

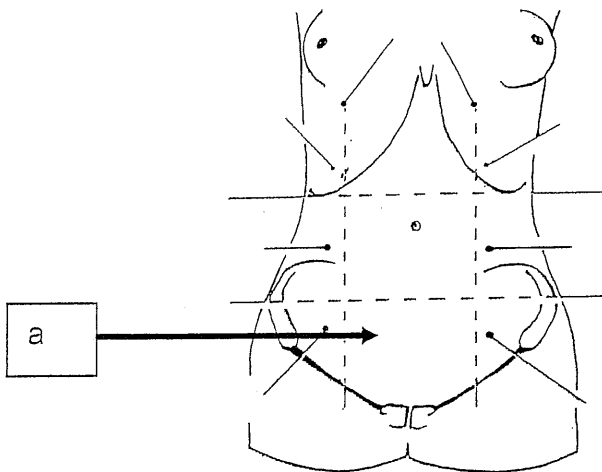
STRUCTURAL BASIS OF MEDICAL PRACTICE  
EXAMINATION 3

September 22, 2008

PART I. Answer in the space provided. (6 pts)

1. Identify the region. (0.5 pt)

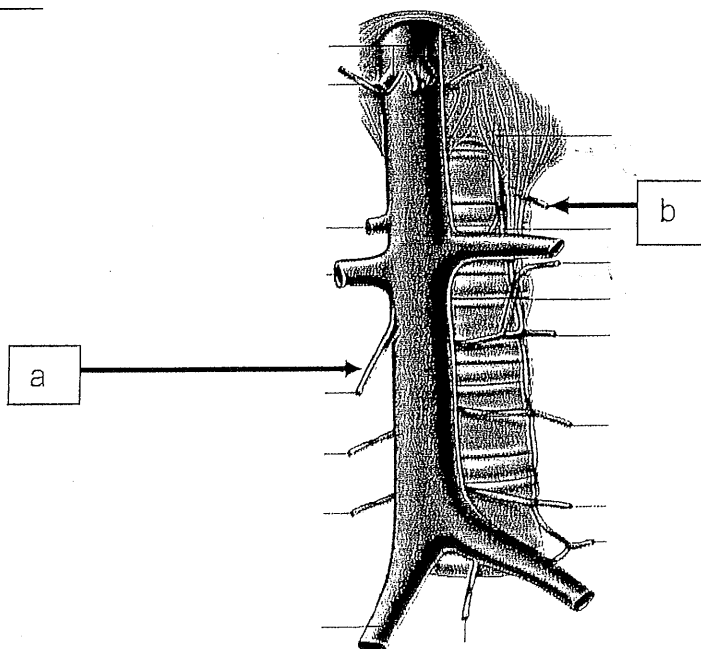
a. Hypogastric



2. Identify the veins. (1 pt)

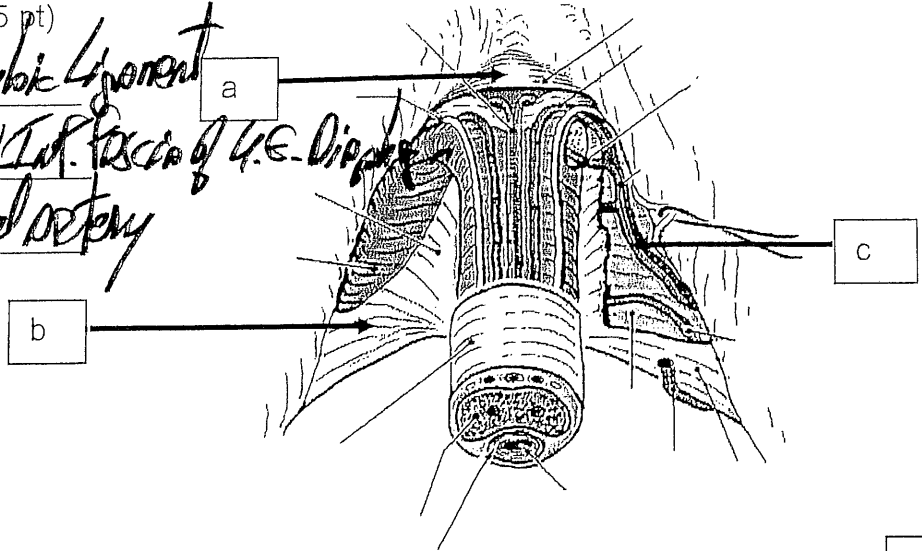
a. Right Gonadal

b. Subcostal



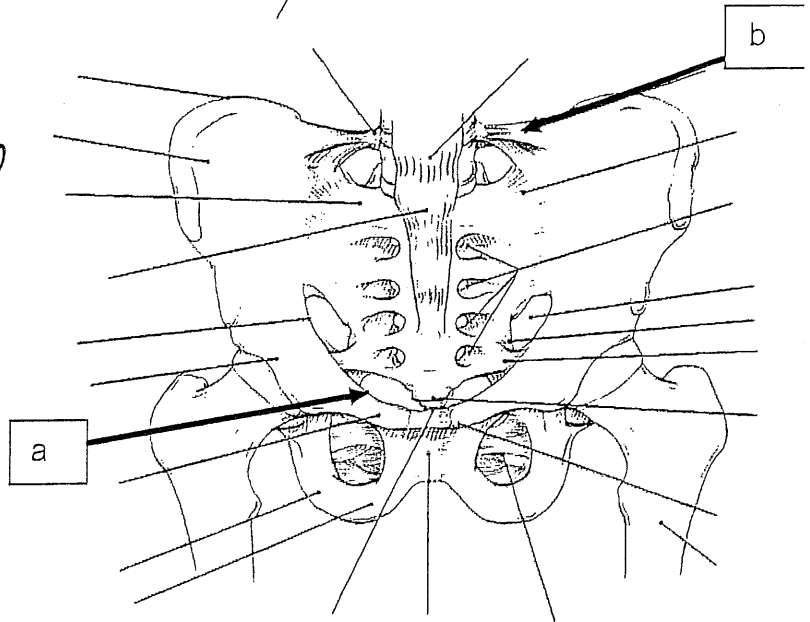
3. Identify the structures. (1.5 pt)

- a. Acetabulum / Inferior Pubic Ligament
- b. Peritoneal Membrane / Inf. fascia of U.S. Diaphragm
- c. Internal pubofemoral artery



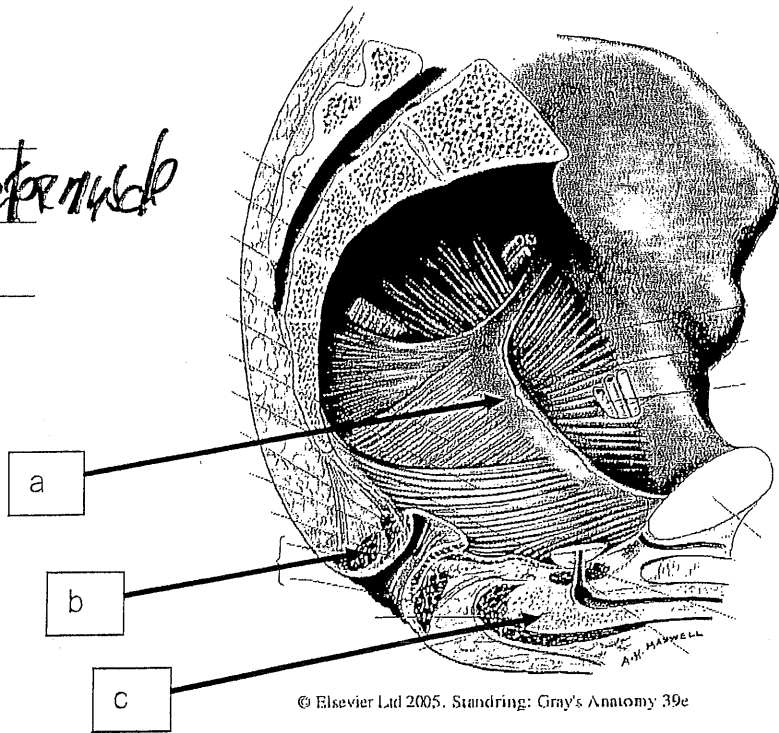
4. Identify the structures. (1 pt)

- a. Pecten pubis / pectineal line
- b. Iliolumbar ligament



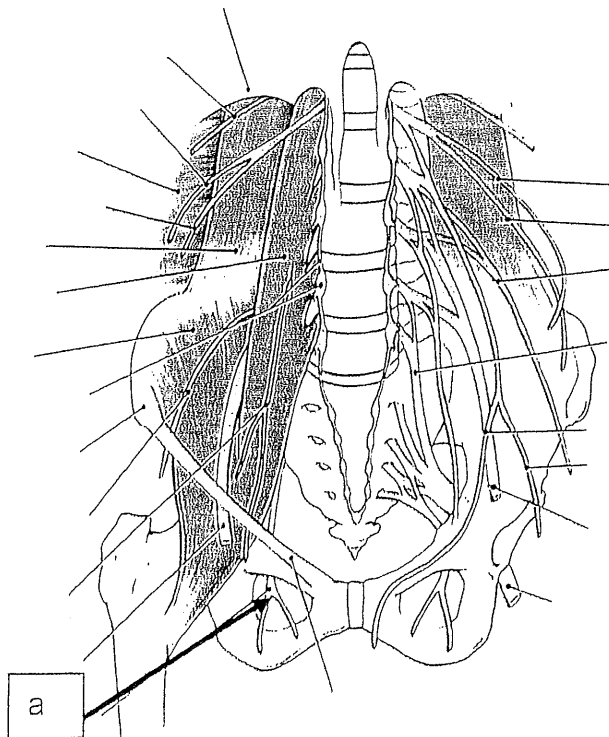
5. Identify the structures. (1.5 pts)

- a. Area tendinosa
- b. External anal sphincter muscle
- c. Bulb of penis



6. Identify the structure. (0.5 pt)

- a. Obturator foramen



## Part II. Circle the correct answer. All, none, or some may apply. (36 pts)

1. With respect to the inguinal region:

a. Direct inguinal hernias occur medial to the inferior epigastric artery and can descend into the scrotum where they are located between the parietal and visceral layers of the tunica vaginalis.

b. Inguinal hernias occur superior and lateral to the pubic tubercle.

c. The iliohypogastric nerve lies superior to the ilioinguinal nerve.

d. The transversus abdominis muscle has part of its origin from the lateral one-third of the inguinal ligament.

e. The deep inguinal ring refers to a finger-like diverticulum of the external spermatic fascia.

f. The cremaster artery arises from the umbilical artery.

g. The scrotal ligament is a remnant of the gubernaculum.

h. The testis is innervated in part by the vagal parasympathetic nervous system.

2. In regard to the abdominal vasculature and nerves:

a. The proper hepatic artery courses through the hepatoduodenal ligament.

b. The inferior mesenteric ganglia are located at the level of L3

c. The middle colic artery contributes blood to the marginal artery.

d. The first part of the duodenum lies inferior to the superior pancreaticoduodenal artery.

e. The dorsal pancreatic artery is located posterior to the tail of the pancreas.

f. The ileocolic artery is located in the mesentery.

g. The superior mesenteric vein crosses the 3rd part of the duodenum and the uncinate process of the pancreas.

h. The superior rectal artery is the continuation of the sigmoidal arteries to vascularize the rectum.

3. With respect to the liver, duodenum, and pancreas:

a. The anterior layers of the coronary ligament is a derivative of the ventral mesentery.

- b. According to internal morphology, the quadrate lobe and part of the caudate lobe belong to the right lobe of the liver.
  - c. The lesser omentum extends from the stomach and first part of the duodenum to the porta hepatis and fissure for the ligamentum teres.
  - d. The gastroduodenal artery, the common bile duct, and the portal vein lie anterior to the 1st part of the duodenum.
  - e. The transverse colon lies ventral to the 2nd part of the duodenum.
  - f. The root of the intestinal mesentery begins at the duodenojejunal flexure.
  - g. The accessory pancreatic duct is derived from the ventral pancreas.
  - h. Ileum comes from the Latin and means "empty", and jejunum means "twisted".
  - i. The superior mesenteric and splenic veins unite to form the portal vein posterior to the neck of the pancreas.
  - k. Part of the tail of the pancreas lies within the gastrolial ligament.
4. In regard to the kidneys, suprarenal glands, and abdominal nerves:
- a. The renal fascia is a derivative of the transversalis fascia.
  - b. Perirenal fat lies in the renal sinus.
  - c. The central vein of the right suprarenal gland drains into the inferior vena cava.
  - d. All but the inferior surface of the suprarenal glands are enclosed by renal fascia.
  - e. Parasympathetic innervation of the left colic flexure is by the vagal nerve.
  - f. The kidneys receive sympathetic nerve innervation by the lumbar splanchnic nerves.
  - g. The appendix is innervated by somatic nerves from spinal nerve T10.
  - h. Sympathetic trunk ganglia at L4 have gray but no white rami communicans.
  - i. The intermesenteric plexus receives contributions from the pelvic splanchnic nerves.
  - j. Both the lumbar splanchnic and pelvic splanchnic nerves contain pre-ganglionic nerve fibers.

5. With respect to the perineum:

- a. The deep transverse perineus muscle lies anterior (inferior) to the superior fascia of the U.G. diaphragm.
- b. The bulbourethral glands in the male are homologous to the greater vestibular glands in the female and both glands reside in the superficial pouch/space.
- c. The perineal membrane (inferior fascia of the U.G. diaphragm) is parietal pelvic fascia.
- d. The superior fascia of the pelvic diaphragm is a condensation of parietal visceral fascia.
- e. The ischiorectal fossa and superficial pouch are continuous at the posterior border of the U.G. diaphragm.
- f. Scarpa's fascia is a specialization of the tela subcutanea in the ischiorectal fossa.
- g. The membranous urethra of the female is in the deep pouch/space.
- h. The deep dorsal vein of the penis lies deep to Buck's fascia on the dorsal surface of the corpora cavernosa penis.
- i. The fusion of the superior and inferior fascia of the U.G. diaphragm at the anterior margin of the U.G. diaphragm is the transverse perineal ligament.
- j. Extravasation of urine into the superficial pouch by damage of the spongy urethra can course into the anterior recess of the ischiorectal fossa.

6. With respect to the pelvic anatomy:

- a. The levator ani consists of the puborectalis, ischiococcygeus, and iliococcygeus muscles.
- b. The iliococcygeus muscle forms the "puborectal sling".
- c. The iliac fossa is part of the false/greater pelvis.
- d. The male (true) pelvis has an "inlet" that is "heart-shaped".
- e. In weight distribution involving the pelvis, weight passes from the 5th lumbar vertebrae to the base of the sacrum, and then to the sacrotuberous joint.
- f. The posterior fascial wall of the prostate gland is termed the "Fascia of Denonvillier's" which is derived from the pelvic visceral fascia.
- g. The seminal colliculus is medial to the utricle.

h. The lower third of the rectum is devoid of peritoneum.

i. There are 2 left transverse rectal folds but only 1 right transverse fold.

j. The anal canal lies above (superior) to the pelvic diaphragm.

k. The middle rectal artery drains into the internal iliac artery.

l. Hemorrhoids below the pectinate line involve the superficial inguinal lymph nodes and have somatic nerve innervation.

7. In regard to the pelvic nerves and vessels:

a. The iliacus muscle is innervated by the obturator nerve.

b. An autonomous/neurogenic bladder results when spinal cord transection occurs superior to S2-4.

c. Defecation involves reflex arcs of the parasympathetic and vagal sympathetic nerves.

d. The "nervi erigentes" refers to the pelvic splanchnic nerves (S2-4).

e. The pelvic splanchnic nerves are responsible for parasympathetic innervation of the descending colon, and synapse in the inferior hypogastric ganglion.

f. The anterior scrotal nerves are part of the innervation of the scrotum and consist of the ilioinguinal and genitofemoral nerves.

g. The right and left sympathetic trunks converge inferiorly and terminate anterior to the coccyx in the ganglion impar.

h. The helicine arteries are stimulated to dilate by visceral afferent nerves of the parasympathetic nervous system.

8. "This and that":

a. The suspensory ligament of the penis is a continuation of the median septum of the membranous layer of the superficial fascia attached to the linea alba.

b. The inferior fascia of the thoracic diaphragm is provided by the transversalis fascia.

c. The thoracic duct passes from the abdomen to the thorax at the level of T12.

d. The greater splanchnic nerve pass from the thorax to the abdomen through the aortic hiatus.

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- e. The testicular arteries arise from the aorta inferior to the middle suprarenal arteries.
- f. The periphery of the diaphragm has motor innervation by the phrenic nerve.



## Written Exam #2 PART 3: 2008

- (4) 1. RENAL FASCIA:
- encloses both kidney's and its fatty capsule (perirenal fat)
    - anterior layer (of Gerota): runs with renal vessels becomes thin as it approaches and attaches to the aorta and IVC (great vessels), passes laterally and attaches to the posterior layer
    - posterior layer (of Zuckerandl): blends/fuses with fascia of the two/three muscles of the posterior abdominal wall (quadratus lumborum and psoas major/minor)
  - membranous condensation of extra/retroperitoneal connective tissue of the posterior abdominal wall (transversalis fascia)
  - separates perirenal fat from pararenal (general adipose) fat of the posterior abdominal wall
  - completely covers both kidneys and suprarenal (adrenal) gland and sometimes contributes to a septum between them
  - continuous communication at the midline at the 3<sup>rd</sup> to 5<sup>th</sup> lumbar levels
  - at the midline the anterior and posterior layers fuse superiorly and are attached to the crus of their respective hemidiaphragms
  - in >2/3 of clinical cases there may be a fibrous septa in the midline
  - the inferior border is open around the ureters and can spread an kidney infection to the pelvis through the paravertebral gutter (or a pelvic infection can spread to the kidneys)
- (3) 2. RIGHT PARACOLIC GUTTER:
- peritoneal recess on the posterior abdominal wall lateral to the ascending colon
  - right paracolic gutter runs from the superolateral aspect of the hepatic flexure of the colon, down the lateral aspect of the ascending colon and around the cecum
  - continuous, inferiorly, with the peritoneum as it descends into the pelvis over the pelvic brim (provides pathway for spread of intraperitoneal infections and can spread to the pelvis)
  - continuous, superiorly, with the peritoneum which lines the hepatorenal pouch and through the epiploic foramen, the lesser sac.
  - clinically important because bile, pus or blood could be released from viscera anywhere along it's length and be collected in sites away from the infected organ
  - within the infracolic compartment of the greater sac, also known as the paracolic sulci
  - visceral peritoneum on anterior lateral surfaces of the ascending colon are continuous with parietal peritoneum of the lateral side
  - left paracolic gutter is limited by the phrenicocolic ligament from the left colic flexure to the diaphragm
  - both paracolic gutters lead into the iliac fossa then into the pelvis
- (4) 3. PELVIC SPLANCHNIC NERVES:
- sacral parasympathetic outflow, also called NERVI ERIGENTES (nerves capable of causing erection of the penis and clitoris)

- division of the sacral plexus S2, S3 and S4
- major pathway for visceral afferents for most pelvic organs
- course forward and medially between the branches of the internal iliac vessels and the lamina of the pelvic fascia that contains them
- forms the inferior hypogastric plexus along with the right and left hypogastric nerves (sympathetic)
- cholinergic
  - visceral efferents: cell bodies in the intermediolateral cell column of S2 to S4 segments, PREGANGLIONIC, do not pass through the sacral sympathetic trunk ganglia and synapse either in ganglia within the inferior hypogastric plexus or within the walls of the viscera they innervate (i.e. muscle wall of bladder and the rectum)
  - visceral afferents: ascend through the posterior roots to the cell bodies in the spinal ganglia of S2 – S4 spinal nerves. Not only general visceral afferents but they also mediate sensation of pain from all pelvic organs (important because thoracic and abdominal pain generally follow a sympathetic pathway)

### **Perineal body (4 points)**

-Fibromuscular tissue with contributions from right and left superior and deep transverse perinei muscles, external anal sphincter, bulbospongiosus, levator ani, perineal raphe (males)/posterior commissure of labia majora (females)

-Located in the midline where urogenital and anal triangle come together

#### Relationships:

Anterior: Posterior labial commissure or perineal raphe

Posterior: External anal sphincter

Lateral: Superficial & deep transverse perinei muscles

Superior: Rectovaginal or rectoprostatic septum

Inferior: Tela subcutanea, skin

-Clinically, can be stretched or torn during childbirth; this may be avoided by posterolateral episiotomy.

## Answer Key – Exam 3 – Part IV

Indicate your understanding of the following:

### 1. Left renal vein (4 points)

- Drains left kidney, left suprarenal gland (via central vein), left testicle/ovary (via left testicular/ovarian vein)
- Empties into inferior vena cava
- Longer than right renal vein due to the fact that it crosses descending aorta, along with 3<sup>rd</sup> part of duodenum, inferior to the superior mesenteric artery (Nutcracker)
- Travels anterior to left renal artery, and empties into inferior vena cava superior to the level of the right renal vein

### 2. Medial umbilical ligament (3 points)

- Formed from obliterated umbilical arteries
- Throws parietal peritoneum into medial umbilical folds
- Flanked medially by suprapubic fossa, then median umbilical ligament & laterally by medial inguinal fossa, then inferior epigastric vessels
- Other relationships:
  - Superior: umbilicus
  - Anterior: transversalis fascia
  - Posterior: peritoneum
  - Inferiorly the medial umbilical ligament is continuous with the still patent umbilical artery as it gives rise to the superior vesicle arteries

## Abdomen, Pelvis, and Perineum - Written Examination September 22: Part V - Essay

\*Note: This is an outline of topics to be covered. It is not the "answer key." It is an answer guide. \*

### External Oblique Muscle

**Define the origin(s), insertion(s) and relationships of the external abdominal oblique muscle, including any aponeurotic/derivations/ligamentous terminations. Discuss the innervation, vasculature, and lymphatics of this muscle.**

- The external oblique is a digastric muscle having the linea alba as its central tendon. Each belly is quadrilateral in shape. It has superior attachments to the external surface of the ribs. Inferior attachments to the ilium and pubis. Anterior attachments to the rectus sheath and linea alba. The posterior aspect of the external oblique has a free border near the lateral extent of the thoracolumbar fascia.
- Origins
  - Anterior, lateral, and external surfaces of Ribs 5 - 12
  - Paired digastric muscle with linea alba as central tendon
- Insertions
  - Anterior and lateral iliac crest
  - Anterior superior iliac spine
  - Inguinal ligament - free edge of the aponeurosis
  - Pubic tubercle, crest, and symphysis
  - Pectin line by way of pectineal ligament
- Relationships
  - Continuous with external intercostals and forms outer muscle layer of anterior abdominal wall
  - Interdigitates with serratus anterior and with latissimus dorsi
  - Superficial to the internal oblique muscle
  - Deep to tela subcutanea, campers fascia, and Scarpa's fascia
  - Attachments of Scarpa's fascia define potential space, fundiform ligament
  - Inguinal ligament provides site of attachment for the internal oblique and for the transversus abdominis
- Derivations
  - Rectus sheath
    - anterior lamina
    - linea semilunaris
  - Linea alba
  - Lumbar triangle
  - Inguinal canal
    - Inguinal ligament - inferior
    - Aponeurosis - anterior
    - Arcades - superior
    - Superficial ring - distal opening
  - Superficial inguinal ring
    - Inguinal ligament
    - Medial crus
    - Lateral crus
    - Intercrural fibers
    - Reflected inguinal ligament
    - External spermatic fascia
  - Femoral ring
    - Inguinal ligament - anterior
    - Lacunar ligament - medial
    - Pectineal ligament - Posterior
- Innervation
  - Lower 6 intercostal nerves and the subcostal nerve
  - Iliohypogastric nerve
- Vasculature
  - Lower 6 intercostal arteries and the subcostal artery
  - Lumbar arteries
  - Iliolumbar artery
  - Deep circumflex iliac arteries
  - Inferior and superior epigastric arteries
  - Superficial epigastric and superficial circumflex iliac arteries and veins
- Lymphatics
  - Below the level of the umbilicus there is superficial drainage into superficial inguinal nodes by way of lymph vessels traveling with superficial epigastric and superficial circumflex iliac veins.
  - Above the level of the umbilicus there is superficial drainage into parasternal, pectoral, subscapular, and axillary nodes.
  - Deep drainage is into common iliac nodes (deep circumflex iliac vessels and inferior epigastric vessels)
  - para-aortic nodes (lumbar and intercostal vessels), intercostal nodes, internal iliac nodes (iliolumbar vessels)
  - Parasternal nodes (superior epigastric vessels)

## Stomach

Review the structure of the stomach. Include the anatomy of the stomach, supporting elements, vasculature, lymphatic drainage, innervation, and relationships to surrounding structures and spaces.

- General
  - The stomach is located in the left upper quadrant of the abdominal cavity.
  - Extends toward the right to reach the level of the umbilical region
  - Adult capacity of about 1500 ml
  - Intervenes between the esophagus and the duodenum
  - The most superior extent of the fundus is at T9
  - The most inferior extent of the antrum is at L2
- External Structure
  - Cardiac incisor
  - Body
  - Fundus - projects into the left dome of the diaphragm as high as the 5th intercostal space
  - Antrum
  - Pyloric canal - 1-2 cm in length
  - Pylorus - sphincter into duodenal cap
  - Lesser curvature - to the right between the cardiac incisura and the pyloric sphincter, lesser omentum, ventral mesentery
  - Greater curvature - gastrosplenic ligament, greater omentum, dorsal mesentery, as high as the 5th intercostal space
- Internal Structure
  - Gastric rugal folds of mucosa
  - Longitudinal folds
  - Pyloric orifice
- Support
  - Lesser omentum (hepatogastric and hepatoduodenal ligament)
  - Greater omentum - gastrocolic ligament
  - Gastrosplenic ligament
  - Lienorenal ligament
  - Esophageal hiatus
- Vasculature
  - Lesser curvature - right and left gastric arteries from hepatic artery and celiac trunk, lesser omentum
  - Cardiac region - esophageal artery from left gastric, vein is implicated in esophageal varices in the case of portal hypertension
  - Fundus - short gastric arteries from splenic artery, gastrosplenic ligament
  - Greater curvature - left and right gastroepiploic arteries from splenic and gastroduodenal arteries, greater omentum
  - Venous drainage directly into portal vein and indirectly by way of superior mesenteric vein
- Lymphatic drainage
  - Nodes named for the arterial supply drain into celiac nodes
  - Splenic nodes, pancreatic nodes, infrapyloric nodes,
- Innervation
  - Preganglionic parasympathetic - vagus nerve branches to celiac plexus follow arterial supply to the stomach
  - Postganglionic parasympathetic - intrinsic ganglia within the stomach
  - Preganglionic sympathetic - IMLCC of T5-9 ventral root - spinal nerves - white ramus communicans - thoracic sympathetic trunk - splanchnic nerves - greater splanchnic nerve - pierce right crus diaphragm - enter celiac ganglion
  - Postganglionic sympathetic - celiac ganglion - celiac plexus - follow arterial supply to stomach
  - Sensory (low threshold homeostatic) celiac plexus to anterior and posterior vagal trunks
  - Sensory (high threshold pain) celiac plexus through celiac ganglion - greater splanchnic nerves - splanchnic nerves - sympathetic trunk - ramus communicans - spinal nerve - dorsal root - cord levels T5-9
  - Superior mesenteric ganglia and the plexus are sometimes said to contribute. Thus T10-11 levels may be involved.
- Relationships
  - Anterior surface
    - Faces greater sac
    - Left - diaphragm, spleen, intercostal spaces 5 - 9
    - Right - quadrate lobe of liver
    - Inferior - transverse colon
    - Superior - dome of the diaphragm
  - Posterior surface
    - Faces lesser sac
    - Right - left crus diaphragm and diaphragm proper, left inferior phrenic artery and suprarenal gland,
    - Intermediate posterior - pancreas, splenic artery, transverse colon
    - Left - left colic flexure, spleen, superior pole left kidney
  - Spaces
    - Subphrenic space

## Ovary

Discuss the anatomy of the ovary and include relationships (6 directions), structure, surfaces, supports, vasculature, innervation, and lymphatic drainage.

- Structure

- The ovary is roughly cylindrical about 3 cm long and 1 cm in diameter.
- Surfaces
  - The visceral peritoneum covering the ovary gives way to a specialized germinal epithelial cell layer. \*The egg is able to penetrate this layer and enter the peritoneal cavity.
- Support
  - The ovary is suspended from the posterior lamina of the broad ligament by the mesovarium -- a peritoneal ligament.
  - Supporting the superior pole of the ovary to the pelvic brim is the suspensory ligament of the ovary.
  - Supporting the inferior pole of the ovary to the lateral uterus is the ovarian ligament.
- Vasculature
  - The arterial supply is mostly from the ovarian arteries. These are paired arteries arising from the anterolateral surface of the aorta near the level of the third lumbar vertebra. The ovarian veins arise from the IVC on the right and the left renal vein on the left. Additional blood supply is by ascending branches of the uterine vessels (ovarian br.) that anastomose with the ovarian vascular supply.
- Innervation
  - Parasympathetic preganglionic cell bodies are located in the central gray of the spinal cord (IMLCC) at levels S2-4. Preganglionic fibers enter the inferior hypogastric plexus by way of the pelvic splanchnic nerves. The inferior hypogastric plexus contributes a uterine plexus and then to the ovarian plexus. Postganglionic parasympathetic cell bodies are located in intrinsic ganglia of the ovary. The above pathway assumes that the uterovaginal plexus reaches the ovary. This is not known for certain. Parasympathetic preganglionic contributions from the vagus n. may also follow the ovarian plexus.
  - Sympathetic preganglionic cell bodies are located in the interomediolateral cell column at cord levels T10 (and perhaps T11-12). Preganglionic fibers follow the lesser and least splanchnic nerves to aortic ganglia near (and including) the superior mesenteric ganglion and the aorticorenal ganglion. Postganglionic fibers from these ganglia enter the aortic plexus and extend along the ovarian artery as the ovarian plexus. Visceral afferent pathways follow the sympathetic pathways up to the T10 spinal level. Additional visceral pathways follow parasympathetic pathways back to the S3-4 spinal levels.
- Lymphatic drainage
  - Lymph drainage is primarily along the embryological descent of the ovary. This includes upper lumbar nodes in the vicinity of the renal arteries. Much of the vascular supply reaches the ovary through the suspensory ligament.
  - Lymph drainage to superficial inguinal nodes follows the ovarian and round ligament.
  - Internal iliac nodes and ovarian fossa
- Relationships
  - superior to the ovary is the pelvic brim and suspensory ligament
  - inferior to the ovary is the uterine wall and the ovarian ligament
  - anterior to the ovary is the broad ligament, uterine tube, and fimbria of uterine tube
  - posterior to the ovary is the rectum and pelvic floor
  - medial to the ovary is the pararectal fossa, rectouterine pouch, fundus of the uterus
  - lateral to the ovary is the ovarian fossa (internal iliac a. and ureter), psoas major muscle, and obturator n.

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-- [LorenEvey](#) - 27 Sep 2008

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