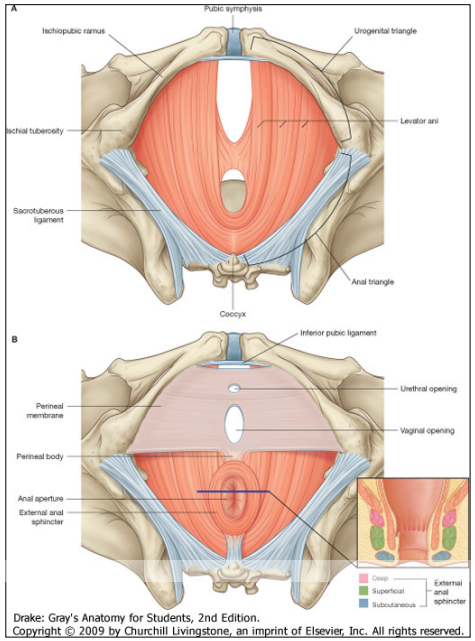
FEMALE PELVIC FLOOR – Superior View

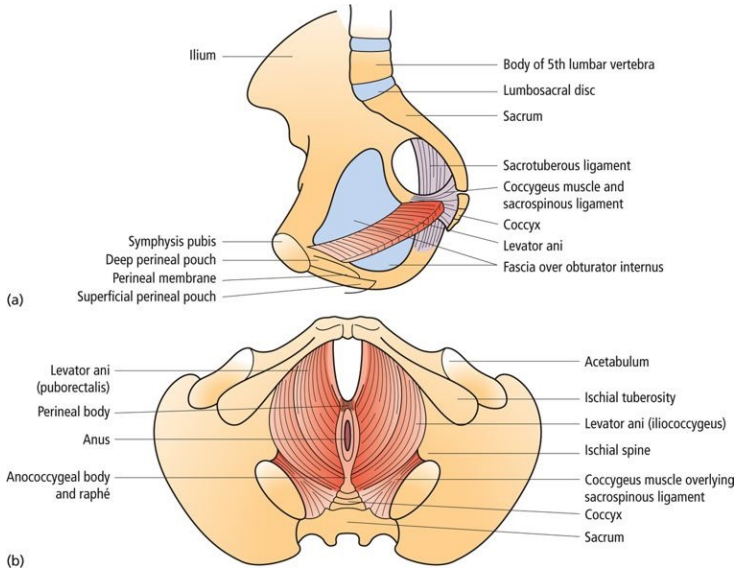


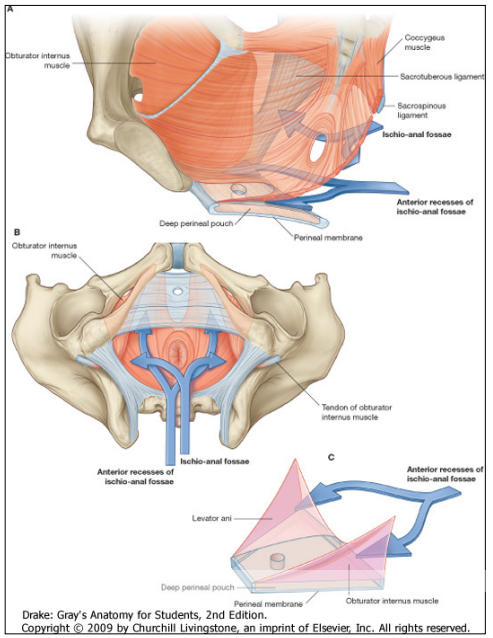




Know all the outlets and sphincters!

Pelvic diaphragm/ Pelvic Floor



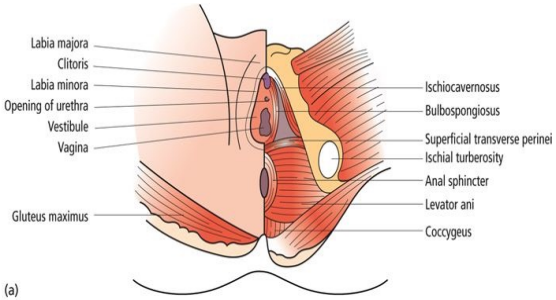


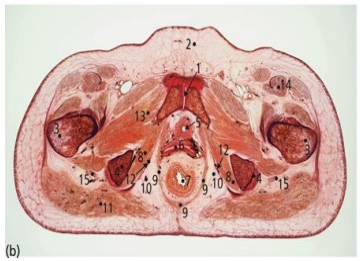
Ischiorectal (Ischioanal) fossa

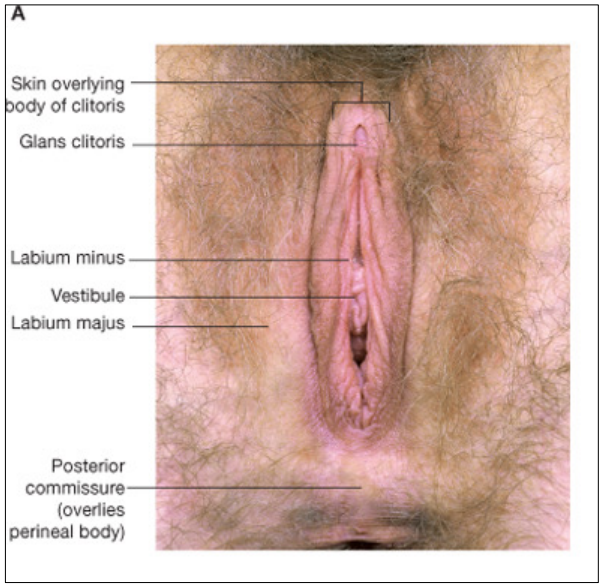
How may pus track from side to side?

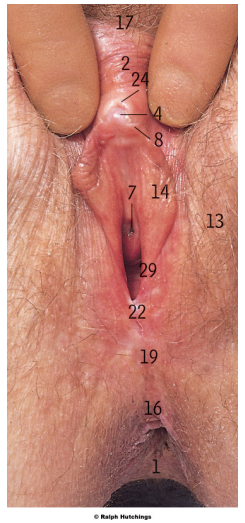
Communication at the posterior aspect but nil anteriorly.

Female Perineum



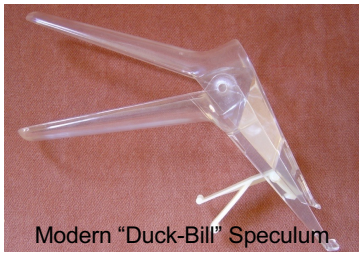




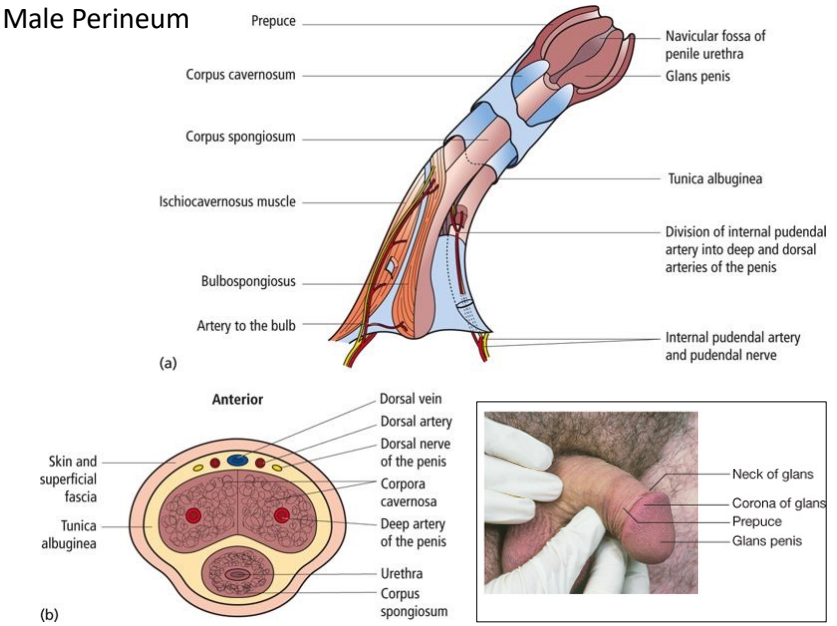


Examination of the Vulva

- INSPECTION see Female circumcision
- Palpation

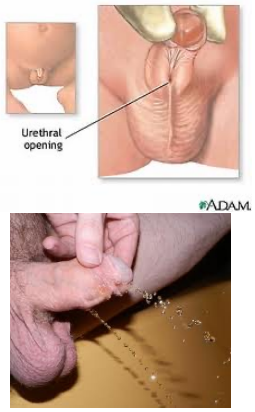


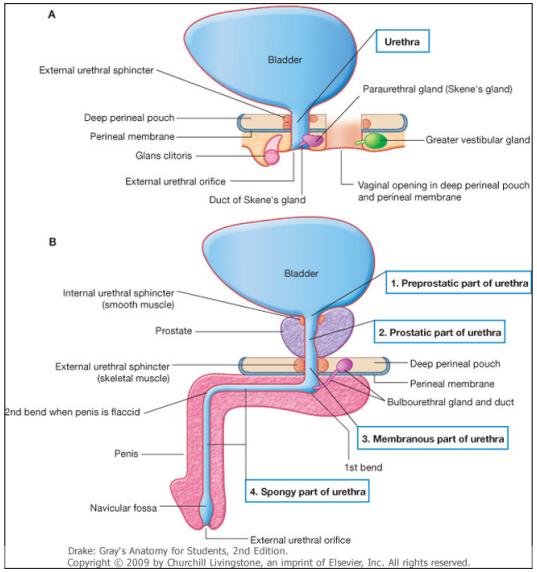
Male Perineum



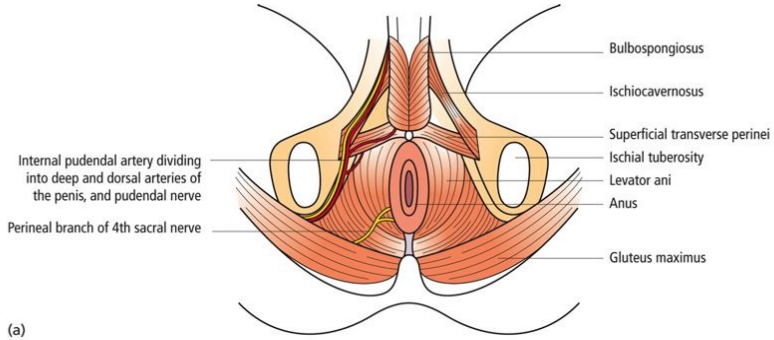
Female vs Male urethra

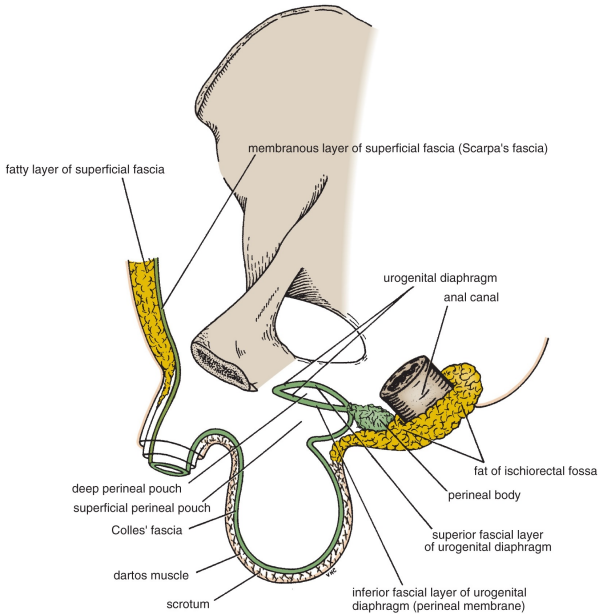
What is hypospadia?

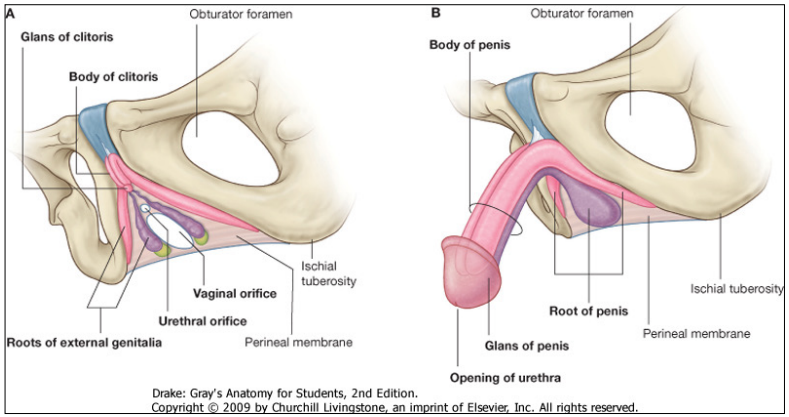




Male perineum & Pudendal nerve



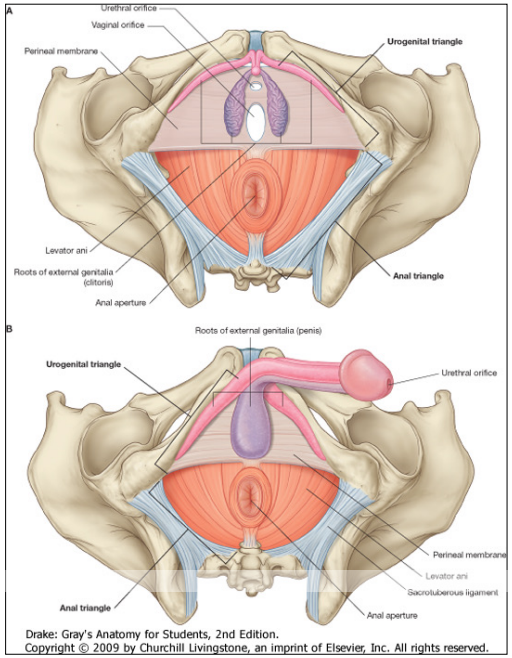


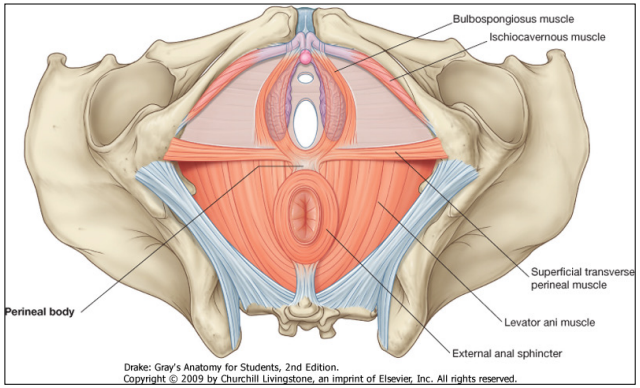


Compare female and male external genitalia.

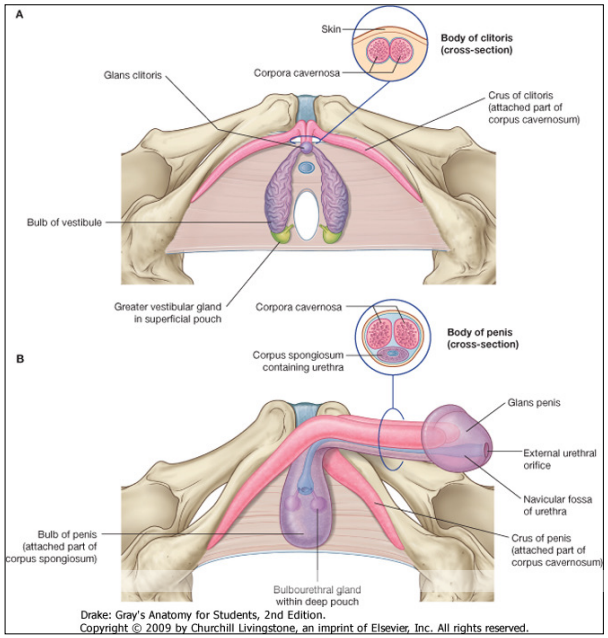
Where is the bulbospongiosus muscle? Function?

Where are the ischiocavernosus muscles? Function?

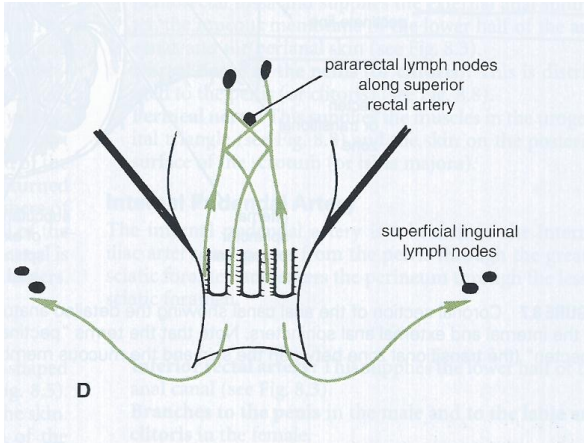




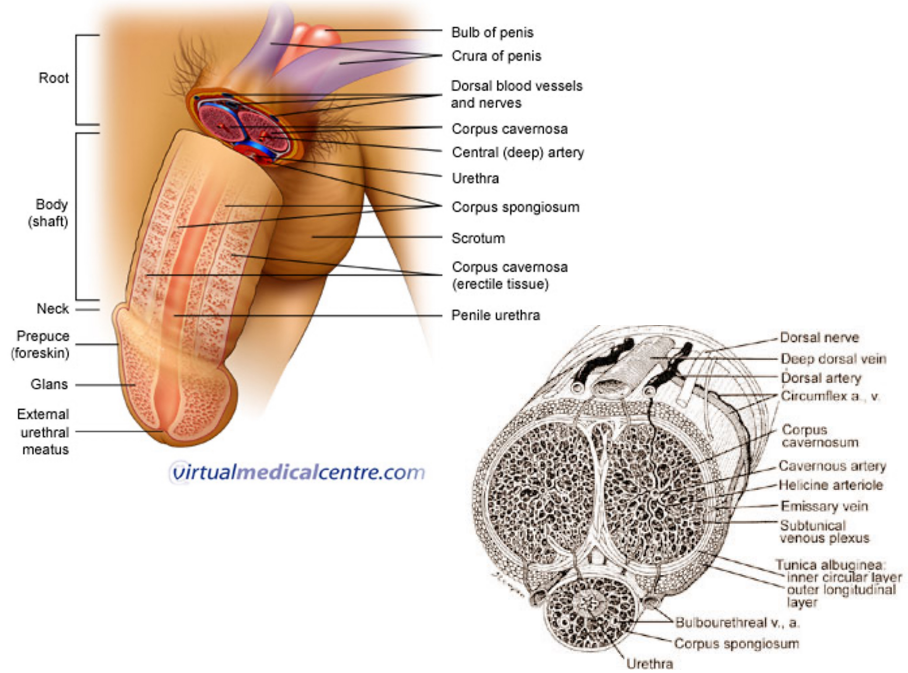
Where is the urogenital diaphragm?



Lymphatic drainage of anal canal



Erectile Dysfunction



Erection

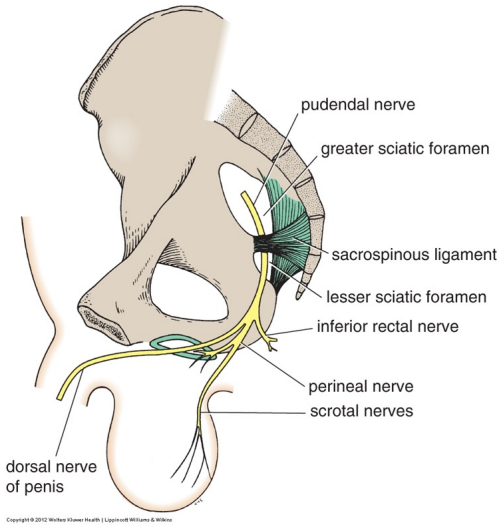
- Stimuli ;)
- Afferent stimuli through somatic fibres in pudendal nerve
- Parasympathetic outflow from efferent fibres of S2-S4 (Neurotransmitter: NO)
- Vasodilation of arteries -> Erectile tissues engorged with blood
- Penis increases in length and diameter

Ejaculation

- Bulbourethral (Cowper's) glands secrete viscous pre-ejaculate for lubrication purposes
- Friction on glans penis stimulates sympathetic fibres
- Contraction of smooth muscle of epididymis, vas deferens, seminal vesicles, prostrate -> secretions and spermatozoa enter prostatic urethra
- Rhythmic contraction of bulbospongiosus muscle -> eject semen out of penile urethra
- Contraction of urethral sphincter prevents reflux of semen into urinary bladder (retrograde ejaculation)

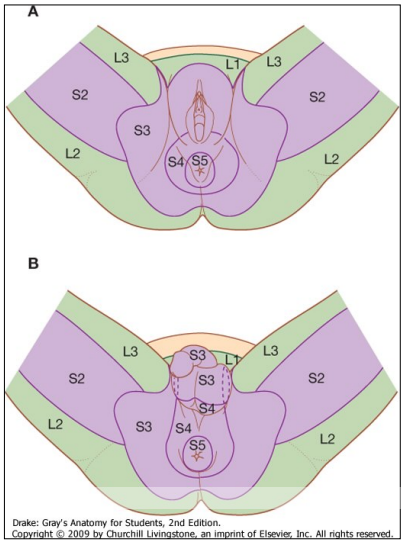
Erectile Dysfunction

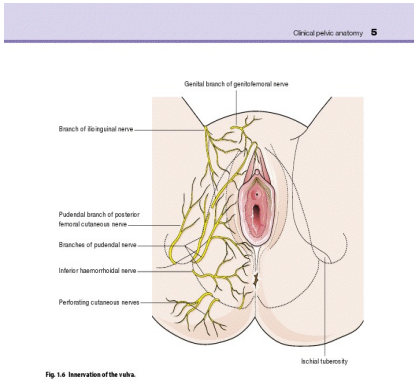
- Inability to develop or maintain an erection
- Causes:
  - Psychological: stress, performance anxiety
  - Surgery: nerve damage, disrupt blood supply
  - Lifestyle: Smoking (constriction of arteries)
- Treatment
  - Medication: Phosphodiesterase type 5 inhibitors – block PD5, degradation of cGMP (cGMP = stimulates relaxation of smooth muscle)
  - Penis Pump – uses negative pressure to draw blood into penis
  - Surgery: Prostatic implants (insertion of artificial rods)

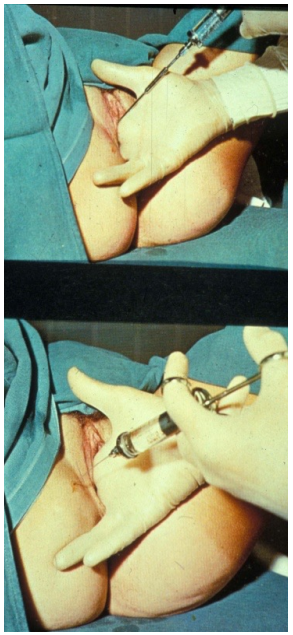


Pudendal nerve

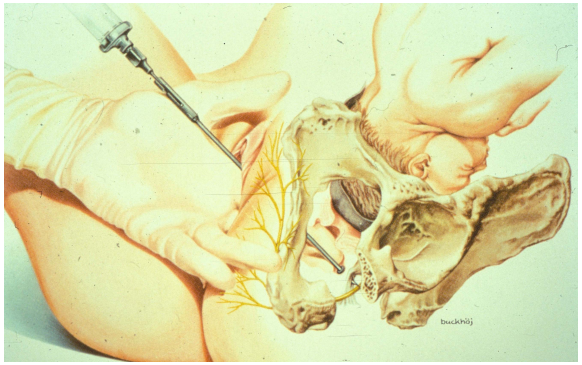
Arising from the anterior rami (S2,3,4)







Pudendal block



KEY LANDMARK -- ISCHIAL SPINE

Branches of internal iliac artery

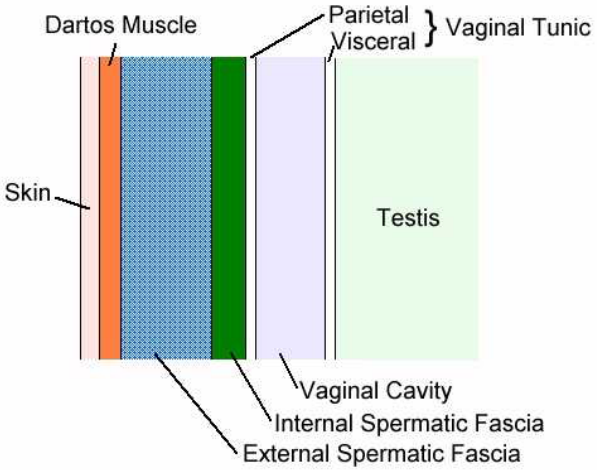
A useful **mnemonic** to remember the branches

I Love Going Places In My Very Own Underwear!

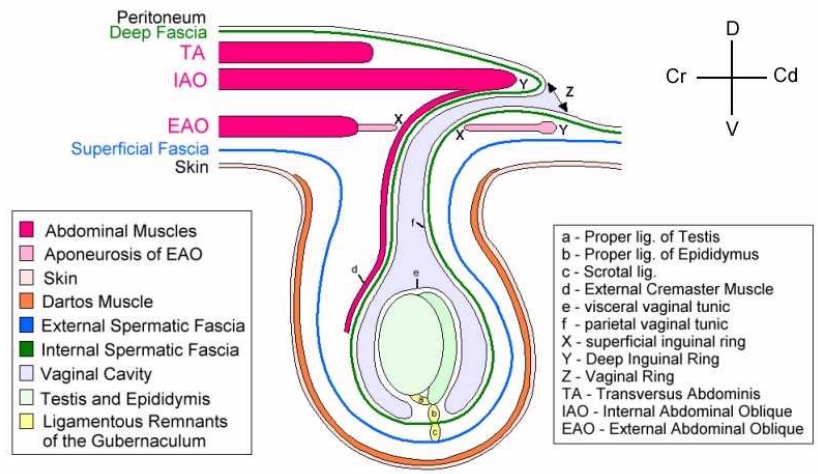
Mnemonic

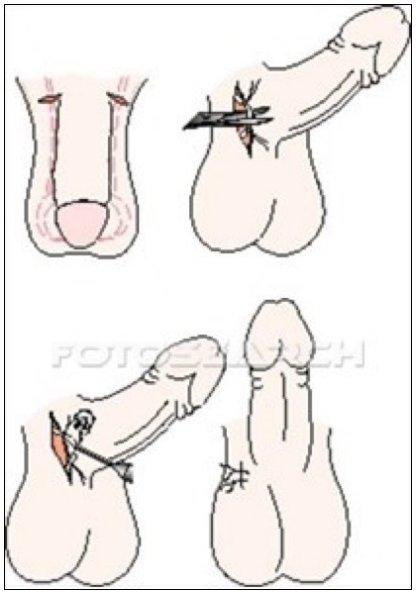
I - iliolumbar artery
L - lateral sacral artery
G - gluteal (superior and inferior) arteries
P - (internal) pudendal artery
I - inferior vesicle (uterine in females) artery
M - middle rectal artery
V - vaginal artery
O - obturator artery
U - umbilical artery

Testes and scrotum



Testes and scrotum





Vasectomy

Thank you !