

Dissection 15: The Pelvis & Perineum

Objective 1)

Identify the bony walls and ligamentous landmarks of the pelvis. Identify the normal position and anatomical relationships of the pelvic viscera.

Bony walls and ligamentous landmarks:

Bony pelvis:

Hip bones: fusion of ilium, ischium, pubis

Sacrum: five fused sacral vertebrae

Coccyx: 4 fused coccygeal vertebrae

Anteriorly, hip bones join at pubic symphysis. Posteriorly, hip bones join to sacrum at sacroiliac joints.

Greater/ false pelvis: superior to pelvic inlet; bounded by the ala of the ilium bones, L5 and S1 vertebrae, and the sigmoid colon and part of ileum

Lesser/ true pelvis: between the pelvic inlet and diaphragm; location of pelvic viscera

Pelvic inlet: superior pelvic aperture or pelvic brim; separates the greater/false pelvis from the inferiorly located lesser pelvis/true pelvis/pelvic cavity

Pelvic inlet bounded by the **linea terminalis** of the pelvis, which consists of superior margin of pubic symphysis, posterior border of pubic crest, pectens pubis, arcuate line of ilium, anterior border of ala of sacrum, sacral promontory

Pelvic outlet: inferior pelvic aperture; closed by musculofascial pelvic diaphragm; Bounded by inferior margin of pubic symphysis, inferior pubic ramus, ischial ramus and tuberosity, sacrotuberous ligaments, tip of coccyx

Ligaments:

Iliolumbar ligaments: unite the ilia and L5 vertebra

Anterior and posterior sacrococcygeal ligaments

Anterior and posterior sacroiliac ligaments and interosseous ligaments unite the sacrum and the ilium

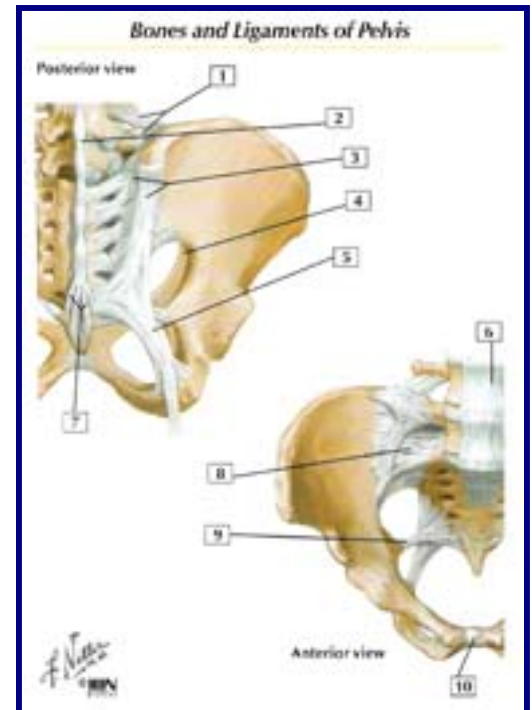
Sacrotuberous ligament and sacrospinous ligaments: create the lesser and greater sciatic foramina, respectively

Interpubic disc at the pubic symphysis

Superior pubic ligament and inferior/arcuate pubic ligament located at the pubic symphysis

Position and Anatomic Relationships of Pelvic Viscera:

Ureters:



Pass over pelvic brim at bifurcation of the common iliac arteries and run posteroinferiorly on lateral walls of pelvis; retroperitoneal; enters posteroinferior aspect of bladder

Males: ductus deferens/vas deferens passes between ureter and peritoneum and is anteromedial to the ureter

Females: ureter passes medial to origin of uterine artery; at level of ischial spine, crossed superiorly by uterine artery and inferiorly by vaginal artery; ureter passes close to lateral part of fornix of vagina

Urinary Bladder:

Posterior and slightly superior to pubic bones; is in the lesser pelvis when empty and can extend as high as umbilicus when full; retroperitoneal; rests on the pelvic floor; separated anteriorly from the pubic bones by the **retropubic space**; neck held in place by the **puboprostatic ligaments**(*males*) and the **pubovesical ligaments**(*females*)

Male Urethra:

Carries urine from the internal urethral orifice to the external urethral orifice at the tip of the glans penis
Four parts:

Urethra in the bladder neck/ **preprostatic urethra**

Prostatic urethra: descends through the prostate; contains opening of ejaculatory ducts

Intermediate/ Membranous part of urethra: passes through the external urethral sphincter and perineal membrane; extends from prostatic urethra to spongy part of urethra; narrowest and least distensible part of the urethra due to the sphincter

Spongy part of urethra: located in the corpus spongiosum of the penis

Female Urethra:

Passes anteroinferiorly from the internal urethral orifice of the urinary bladder to the external urethral orifice in the vestibule of the vagina; located posterior and then inferior to the pubic symphysis; travels anterior to and with the vagina through the pelvic diaphragm, external urethral sphincter, and perineal membrane

Rectum:

Continuous proximally with sigmoid colon and distally with anal canal; rectosigmoid junction at S3 level; follows curve of sacrum and coccyx and ends anteroinferior to tip of coccyx

Rests posteriorly on inferior 3 sacral vertebrae and the coccyx, anococcygeal ligament, median sacral vessels, and inferior ends of sympathetic trunks and sacral plexus.

At tip of coccyx, rectum turns posteroinferiorly and becomes anal canal

Ampulla of rectum: dilated terminal part of rectum

At anorectal flexure, rectum perforates pelvic diaphragm and becomes anal canal

Peritoneum covers anterior and lateral surfaces of superior third of rectum, anterior surface of middle third, none of the inferior third.

Males: peritoneum reflects from rectum to posterior wall of bladder to form floor of **rectovesical pouch**. Anterior to rectum is fundus of urinary bladder, terminal parts of ureters, ductus deferens, seminal glands and prostate. Below pouch, **rectovesical septum** between fundus of bladder and ampulla of rectum

Females: peritoneum reflects from rectum to posterior fornix of vagina to form floor of **rectouterine pouch**. Anterior to rectum is vagina. Below pouch, **rectouterine septum** separates rectum from superior half of posterior wall of vagina

Anal Canal:

Terminal part of large intestine; extends from upper part of pelvic diaphragm to anus; begins where rectal ampulla abruptly narrows at level of puborectalis muscle; canal surrounded by internal and external anal sphincters and it descends posteroinferiorly between **anococcygeal body (ligament)** and the **perineal body**

Male Internal Genital Organs:

Testes:

Suspended in scrotum by spermatic cord

Seminiferous tubules-site of sperm production

Straight tubules join seminiferous tubules to the rete testis, which is a network of canals at the termination of the seminiferous tubules.

Epididymis:

Formed by convolutions of the duct of the epididymis on posterior surface of testis.

Not covered by the tunica vaginalis.

Efferent ductules transport sperm from rete testis to epididymis, where they are stored until mature.

Epididymis consists of a head formed by the coiled ends of 12 to 14 efferent ductules, a body formed by the convoluted duct of the epididymis, and a tail that becomes the ductus deferens.

Ductus deferens/ vas deferens:

Begins in the tail of the epididymus as the continuation of the duct of the epididymus; ascends in the spermatic cord, passes through inguinal canal, crosses over external iliac vessels, and enters pelvis; passes retroperitoneally along lateral wall of pelvis; crosses between the ureter and the peritoneum near the posterolateral angle of the bladder to reach the fundus of the bladder; traveling posterior to the bladder, the ductus lies superior to the seminal gland and then descends medial to the ureter and gland; joins the duct of the seminal gland to form the ejaculatory duct

Seminal glands/ vesicles:

Lie between the fundus of the bladder and the rectum; superior end of seminal glands covered with peritoneum and lie posterior to the ureters, where the peritoneum of the **rectovesical pouch** separates them from the rectum; inferior ends of seminal glands separated from rectum by **rectovesical septum**; duct of seminal gland joins ductus deferens to form the ejaculatory duct

Ejaculatory duct: the 2 ducts arise near the neck of bladder from union of ductus deferens and the duct of seminal gland; pass anteroinferiorly through the posterior part of prostate and open into prostatic utricle of prostatic urethra

Prostate: surrounds the prostatic urethra; prostatic ducts open into the prostatic sinuses on the posterior wall of the prostatic urethra; fibrous prostatic sheath continuous with the **puboprostatic ligaments** and posterior part of sheath makes up **rectovesical septum**, which passes from the perineal body to the floor of the **rectovesical pouch**; septum lies between ampulla of rectum and the prostate, seminal glands, ductus deferens

Base/superior aspect: near neck of bladder

Apex/ inferior aspect: in contact with fascia of superior part of urethral sphincter and deep perineal muscles

Anterior surface: muscular surface; separated from pubic symphysis by retroperitoneal fat in retropubic space

Posterior surface: near ampulla of rectum

Inferolateral surface: next to levator ani muscle

Bulbourethral glands:

Posterolateral to the intermediate/membranous part of urethra; pass through the perineal membrane with the urethra and open into the spongy urethra in the bulb of the penis

Female Internal Genital Organs:**Vagina:**

Extends from the cervix of uterus to vestibule of vagina; vaginal fornix is recess of vagina around the cervix and posterior part of fornix closely related to the rectouterine pouch

Anterior to vagina: base of bladder and urethra

Lateral: levator ani, visceral pelvic fascia, ureters

Posterior: anal canal, rectum, rectouterine pouch

Uterus:

Usually anteverted (tipped anteriorly relative to axis of vagina) and its mass lies over the bladder; divided into a body, which is made up of the fundus and isthmus, and a cervix. Vaginal part of cervix communicates with vagina through external os.

Peritoneum covers uterus anteriorly and superiorly except for vaginal part of cervix.

Anteriorly, uterine fundus and upper body separated from urinary bladder by **vesicouterine pouch**, which is made of peritoneum.

Supravaginal part of cervix separated from bladder anteriorly by loose connective tissue

Isthmus and cervix of uterus in direct contact with bladder.

Posteriorly, body of uterus and supravaginal part of cervix separated from sigmoid colon by peritoneum and from the rectum by the **rectouterine pouch**.

Broad ligament of uterus: double layer of peritoneum that extend from sides of uterus to lateral walls and floor of pelvis; keeps uterus centered in pelvis; contains the ovaries, uterine tubes, and related structures; peritoneum of broad ligament covers the ovarian vessels as the **suspensory ligament** of the ovary.

Broad ligament can be subdivided into **mesovarium** (suspends the ovaries), **mesosalpinx** (mesentery of uterine tube), and **mesometrium** (all the rest).

Ligament of ovary and round ligament of uterus are vestiges of ovarian gubernaculum

Ligament of ovary lies posterosuperiorly and round ligament of the uterus lies anteroinferiorly between layers of broad ligament.

Cervix held in place by ligaments that are condensations of the visceral pelvic fascia (according to Dr. English):

Transverse cervical (cardinal) ligaments: extend from the cervix and lateral parts of fornix of vagina to lateral walls of pelvis

Uterosacral ligaments: pass superiorly and slightly posteriorly from sides of cervix to middle of sacrum

Uterine tubes:

Extend from uterine horns and open into peritoneal cavity near the ovaries; lie in the mesosalpinx formed by the broad ligament; extend posterolaterally to the lateral pelvic walls, then ascend and arch over the ovaries

Four parts of uterine tube:

Infundibulum: opens into peritoneal cavity through abdominal os and contains fimbriae that spread over medial surface of ovary

Ampulla: widest and longest part

Isthmus: thick walled; enters uterine horn

Uterine part: intramural segment that passes through wall of uterus and opens into uterine cavity through uterine os

Ovaries:

Close to lateral pelvic walls; suspended by mesovarium from the broad ligament of uterus

Suspensory ligament of ovary connects distal end of ovary to lateral wall of pelvis; ligament contains ovarian vessels, lymphatics, and nerves to and from ovary; comes from the lateral part of mesovarium

Ligament of ovary: connects proximal (uterine) end of ovary to lateral angle of uterus, inferior to entrance of uterine tube; runs within mesovarium; remnant of gubernaculum

Objective 2)

Identify the extent of the peritoneal cavity and its folds and reflections in the male and female pelvis and their relationship to the pelvic contents. Distinguish between the ligaments which are formed by folds of peritoneum and ligaments which are formed by condensations of visceral pelvic fascia in terms of their function and relative position in the pelvic cavity.

Path of peritoneal reflections in male (see Moore p. 228):

1. From anterior abdominal wall
2. Superior to pubic bone
3. On superior surface of urinary bladder
4. 2 cm inferiorly on posterior surface of urinary bladder
5. On superior ends of seminal glands
6. Posteriorly to make up the rectovesical pouch
7. Covers part of the rectum: anterior and lateral surfaces of superior third of rectum, anterior surface of middle third, none of the inferior third
8. Continues posteriorly to become the sigmoid mesocolon

Path of peritoneal reflections in female:

1. From anterior abdominal wall
2. Superior to pubic bone
3. On superior surface of urinary bladder
4. From the bladder to the uterus, forming the vesicouterine pouch
5. On the fundus and body of the uterus, posterior fornix, and all of the vagina
6. Between the rectum and uterus, forming rectouterine pouch
7. Covers part of the rectum: anterior and lateral surfaces of superior third of rectum, anterior surface of middle third, none of the inferior third
8. Continues posteriorly to become sigmoid mesocolon.

Ligaments from folds of peritoneum:

Rectovesical pouch

Rectouterine pouch

Broad ligament of uterus: peritoneum of broad ligament covers the ovarian vessels as the **suspensory ligament of the ovary**.

Ligament of ovary lies posterosuperiorly and round ligament of the uterus lies anteroinferiorly between layers of broad ligament.

Note: No peritoneal ligaments in males in pelvis according to Dr. English

Ligaments from condensations of pelvic fascia:

Pelvic fascia has parietal and visceral components.

Visceral pelvic fascia surrounds pelvic viscera and their nerves and vessels.

Parietal pelvic fascia lines the internal/pelvic/deep aspect of muscles forming the walls and floor of pelvis. Forms the superior and inferior fascia of the pelvic diaphragm.

Parietal and visceral pelvic fascia becomes continuous where the organs penetrate the pelvic floor.

At this point, the parietal fascia thickens and forms the **tendinous arch of pelvic fascia**, which runs from the pubis to the sacrum along the pelvic floor adjacent to the viscera.

Antermost part of arch: puboprostatic ligament (males) or pubovesical ligament (females), which connects either the prostate to the pubis (males) or the bladder to the pubis (females)

Posteriormost part of arch: forms sacrogenital ligaments from the sacrum around the side of the rectum to attach to the prostate in males or the vagina in females.

Females:

Pelvic fascia attaches to posterior aspect of pubic bone, bladder, cervix, vagina, and rectum in order to form **pubovesical, cardinal (transverse cervical), and uterosacral ligaments**

Transverse cervical (cardinal) ligaments: extend from the cervix and lateral parts of fornix of vagina to lateral walls of pelvis

Uterosacral ligaments: pass superiorly and slightly posteriorly from sides of cervix to middle of sacrum

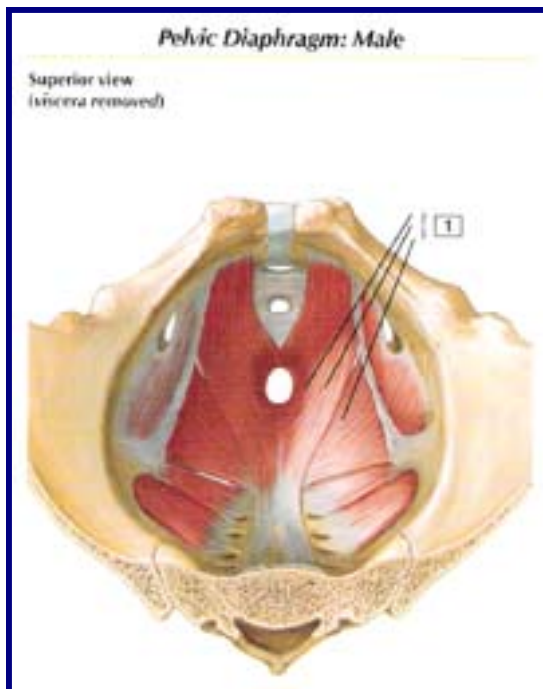
Note: Uterosacral = rectouterine = sacrogenital ligament

Males:

Pelvic fascia attaches to rectum, prostate, urinary bladder, and pubis. Fascia attached to prostate and bladder forms medial and lateral **pubovesical/ puboprostatic ligaments**. Males also have **sacrogenital/ rectoprostatic ligament**.

Objective 3)

Identify the pelvic diaphragm and its components. Identify the urogenital diaphragm and its components. Indicate the relationship of the pelvic diaphragm and the urogenital diaphragm to the genitourinary tracts in the male and female.



A. Pelvic diaphragm

Two muscles and their fascia form the floor of the pelvic cavity and are known collectively as the pelvic diaphragm. The two muscles are:

- i. **Levator ani:** a thin sheet of muscle which originates from the pubic bone and the fascia of the obturator internus and inserts on the coccyx, the anococcygeal raphe and the perineal body; is divided, based on the exact origination and insertion of the fibers, into:
 - a. **Pubococcygeus:** originates from the posterior pubis and inserts into the anococcygeal raphe. It is further divided into:
 - **Levator prostatae/Sphincter vaginae:** originates from the posterior pubis and inserts into the perineal body, forming a sling around the prostate/vagina.

- **Puborectalis:** circular fibers that begin and end at the posterior pubis, forming a sling around the rectum.
- b. **Iliococcygeus:** originates from the obturator internus fascia and ischium and inserts into the anococcygeal raphe.
- ii. **Coccygeus muscle:** originates from the ischial spine and inserts into the lower sacrum and coccyx; it runs parallel and anterior to the sacrospinous ligament.

B. Perineum

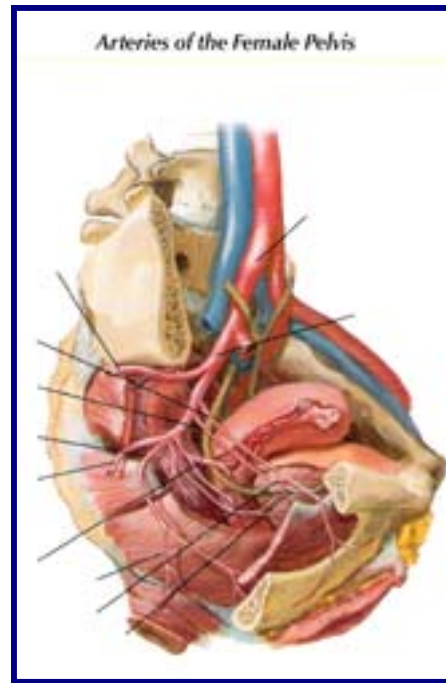
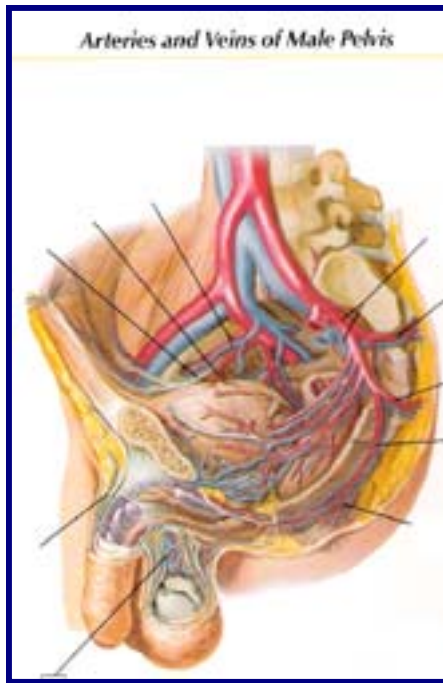
The perineum is located below the pelvic diaphragm (a.k.a. levator ani). The boundaries are: pubic symphysis (anteriorly), inferior pubic and ischial rami (anterolaterally), ischial tuberosities (laterally), sacrotuberous ligaments (posterolaterally), and the inferior most sacrum and coccyx (inferiorly). The perineum is divided into two triangles: urogenital (anterior to the line between the ischial tuberosities) and anal (posterior to the line between the ischial tuberosities).

C. Urogenital diaphragm

- i. Consists of the contents of the deep perineal space and the perineal membrane
- ii. The superficial fascia is divided into a superficial layer and a deep layer. Camper's fascia extends, in the females, to the labia majora. In males, Camper's fascia extends laterally, and also thinly over the scrotum and the penis. This fatty layer contains the cremaster muscle (which causes "shrinkage"). The deep layer of superficial fascia in the perineum (which is analogous to and is a direct continuation of Scarpa's fascia) is called Colle's fascia. This membranous layer is attached to the perineal body and the perineal membrane. In males, Colle's fascia is fused to the dartos.
- iii. The perineal membrane is a very tough, rigid membrane, derived from pelvic fascia, which attaches to the pubis and ends rigidly at the junction between the urogenital triangle and the anal triangle. It is the division between the superficial and deep spaces. The perineal membrane is one of the boundaries of the urogenital diaphragm. It forms the lower portion of the urogenital diaphragm and is the upper boundary of the superficial perineal space.
- iv. The deep layer of fascia has an investing layer called Buck's fascia that covers the entire urogenital triangle. It is deep to Colle's fascia, but superficial to the perineal membrane. Buck's fascia projects into the erectile tissue of the penis.
- v. The levator ani is superior (or deep) to all of the fascial layers. The levator ani delineates the border between the superficial and deep spaces. The superficial space lies between the superficial fascia and the perineal membrane, and the deep space lies between the perineal membrane and the levator ani muscle.
- vi. **Deep perineal space**
 - a. Contains the sphincter urethrae (surrounds the membranous urethra in males) and the deep transverse perineal muscles
- vii. **Superficial perineal space**
 - a. In males the superficial space contains the erectile tissue, some glands, some vessels and nerves, and the component portions of the penis (two crura, bulb of the penis, bulbourethral glands, corpus spongiosum, and glans penis). Each of these three columns of penile tissue is covered with a small muscle. The muscles covering the crura of the penis are the ischiocavernosus muscles. In the midline, the bulbospongiosus muscle starts at the bulb of the penis and covers the corpus spongiosum. These muscles are innervated by the perineal branch of the pudendal nerve. The superficial transverse perineus muscle is also located in the superficial space.
 - b. In females the superficial space contains erectile tissue, little muscles that cover the muscles, nerves, blood vessels and a gland. There are two crura as well as two bulbs of the vestibule. The muscles that cover them are the bulbospongiosus (in contrast to males, there are two because there are two bulbs of the vestibule) and the ischiocavernosus muscles.

Objective 4)

Follow the flow of blood into and out of the structures of the pelvis and perineum and identify important areas of collateral circulation, including portal-caval anastomoses. Identify the lymphatic drainage of structures in the pelvis and perineum. Identify the sites of aggregations of lymph nodes receiving lymphatic drainage from various areas of the pelvis and perineum, whether or not they are present in your cadaver.



A. Arterial blood supply

As the abdominal aorta descends, it gives off the inferior mesenteric artery and bifurcates into the right and left common iliac arteries. The common iliac then bifurcates into internal and external iliac arteries. The external iliac passes under the inguinal ligament into the thigh. The internal iliac artery is the primary source of the blood supply to the pelvis and perineum.

The inferior mesenteric artery and abdominal aorta also provide some blood directly. The IMA supplies blood to the superior rectum via the superior rectal artery and the aorta supplies blood to the gonadal tissues via the gonadal arteries.

- a. External iliac artery: continues on to become the femoral artery; gives off the inferior epigastric artery which supplies the lower abdomen.
- b. Internal iliac artery: *It is important to note that the distribution of the branches of the internal iliac is irregular and shows large variation between individuals. The pattern presented below must therefore be considered as one example of a variety of possibilities.*
 - Posterior internal iliac branches: supply the pelvic wall and gluteal region:
 - i. Iliolumbar artery
 - ii. Lateral sacral artery
 - iii. Superior gluteal artery
 - iv. Inferior gluteal artery
 - Anterior internal iliac branches: supply viscera and obturator artery

- i. Obturator artery: supplies the medial thigh; leaves the pelvis by accompanying the obturator nerve through the obturator canal.
- ii. Umbilical artery
 - a. *Superior vesical artery* (comes from patent part of umbilical artery)
- iii. Inferior vesical artery
 - a. *Artery to ductus deferens* (may come off of the superior vesical artery)
- iv. Middle rectal artery: anastomoses with superior and inferior rectal arteries
- v. Internal pudendal artery: courses with pudendal nerve through the greater sciatic foramen to enter perineum through lesser sciatic foramen. It has three branches:
 - a. *Inferior rectal artery*
 - b. *Perineal artery*
 - c. *Dorsal artery of the penis/clitoris*
- vi. Uterine artery
 - a. *Vaginal artery*

B. Venous drainage

The venous drainage parallels the arterial blood supply. The internal iliac veins empty in the IVC. The right ovarian vein drains into the IVC while the left drains into the renal vein. The superior rectal vein drains into the inferior mesenteric vein, which in turn drains into the portal system. Anastomoses formed between the superior and middle/inferior rectal veins provide a portal-caval shunt. The venous channels of this rectal plexus become dilated to form hemorrhoids.

C. Lymph drainage

Lymphatic drainage of the pelvis generally follows venous drainage; therefore most of the pelvic cavity drains into the internal iliac nodes. The ovaries drain into the abdominal para-aortic nodes just as their veins drain into the IVC/renal vein. Perineum lymphatic drainage is to the superficial inguinal nodes, except for the superior rectal drainage, which goes to inferior mesenteric, following its venous drainage.

Objective 5

Follow the course taken by an ovum through the female reproductive tract or the pathway taken by a spermatozoon through the male reproductive tract. Identify the location, anatomical relations and function of accessory glands in the male and female reproductive tracts.

A. Pathway of Spermatozoon:

Sperm are made in the testes and stored in the epididymis, which lies on the side of the testes. The sperm enter the ductus deferens (or vas deferens), which proceeds through the inguinal canal, across the pelvic rim, over the ureter, and behind the bladder. This is all infraperitoneal. The distal end of the ductus deferens is a palpable swelling called the ampulla (significance unknown). Just next to the ampulla is the seminal gland (or seminal vesicle). The ampulla and the seminal gland are tightly connected, and they share a duct, called the ejaculatory duct. The ejaculatory duct connects the ampulla and the seminal vesicle to the prostatic urethra. The prostate is a big gland (the size of a chestnut) and lies around the base of the bladder. The urethra goes through the prostate and is termed the prostatic urethra. It is then joined by the ejaculatory duct and the prostatic utricle (or the male uterus), which has no known function. Once the fluids have been added to the sperm by the prostate, the seminal vesicle and maybe even the ampulla, the sperm leave the prostatic urethra and go through the membranous [or intermediate] urethra (which goes through the perineal membrane). It then enters the bulb of the penis and is joined by the secretions of the bulbourethral glands. The penile urethra then proceeds through the corpus spongiosum of the penis to the glans penis where the slit-like opening of the external urethral orifice allows fluid to exit.

B. Pathway of Ovum:

The ovaries lie slightly behind the uterus. Once a month, an ovum is extruded through the wall of the ovaries and through the peritoneum that covers it, into the peritoneal cavity. The cell finds its way into the uterine tube via the fimbria (beating cilia-like structures that contain adhesion cells) and if fertilization takes place, it does so in the uterine tube. Via peristalsis, the ovum moves through the uterine tube and the fertilized egg implants in the body of the uterus. If the ovum remains unfertilized, it passes through the body of the uterus, the cervix and the vagina to be released with menstrual fluid. In the female, there are three sets of glands. The *paraurethral glands* correspond to the prostate and open into the vestibule via small ducts on either side of the external urethral orifice. The *greater vestibular glands* are on each side of the vestibule, posterolateral to the vaginal orifice. They are both enclosed by the bulbospongiosus muscle and they secrete mucus into the vestibule during sexual arousal. The *lesser vestibular glands* are smaller glands on each side of the vestibule that open into it between the urethral and vaginal orifices. They secrete mucus into the vestibule, which moistens the labia and vestibule.

Objective 6)

Identify the innervation of the bladder and its sphincters. Identify the openings of the ureters and urethra in the bladder wall. Describe the location and anatomical relations of the internal and external urethral sphincters. Identify the rectum and anus and the anal sphincters and their innervation.

Ureteric orifices and internal urethral orifice at angles of the trigone of bladder. Ureters pass obliquely through bladder wall in an inferomedial direction. Increase in bladder pressure presses the walls of the ureters together, thereby closing the ureters and preventing urine from being forced up the ureters towards the kidneys when pressure is high in the bladder.

Internal urethral sphincter: only in *male*; involuntary muscle controlling the internal urethral orifice.

Innervation of bladder and internal sphincter:

Vesical nerve plexus, which is continuous with the inferior hypogastric plexus, contains both parasympathetic (pelvic splanchnic nerves) and sympathetic nerve fibers (from T11 through L2) and innervates the bladder.

Parasympathetic pelvic splanchnic nerves provide motor innervation to the detrusor muscle of the bladder wall and inhibit the male internal urethral sphincter (ie. Cause sphincter to relax).

Visceral sensory fibers in bladder transmit pain sensations such as overdistention.

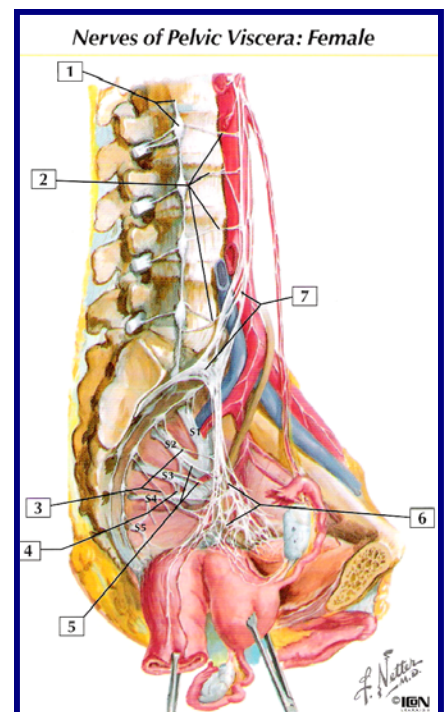
When visceral afferent fibers are stimulated by stretching, the bladder contracts, and the internal sphincter relaxes (for *males*), and urine flows into the urethra. This reflex can be repressed.

External urethral sphincter originates from inferior pubic ramus and ischial tuberosity. Surrounds urethra, and in females the vagina as well. Innervated by deep branch of perineal nerve, from the pudendal nerve. Compresses urethra (as well as vagina for females).

Males: External urethral sphincter surrounds intermediate part of urethra, posterior to prostate.

Females: external urethral sphincter starts at neck of bladder and has another part that encircles both the vagina and urethra

External urethral orifice:



Males: external urethral orifice at tip of glans penis

Females: external urethral orifice posteroinferior to the glans clitoridis and anterior to the vaginal orifice; located in the vestibule

Anal sphincters and innervation:

Internal and external anal sphincters surround anal canal. Both sphincters must relax before defecation can occur.

Internal anal sphincter: involuntary sphincter surrounding superior two thirds of anal canal. Thickening of circular muscle layer of the intestine. Innervated by sympathetic system, which causes contraction. Inhibited and allowed to passively expand via the parasympathetic system. Relaxes in response to pressure of feces or gas distending rectal ampulla. Puborectalis and external anal sphincter must be voluntarily contracted to prevent defecation

External anal sphincter: large voluntary sphincter that forms a broad band on each side of inferior two-thirds of anal canal. Blends superiorly with the puborectalis muscle.

Innervated by S4 via the inferior anal (rectal) nerve, which comes from the pudendal nerve.

