UNIT #2 - ABDOMEN, PELVIS AND PERINEUM
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Reading
Gray’s Anatomy for Students (GAFS), Chapters 4-5
Gray’s Dissection Guide for Human Anatomy (GDGHA), Labs 10-17

Unit #2 - Abdomen, Pelvis, and Perineum
G08- Overview of the Abdomen and Anterior Abdominal Wall (Dr. Albertine)
G09A- Peritoneum, GI System Overview and Foregut (Dr. Albertine)
G09B- Arteries, Veins, and Lymphatics of the GI System (Dr. Albertine)
G10A- Midgut and Hindgut (Dr. Albertine)
G10B- Innervation of the GI Tract and Osteology of the Pelvis (Dr. Albertine)
G11- Posterior Abdominal Wall (Dr. Albertine)
G12- Gluteal Region, Perineum Related to the Ischioanal Fossa (Dr. Albertine)
G13- Urogenital Triangle (Dr. Albertine)
G14A- Female Reproductive System (Dr. Albertine)
G14B- Male Reproductive System (Dr. Albertine)
G08: Overview of the Abdomen and Anterior Abdominal Wall
(Dr. Albertine)

At the end of this lecture, students should be able to master the following:

1) Overview
   a) Identify the functions of the anterior abdominal wall
   b) Describe the boundaries of the anterior abdominal wall

2) Surface Anatomy
   a) Locate and describe the following surface landmarks: xiphoid process, costal margin, 9th costal cartilage, iliac crest, pubic tubercle, umbilicus
3) Planes and Divisions
   a) Identify and describe the following planes of the abdomen: transpyloric, transumbilical, subcostal, transtubercular, and midclavicular

   b) Describe the 9 zones created by the subcostal, transtubercular, and midclavicular planes
   c) Describe the 4 quadrants created by the midline and transumbilical planes and describe their clinical utility
   d) Identify the vertebral levels associated with the following landmarks: xiphoid process, transpyloric plane, subcostal plane, umbilicus, and iliac crest
4) **Structure of the Anterior Abdominal Wall**
   a) Identify and describe the layers of the anterior abdominal wall from superficial to deep (skin, Camper’s fascia, Scarpa’s fascia, deep investing fascia, abdominal muscles, transversalis fascia, extraperitoneal fascia, parietal peritoneum)

![Diagram of the Anterior Abdominal Wall](image1)

5) **Vasculature**
   a) Describe the arterial and venous collateral circuitry of the anterior abdominal wall (superior epigastric, inferior epigastric, deep circumflex iliac, superficial circumflex iliac, superficial epigastric arteries and veins)
   b) Describe the lymphatic drainage of the anterior abdominal wall (superficial and deep)

![Diagram of the Vasculature](image2)
6) Innervation
a) Understand the segmental innervation of the anterior abdominal skin and musculature
   - The navel dermatome is T10 (belly but”ten”)
b) Describe the cutaneous and muscular distribution of the following nerves: lower five intercostal, subcostal (T12), iliohypogastric (L1) and ilioinguinal (L2) nerves
7) Anterior Abdominal Muscles  
a) Identify and describe the general attachments, main function, and innervation of the following muscles: external oblique, internal oblique, transversus abdominis, rectus abdominis, and pyramidalis (See table)  
b) Describe the linea alba, arcuate line, and semilunar line
c) Contrast differences in the rectus sheath above and below the arcuate line

d) Identify and describe the components of the walls of the inguinal canal (anterior wall, posterior wall, roof, and floor)
e) Describe the locations of the deep and superficial inguinal rings
f) Compare and contrast the contents of the male and female inguinal canals
g) Describe relation of direct and indirect hernias to the inguinal canal
8) Internal Anatomy
a) Identify and describe the following ligaments: median umbilical, medial umbilical, and lateral umbilical ligaments
At the end of this lecture, students should be able to master the following:

1) Peritoneum
   a) Define the peritoneum
   b) Differentiate visceral and parietal peritoneum
   c) Describe the difference between intraperitoneal and retroperitoneal organs
   d) Describe the location and embryonic origin of the following peritoneal structures: lesser omentum, greater omentum, transverse mesocolon, and gastrosplenic ligament
   e) Describe the following peritoneal spaces: lesser sac, greater sac, epiploic foramen, and retroperitoneal space
   f) Describe the general vascularization of the peritoneum
   g) Describe the general innervation of the peritoneum
h) Describe the process of embryonic gut rotation

Rotation of the Embryonic Gut

1. [Diagram showing embryonic gut rotation at 42 days]

2. [Diagram showing embryonic gut rotation at 50 days]

3. [Diagram showing embryonic gut rotation at 70 days]

4. [Diagram showing embryonic gut rotation at 73 days]

5. [Diagram showing embryonic gut rotation at 77 days]
2) Gastrointestinal (GI) System Overview

a) Describe the general location, function, and relationships among the following structures: esophagus, stomach, small intestine, large intestine, spleen, pancreas, liver, and gall bladder

b) Identify the principal arterial supply to and venous drainage from the foregut, midgut, and hindgut
3) Foregut
   a) Describe the parts and anatomical relations of the following foregut organs: esophagus, stomach, duodenum, spleen, pancreas, liver, and gall bladder
At the end of this lecture, students should be able to master the following:

1) Regional Vascularization
   a) Arteries of the GI System

   ii) Describe the specific arterial supply to the midgut (Superior mesenteric artery)
iii) Describe the specific arterial supply to the hindgut (Inferior mesenteric artery)

iv) Describe the inferior mesenteric arterial anastomoses with systemic arteries
b) Veins of the GI System
   i) Describe the specific venous drainage of the foregut (Splenic vein and tributaries)
   ii) Describe the specific venous drainage of the midgut (Superior mesenteric vein)
   iii) Describe the specific venous drainage of the hindgut (Inferior mesenteric vein)
2) Portal Venous System
   a) Describe the three veins that combine to form the hepatic portal vein (splenic, superior mesenteric, inferior mesenteric veins)

   ![Portal Venous System Diagram]

   - SMV - Superior mesenteric v.
   - IMV - Inferior mesenteric v.

   b) Describe the main portal-caval anastamoses
      i) Distal end of the esophagus
      ii) Rectum/Anus
      iii) Umbilicus

   ![Portal-caval Anastomoses Diagram]
3) Lymphatic Drainage
   a) Explain the rule in predicting lymph flow in the abdomen
   b) Trace the postnodal lymph flow from the cysterna chyli to its return to the venous blood

Lymphatics surrounding the Large Intestine

Azygos system of veins and thoracic duct
G10A: Midgut and Hindgut (Dr. Albertine)

At the end of this lecture, students should be able to master the following:

1) Midgut
   a) Describe the parts and anatomical relations of the following midgut organs: duodenum, jejunum, ileum, cecum, vermiform appendix, and colon (to the splenic flexure)
   
   b) Describe the structural differences between the jejunum and ileum
2) Hindgut
a) Describe the parts and anatomical relations of the following hindgut organs: colon (splenic flexure and beyond), rectum, and anal canal
G10B: Autonomic Innervation of the GI Tract (Dr. Albertine)

At the end of this lecture, students should be able to master the following:

1) Functions of the autonomic nervous supply to the abdominal viscera
   a) Gastrointestinal tract
      i) Sympathetic: decreases motility and absorption; decreases contraction of the circular and longitudinal muscle fibers; contraction of sphincter muscles; and decreased glandular secretions
      ii) Parasympathetic: increases motility and absorption; contraction and relaxation (peristalsis) of longitudinal and circular muscle fibers; relaxation in sphincter muscles; and increased glandular secretions
   b) Pancreas
      i) Sympathetic: decreased secretion of both insulin and digestive enzymes
      ii) Parasympathetic: increased secretion of insulin and digestive enzymes
   c) Liver
      i) Sympathetic: increased glycogenolysis/gluconeogenesis
      ii) Parasympathetic: increased metabolism and secretions
   d) Spleen
      i) Sympathetic: contraction of capsule

2) Overview of the autonomic innervation of the GI tract
   a) CNS origin
      i) Sympathetics - T5-L2
      ii) Parasympathetics – CN X and S2-S4
   b) Splanchnics – transport autonomic fibers from the sympathetic trunk (sympathetics) or spinal nerves (parasympathetics) to the prevertebral plexus
      i) Sympathetic splanchnic nerves
         (1) Greater splanchnic – carry sympathetics from the T5-T9 level of the spinal cord to the prevertebral plexus (celiac and superior mesenteric)
         (2) Lesser splanchnic – carry sympathetics from the T10-T11 level of the spinal cord to the pervertebral plexus (celiac and superior mesenteric)
         (3) Least splanchnic- carry sympathetics from the T12 level of the spinal cord to the prevertebral plexus (aorticorenal and inferior mesenteric)
         (4) Lumbar splanchnic- carry sympathetics from L1-2 level of the spinal cord to the prevertebral plexus (inferior mesenteric and inferior hypogastric)
      ii) Parasympathetic splanchnic nerves
         (1) Sacral splanchnic – transports parasympathetic fibers from the S2-S4 spinal nerves to the prevertebral plexus (inferior hypogastric plexus)
c) Prevertebral plexus- serves as a common pathway for both sympathetics and parasympathetics to travel to the end-organ

i) Celiac plexus and celiac ganglia
   (1) Hepatic plexus to liver and gall bladder
   (2) Gastric plexus to stomach
   (3) Splenic plexus to spleen
   (4) Pancreatic plexus to pancreas and proximal portion of the duodenum

ii) Superior mesenteric plexus and superior mesenteric ganglia
   (1) To head of the pancreas, distal duodenum, jejunum, ileum, cecum, ascending colon, and transverse colon

iii) Aorticorenal plexus and aorticorenal ganglia
   (1) Ureteral plexus to the suprarenal gland, kidney, and proximal ureter

iv) Inferior mesenteric plexus and inferior mesenteric ganglia
   (1) Superior rectal plexus to the descending colon, sigmoid colon, and upper portion of rectum

v) Inferior hypogastric plexus and pelvic ganglia
   (1) Middle rectal plexus to middle portion of the rectum
   (2) Inferior rectal plexus to the
d) Trace the sympathetic and parasympathetic pathways to the following regions of the GI tract, include specific levels of origin, location of motor-motor synapse, and all preganglionic and postganglionic nerves traveled

i) Foregut (symp. T5-T9 via greater splanchnic n.) (para. CN X)
ii) Pancreas (symp. T6-T9 via greater splanchnic n.) (para. CN X)
iii) Liver (symp. T6-T9 via greater splanchnic n.)
iv) Spleen (symp. T6-T8 via greater splanchnic n.)
v) Midgut (symp. T9-T11 via lesser splanchnic n.) (para. CN X)
vi) Hindgut (symp. L1-L2 via lumbar splanchnic nn.) (para. S2-S4 via sacral splanchnics)
3) Enteric System
   a) Describe the relationship between the enteric system and the sympathetic and parasympathetic systems
   b) Describe the role of the enteric system in the following functions
      i) Gastric secretions
      ii) Gastrointestinal blood flow
      iii) Peristalsis
   c) Describe the location and nerve fiber contents of the following components of the enteric system:
      i) Myenteric plexus
      ii) Submucosal plexus
At the end of this lecture, students should be able to master the following:

1) Posterior Abdominal Muscles
   a) Describe the specific attachments and actions of the following muscles: iliacus, quadratus lumborum, psoas major, and psoas minor muscles
   
   b) Describe the pathway through the diaphragm of the following structures: esophagus, aorta, and inferior vena cava
   
   c) Describe the median, medial, and lateral ligaments of the diaphragm
2) Nerves

a) Describe the pathway and general distribution of the following nerves: subcostal, iliohypogastric, ilioinguinal, lateral femoral cutaneous, femoral, genitofemoral, and lumbosacral trunk nerves

b) Describe the origin and synapse site of the lower thoracic and lumbar sympathetic splanchnic nerves
c) Describe the origin and synapse site of the vagus and sacral parasympathetic nerves
3) Vasculature and Lymphatics
   a) Describe the course of the aorta through the abdomen
   b) Describe the course, distribution, and vertebral level of the branches of the abdominal aorta in descending order

   c) Describe the course of the inferior vena cava through the abdomen
   d) Describe the differences in the branches of the abdominal aorta and inferior vena cava
e) Trace lymph flow from the aortic and preaortic lymph nodes to its return to venous blood
4) Suprarenal Glands
a) Describe the location of the suprarenal glands
b) Describe the differences in embryonic origin and function of the cortex and medulla
c) Identify the three arterial sources to and two venous routes from the suprarenal glands
d) Describe the sympathetic innervation of the suprarenal glands (greater, lesser, and least splanchnic nerves)

5) Kidneys
a) Describe the locations of the right and left kidneys
b) Identify the right and left surface projections of the kidneys
c) Describe the relations of the right kidney to the following structures: suprarenal gland, liver, 2nd part of the duodenum, right colic flexure, 12th rib, diaphragm, psoas, quadratus lumborum, and transversus abdominis
d) Describe the relations of the left kidney to the following structures: suprarenal gland, stomach, spleen, pancreas, jejunum, descending colon, 11th and 12th ribs, diaphragm, psoas, quadratus lumborum, and transversus abdominis
e) Describe the autonomic innervation of the kidney
i) Sympathetic
(1) Preganglionic neurons
   (a) Greater, lesser, and least splanchnic nerves
   (b) Aorticorenal ganglia (motor-motor synapse)
(2) Postganglionic neurons
   (a) Renal plexus to kidney
ii) Parasympathetic
(1) Preganglionic neurons
   (a) Posterior vagal trunk
   (b) Pelvic splanchnic nerves (S2-4)
   (c) Renal plexus
   (d) Wall of organ (motor-motor synapse)
6) Ureters
   a) Describe the pathway of the ureters through the abdomen and pelvis
   b) Describe the differences in the relations of the right and left ureters
   c) Describe the autonomic innervation of the ureters
      i) Sympathetic
         (1) Preganglionic neurons
            (a) Greater, lesser, and least splanchnic nerves
            (b) Aorticorenal ganglia (motor-motor synapse)
         (2) Postganglionic neurons
            (a) Renal plexus to ureter
      ii) Parasympathetic
         (1) Preganglionic neurons
            (a) Posterior vagal trunk
            (b) Pelvic splanchnic nerves (S2-4)
            (c) Renal plexus (variable)
            (d) Wall of organ (motor-motor synapse)

7) Bladder
   a) Describe the features of the four regions of the bladder (apex, base, neck, and inferior surface)
   b) Contrast the differences between the male and female bladder
   c) Describe the vascularization of the bladder
d) Describe the source and function of sympathetic innervation of the bladder
   i) Preganglionic neurons
      (1) Lumbar splanchnic nerves
      (2) Inferior mesenteric ganglion (motor-motor synapse)
   ii) Postganglionic neurons
      (1) Superior hypogastric plexus
      (2) Inferior hypogastric plexus
      (3) Vesicle plexus to bladder

e) Describe the source and function of parasympathetic innervation of the bladder
   i) Preganglionic neurons
      (1) Pelvic splanchnic nerves
      (2) Inferior hypogastric plexus
At the end of this lecture, students should be able to master the following:

1) Gluteal Region

2) Perineum
   a) Describe the location of the perineum
3) Ischioanal Triangle
a) Identify the boundaries of the ischioanal triangle (lateral, posterior, anterior, superior, and inferior)
b) Describe the contents of the ischioanal triangle (levator ani, ischioanal fat pad, pudendal canal, pudendal neurovascular bundle, anococcygeal body, rectum, and anus)
c) Describe the vascular supply of the ischioanal fossa (Internal pudendal artery and its branches)

d) Describe the differences in the male and female perineal bodies
G13: Urogenital Triangle (Dr. Albertine)

At the end of this lecture, students should be able to master the following:

1) Overview
   a) Identify the boundaries of the urogenital triangle

b) Compare and contrast the vascularization between the male and female urogenital triangles
c) Describe the innervation of the urogenital triangle

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Innervation of the female perineum
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2) Deep Perineal Space
   a) Identify the boundaries of the deep perineal space
   b) Compare and contrast contents between the male and female deep perineal spaces
3) **Superficial Perineal Space**
   a) Identify the boundaries of the superficial perineal space
   b) Compare and contrast contents between the male and female superficial perineal spaces
G14A: Female Reproductive System (Dr. Albertine)

At the end of this lecture, students should be able to master the following:

1) General
   a) Describe the general location and function of the ovaries, uterine tubes, uterus, vagina, clitoris, bulb of the vestibule, greater vestibular glands, paraurethral glands, labia minora, and labia majora

2) Ovaries
   a) Describe the location and anatomical contents of the following ovarian and uterine ligaments
      i) Mesovarium
      ii) Broad ligament
         (1) Mesosalpinx
         (2) Suspensory ligament of the ovary
         (3) Ligament of the ovary
   b) Describe the vascularization of the ovary (ovarian artery, ovarian venous plexus, ovarian vein)
   c) Describe the autonomic innervation of the ovary
      i) Sympathetic innervation
         (1) Preganglionic neurons
            (a) Lesser, and least splanchnic nerves
            (b) Superior mesenteric ganglion or renal ganglia (motor-motor synapse)
         (2) Postganglionic neurons
            (a) Superior mesenteric plexus or renal plexus
            (b) Ovarian plexus to ovary
3) **Uterine Tubes and Uterus**

a) Describe the following parts of the uterine tube
   i) Isthmus  
   ii) Ampulla  
   iii) Infundibulum  
   iv) Ostium  
   v) Fimbriae

b) Describe the relation of the uterine tubes to the ovaries and broad ligament

c) Describe the relation of the uterus to the bladder, rectum, small intestines, ovaries, and vagina

d) Describe the following components of the uterus
   i) Fundus  
   ii) Body (uterine cavity)  
   iii) Cervix (internal os, external os, cervical canal)
e) Describe the muscular (pubococcygeus muscle) and ligamentous (perineal body, pubocervical ligament, cardinal ligament, uterosacral ligament, and round ligament) support of the uterus.

f) Describe what a physician sees when looking through a speculum during a pelvic exam (cervical exam).

g) Describe the vascularization of the uterus and uterine tubes (internal iliac artery, uterine artery to uterus, tubal branch of uterine artery to uterine tubes, and corresponding veins).

i) Describe the relation between the uterine artery and the ureter.
h) Describe the autonomic innervation of the uterus
   i) Sympathetic
      (1) Preganglionic neurons
         (a) Lesser, least, and lumbar splanchnic nerves (T10-L2)
         (b) Superior mesenteric ganglion (motor-motor synapse)
      (2) Postganglionic neurons
         (a) Superior mesenteric plexus
         (b) Inferior mesenteric plexus
         (c) Superior hypogastric plexus
         (d) Inferior hypogastric plexus
         (e) Uterovaginal plexus
   ii) Parasympathetic
      (1) Preganglionic neurons (S2-4)
         (a) Pelvic splanchnic nerves
         (b) Inferior hypogastric plexus
         (c) Uterovaginal plexus
         (d) Organ wall (motor-motor synapse)

4) Vagina
   a) Describe the relation of the vagina to the cervix, urethra, pelvic floor, and vestibule
   b) Describe the following parts of the vagina: introitus, vaginal vault, vaginal rugae, vaginal fornix
   c) Describe the differences in the upper and lower parts of the vaginal wall
   d) Describe the vascularization of the vagina (internal iliac artery, uterine artery, vaginal branches, and corresponding veins)
      i) Describe the anastamoses among the ovarian, uterine, and vaginal arteries
   e) Describe the innervation to the upper and lower parts of the vagina
      i) Upper part- parasympathetic from S2-4
         (1) S2-4 spinal nerves
         (2) Pelvic splanchnic nerves
         (3) Inferior hypogastric plexus
         (4) Uterovaginal plexus
      ii) Lower part- somatic
         (1) Pudendal nerve
5) Clitoris
a) Describe the structure of the clitoris
   i) Corpora cavernosa
      (1) Root
         (a) Ischiocavernosus muscle
      (2) Body
   ii) Corpus spongiosum
      (1) Glans clitoris
   iii) Prepuce of the clitoris
b) Describe the suspensory ligament of the clitoris
c) Describe the autonomic innervation of the clitoris
   i) Sympathetic
      (1) Preganglionic neurons (from L1-2)
         (a) Sacral splanchnic nerves
         (b) Inferior hypogastric plexus (motor-motor synapse)
      (2) Postganglionic neurons
         (a) Uterovaginal plexus
         (b) Cavernous nerves to clitoris
   ii) Parasympathetic
      (1) Preganglionic neurons (S2-4)
         (a) Pelvic splanchnic nerves
         (b) Inferior hypogastric plexus
         (c) Uterovaginal plexus
         (d) Cavernous nerves
         (e) Organ wall (motor-motor synapse)
b) Describe the vascularization of the clitoris (internal iliac artery, internal pudendal artery, deep and dorsal clitoral arteries, and corresponding veins)

6) Bulb of the Vestibule, Greater Vestibular Glands, and Paraurethral Glands
   a) Describe the location and composition of the bulb of the vestibule
      i) Corpus spongiosum
         (1) Bulbospongiosus muscle
   b) Describe the location and function of the greater vestibular glands
   c) Describe the location of the paraurethral glands
7) Vulva
a) Describe the location of the labia majora and their relation to the labia minora and mons pubis
b) Describe the location labia minora and their relation to the clitoris, vestibule, and bulb of the vestibule
c) Describe the following components of the vestibule
   i) Urethral opening
      (1) Opening of ducts of paraurethral glands
   ii) Vaginal opening
      (1) Opening of duct of greater vestibular gland
   iii) Hymen
d) Describe the cutaneous innervation of the vulva (pudendal nerve, S2-4)

8) Ovulation
a) Describe the pathway of an ovum from ovulation to implantation
   i) Ovary
   ii) Uterine tube (Ostium, infundibulum, ampulla, isthmus)
   iii) Uterus (endometrium of the uterine body)
G14B: Male Reproductive System (Dr. Albertine)

At the end of this lecture, students should be able to master the following:

1) General
   a) Describe the general location and function of the testis, epididymis, ductus deferens, seminal vesicle, ejaculatory duct, prostate gland, urethra and penis

2) Scrotum
   a) Identify the layers of the scrotum and their correlation to the layers of the abdominal wall
   b) Describe the cutaneous innervation of the scrotum (genitofemoral n., L1-L2)
   c) Explain how an inguinal hernia may affect scrotal nerves (genital branch of the genitofemoral nerve)

<table>
<thead>
<tr>
<th>Layers of Abdominal Wall</th>
<th>Corresponding Layers in the Scrotum</th>
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<tbody>
<tr>
<td>1. Skin</td>
<td>1. Skin</td>
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<tr>
<td>Superficial fascia</td>
<td></td>
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<tr>
<td>2. Fatty (Camper’s)</td>
<td>2. Disappears - no fat in scrotal wall</td>
</tr>
<tr>
<td>3. Membranous (Scarpa’s)</td>
<td>3. Dartos muscle and fascia</td>
</tr>
<tr>
<td>4. External oblique</td>
<td>4. External spermatic fascia</td>
</tr>
<tr>
<td>5. Internal oblique</td>
<td>5. Cremasteric muscle and fascia</td>
</tr>
<tr>
<td>6. Transversus abdominis</td>
<td>6. No contribution</td>
</tr>
<tr>
<td>7. Transversalis fascia</td>
<td>7. Internal spermatic fascia</td>
</tr>
<tr>
<td>8. Extraperitoneal fatty tissue</td>
<td>8. Areolar connective tissue</td>
</tr>
</tbody>
</table>
3) **Testis and Epididymis**
   a) Describe the site of production of spermatozoa
   b) Describe the vascularization of the testis (testicular artery and vein, pampiniform plexus of veins)
   c) Trace the sympathetic innervation of the testis
      i) Preganglionic neurons (Celiac ganglion (motor-motor synapse))
      ii) Postganglionic neurons (Testicular plexus to testis)
   d) Describe the function and regions of the epididymis (head, body, tail)

4) **Spermatic Cord**
   a) Describe the contents and the pathway of the following anatomical structures within the spermatic cord
      i) Ductus deferens (and the artery of the ductus)
      ii) Testicular artery and Pampiniform plexus of veins
      iii) Cremasteric muscle
      iv) Genital branch of the genitofemoral nerve (L1-L2)
      v) Autonomic fibers for testis and epididymis
      vi) Lymphatic vessels
5) Ductus Deferens  
   a) Describe the pathway of the ductus deferens relative to the inguinal canal, inferior epigastric artery, external iliac artery, ureters, seminal vesicle, and bladder  
   b) Describe the vascularization of the ductus deferens (internal iliac artery, umbilical artery, artery of the ductus, pampiniform plexus of veins, testicular vein)  
   c) Describe the sympathetic innervation of the ductus deferens  
      i) Preganglionic neurons (L1-2)  
         (1) Lumbar splanchnic nerves  
         (2) Inferior hypogastric plexus and pelvic ganglia (motor-motor synapse)  
      ii) Postganglionic neurons  
         (1) Deferential plexus to ductus deferens

6) Seminal Vesicles  
   a) Describe the location seminal vesicles and the function of their secretions  
   b) Describe the relationship among the ductus deferens, seminal vesicles, and the ejaculatory ducts

7) Prostate Gland and Ejaculatory duct  
   a) Describe the prostate’s relationship to the ejaculatory ducts, bladder, urethra, and rectum  
   b) Identify the five lobes of the prostate  
   c) Describe the function of the prostatic secretions  
   d) Describe the vascularization of the prostate (internal iliac artery, inferior vesicle artery, prostatic branches and venous plexus, vesicle venous plexus and veins)  
   e) Describe the autonomic innervation of the prostate  
      i) Sympathetic innervation  
         (1) Same as seminal vesicles  
      ii) Preganglionic neurons (S2-4)  
         (1) Pelvic splanchnic nerves  
         (2) Inferior hypogastric plexus  
         (3) Prostatic plexus  
         (4) Wall of organ (motor-motor synapse)  
   f) Describe the process of a digital prostate exam  
   g) Explain why men will commonly experience impotence after a prostatectomy
8) Urethra and Bulbourethral Glands
   a) Describe the three parts and pathway of the male urethra
      i) Prostatic
      ii) Membranous
      iii) Spongy
   b) Describe the location, innervation, and function of the urethral sphincters in urination and ejaculation
      i) Internal urethral sphincter
      ii) External urethral sphincter
   c) Describe the location and function of the bulbourethral glands

9) Penis
   a) Describe the structure of the penis
      i) Corpora cavernosa (Deep arteries of the penis)
      ii) Corpus spongiosum (Spongy urethra)
      iii) Root of the penis (Ischiocavernosus muscles)
      iv) Bulb of the penis (Bulbospongiosus muscle)
      v) Glans penis
      vi) Prepuce (foreskin)
   b) Describe the facial layers of the penis
      i) Superficial fascia
      ii) Deep (“Buck’s”) fascia
      iii) Tunica albuginea
   c) Describe the ligaments of the penis
      i) Suspensory and Fundiform ligaments of the penis
   d) Describe the vascularization of the penis
   e) Describe the sympathetic innervation of the penis from L1-2
      i) L1-2 spinal nerves - white rami communicantes - sympathetic trunk - sacral splanchnic nerves - inferior hypogastric plexus - prostatic plexus - cavernous nerves
   f) Describe the parasympathetic innervation of the penis from S2-4
      i) S2-4 spinal nerves - pelvic splanchnic nerves - inferior hypogastric plexus - prostatic plexus - cavernous nerves
   g) Explain the role of the parasympathetic nervous system (S2-S4) in erection
      i) Dilation of arterial supply to erectile tissues
   h) Explain the role of the sympathetic nervous system (L1-L2) in ejaculation and detumescence
      i) Contraction of smooth muscle within ductus deferens and accessory glands
      ii) Contraction of internal urethral sphincter
      iii) Contraction of smooth muscle within arteries, arresting blood flow to erectile tissues
   i) Explain the role of the pudendal nerve and the penis
10) Fertilization Pathway
Trace the ejaculation pathway: Seminiferous tubules - rete testis - straight tubules - efferent ductules of the testis - epididymis (head, body, tail) - ductus deferens - ejaculatory duct - prostatic urethra - membranous urethral - spongy urethra – urethral orifice

Homologs

<table>
<thead>
<tr>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testes</td>
<td>Ovaries</td>
</tr>
<tr>
<td>Corpora cavernosa of penis</td>
<td>Corpora cavernosa of clitoris</td>
</tr>
<tr>
<td>Corpus spongiosum of penis</td>
<td>Corpora spongiosum of clitoris and bulb of the vestibule</td>
</tr>
<tr>
<td>Bulbourethral glands</td>
<td>Greater vestibular glands</td>
</tr>
<tr>
<td>Prostate gland</td>
<td>Paraurethral glands</td>
</tr>
<tr>
<td>Scrotum</td>
<td>Labia majora</td>
</tr>
<tr>
<td>Spongy urethra</td>
<td>Labia minora</td>
</tr>
<tr>
<td>Prostatic utricle</td>
<td>Uterus</td>
</tr>
</tbody>
</table>