CHAPTER 23, part b  DIGESTIVE SYSTEM

2. Pharynx
Food goes from mouth → oropharynx → esophagus
Mucosa: inner wall is friction/abrasion resistant – stratified squamous epithelial tissue w/ mucous producing glands
Muscularis Externica: 2 layers of skeletal muscles 1. longitudinal & 2. circular which propel food bolus into esophagus.

3. Esophagus
10 inches long carries food from pharynx to stomach
Epiglottis closes of trachea when swallowing
Passes through mediastinum and pierces diaphragm, entering abdominal cavity, at the esophageal hiatus Joins the stomach at cardiac orifice (opening) through cardiac sphincter

4. Esophagus
Canal layers
Mucosa – still non-keratinized stratified squamous epithelium
Submucosa – mucus secreting glands to “grease” the food
Muscularis externica: superior third skeletal; middle third mixed skeletal & smooth; inferior third all smooth
Deglutition: Swallowing
Serosa – Connective tissue?

5. Figure: 23.12  pg. 865

6. Figure: 23.13;  page 867

7. Figure: 23.13  pg. 867
8. Inferior to stomach – temporary “storage tank” where chemical digestion of proteins start
Chyme: food, when turned into a creamy paste
Found in upper left quadrant
6-10 inches long
Stretches! 50 ml to 4 liters (4000 ml)
Rugae (wrinkly): longitudinal folds when empty

9. Regions of stomach
Cardiac region (near heart)
Fundus: dome shaped superior edge up against the diaphragm
Body: Mid portion
Pyloric region: distal end of stomach w/pyloric sphincter controlling entry to small intestine.
Lesser curvature/greater curvature: inner, superior, curved edge/outer, inferior, curved edge

10. Figure 23.14 a; page 868

11. Omenta (pl): Double mesentery linings that help tether (hold) the stomach & other organs together and to the abdominal wall
Lesser omentum: goes from liver to the stomach’s lesser curvature & then becomes continuous with stomach’s visceral peritoneum
Greater omentum: stomach’s visceral peritoneum drapes off inferiorly, the greater curvature where it continues to envelop the small intestine, the spleen and parts of the large intestine and finally attaches to the posterior abdominal wall

12. Microscopic Anatomy – four layers
Epithelial (inner) - simple columnar
Secretes:
Protective alkaline mucus against stomach acids
Gastric glands in deep gastric pits secrete gastric juices
Parietal cells: HCl – hydrochloric acid
Chief cells: Pepsinogen that becomes pepsin which starts protein digestion
Enteroendocrine glands (gut hormones) chemical messengers to stimulate digestion activities
13. Muscularis: three layers instead of two
Longitudinal, circular and oblique
Mixes, moves and churns the food
Breaks it down into smaller pieces (more surface area) for chemical digestion
Bends into a “V” shape to force food into small intestine.

14. Figure: 23.14; page 868

15. Small intestines – Main digestive organ
Most digestion occurs here and all absorption occurs here
About 20/7-13 feet long
1 to 1.6 inches in diameter
3 parts: duodenum, jejunum & ileum- all coiled up and “hanging” in mesentary

16. Duodenum – 10 inches long, coming off stomach at the pyloric sphincter.
Bile duct & main pancreatic duct dump off bile and pancreatic juices in duodenum at the hepatopancreatic ampula and sphincter

17. Fig. 23.21; pg. 878

18. Jejunum: Middle 8 feet
Ileum: Final 12 feet that joins the large intestine at the ileocecal valve.
Modifications for absorption – circular folds, villi and micro villi – increases surface area/absorption area 600 times – two tennis courts
Circular folds:
longitudinal about 1 cm tall – set up turbulence that slows the chyme down for more absorption
Villi:
fingerlike projections – 1 mm high – velvety appearance – primarily absorptive, columnar epithelial tissue
Dense capillary beds and lymphatic lacteals to absorb nutrients into blood and lymph

Microvilli –
little fingerlike projections with even littler fingerlike projections.
Fuzzy appearance so called a brush poarder

21. Figure: 23.22a; pg. 879

22. Figure 23.22b;  pg. 879

23. Figure 23.22 c  pg. 879

24. Endothelial:
Simple columnar for absoption
Goblet cells to secret mucous dissolves digesting molecules, keeps chyme liquid, allows for slippery surface
Antimicrobial defenses
Endothelial cells are sloughed off rapidly but, they reproduce just as quick

25. LIVER AND GALLBLADDER
Many metabolic and regulatory roles
In digestion it’s role is to produce bile
Bile is a fat emulsifier – breaks fats into tiny particles so its digested easier
Gallbladder stores the bile
Liver is largest gland in body – weighs about 3 lbs
Wedged shaped, upper right quadrant just under the diaphragm
26. Liver Anatomy
Two main lobes, right and left, separated by falciform ligament
Also a quadrate and caudate lobe
Blood supply leaving the GI tract goes to the liver by the hepatic portal vein. This allows the liver to remove the “bad stuff” from the bad blood before it goes to the rest of the body.

27. Figure 23.24; pg. 882

28. Histology
Liver lobes are made up of liver lobules
Six-sided, functional unit the size of a sesame seed
Each lobule is made up of plates of hepatocytes (liver cells) which produce bile and dumped into canaliculi which dump into bile ducts which merge to form the common bile duct that joins with the cystic duct from the gallbladder to form the common bile duct that joins pancreatic duct hepatopancreatic ampulla

29. Figure 23.25; page 883

30. Figure 23.25c; page 883

31. Gallbladder
Pear shaped sack on the posterior side of the liver near right lobe
About 4 inches long
Stores and concentrates bile. Ejects it into cystic duct to common bile duct into small intestine

32. Pancreas
Secretes enzymes that are crucial to digestion
It drains into the pancreatic duct that joins w/ the bile duct at the hepatopancreatic duct. “Tadpole” shaped, positioned laterally, mostly posterior of stomach, with large “head” side to right
33. Figure: 23.1 page. 852

34. Large Intestine
About 5 feet long and almost 3 inches in diameter
Main function is to absorb excess water from chyme/digested food and temporarily store the residue and then eliminate them from the body as feces
Joins with small intestine in lower right quadrant at the iliocecal valve

35. Ascending colon, cecum, appendix, splenic flexure, transverse colon, hepatic flexure, descending colon, sigmoid colon and rectum. Ending at anus with internal (involuntary) and external (voluntary) sphincter muscles
Muscularis tunic (layer): 3 longitudinal rows of smooth muscle that pulls the intestines making it “pucker” up into pouch-like segments called haustra (to draw up)

36. Figure: 23.29a; page: 891

37. Mucosa tunic/layer
Simple columnar tissue. No absorption so, no folds or villi. Lots of crypts w/ goblet cells producing mucus to reduce friction on exiting feces.
1. **CHAPTER 25, URINARY SYSTEM**

2. Urinary system kidneys, filter the blood allowing the body to get rid of toxins, metabolic wastes and excess ions in urine while returning needed substances to the blood. Filters around 200 liters per day. It also regulates the volume and chemical make up of the blood, maintaining proper balance between water & salts, acids & bases.

3. Urinary system includes:
   - Kidneys – filters
   - Urinary bladder – temporary storage reservoir for urine
   - Ureters – pair of tubes connecting kidneys and bladder
   - Urethra – connecting bladder to the outside

4. Kidneys are, retroperitoneal, bean shaped organs in the posterior, lumbar region.

5. Figure 25.1; pg. 961

6. Figure 25.2 a&b; pg. 962

7. External Anatomy of kidney
   1. **Renal fascia:** outer layer of dense fibrous CT that anchors kidney to surrounding tissues & posterior abdominal wall
   2. **Perirenal adipose capsule:** fatty mass around kidney - a protective cushion
   3. **Fibrous renal capsule:** Transparent thin capsule protecting from surrounding infections
   4. Renal hilum: Notch at concaved medial aspect of kidney where ureters leave and arteries, veins and nerves enter
10. Internal Anatomy of kidney – 3 distinct regions: cortex, medulla & pelvis
   1. Renal cortex: Most superficial, light, reddish granular appearance
   2. Renal Medulla: Next layer, darker reddish brown with cone shaped tissue masses called renal pyramids separated by renal columns
   3. Renal papilla: apex of renal pyramid that points to renal hilum

11. Kidney internal anatomy (cont.)
  6. Renal Pelvis: Funnel shaped tube continuous with ureters. The pelvis divides into 2 or 3 major calyces which divides into minor calyces, each of which collects urine from the renal papillae of the pyramid

  Urine from pyramids → papillae → minor calyx → major calyx → pelvis → ureters

   Renal arteries enter kidney and diverge into smaller and smaller arteries with most of the blood initially going into the renal cortex
   The blood leaves the cortex through a series of veins that eventually join, leave the kidney and go to the inferior vena cava by the way of the renal veins

13. Figure: 25.4; page 964
14. Nephron
Structural and functional units of the kidney to produce urine
About a million in each kidney
Thousands of collecting duct to collect the urine from several nephrons

15. Anatomy of nephron
Each nephron has a glomerulus – little ball of capillaries
Each glomerulus sits in a glomerular capsule (Bowman’s capsule) together they’re known as a renal tubule.
Solute rich fluid can pass from the blood in the glomerulus (capillaries) into the Bowman’s capsule
The “filtrate” then goes from the Bowman’s capsule to the renal tubule

16. Fig. 25.5; pg.965

17. Figure; 25.8; pg. 968

18. The renal tubule leaves the glomerular capsule, gets all twisted up, and becomes the proximal convoluted tubule (PCT)
It straightens out makes 180 degree “U” turn back towards the glomerular capsule. This is known as the loop of Henele. Next it gets all twisted up again to become the distal convoluted tubule (DCT)
Finally at this point, it dumps whatever filtrate it picked up from the blood into the collecting duct

19. The Bowman’s capsule absorbs a lot from the glomerular capillaries – bad stuff and good stuff. 180 liters/24 hours
Afferent arterioles wrap around the renal tubules which reabsorb a lot of the good stuff that was initially lost. Urine: .6-2.5 liters /day
20. Ureters
Urine drained from renal pelvis to ureters, which carries it to the bladder
One for each kidney
When pressure builds up in bladder, openings to ureters close so urine won't back up into kidneys

21. Figure 25.1; pg. 961

22. Figure 25.19; pg. 985

23. Ureter Histology
1. mucosa – secretes mucous to protect epithelium from low pH (acidic) of urine
2. muscularis – inner longitudinal and outer circular smooth muscles
3. adventitia – areolar connective tissue that holds ureters in place

24. Urinary Bladder
Expandable muscular sack to store urine just posterior to the pubic symphysis
Three openings – 2 for the ureters & 1 for the urethra – These three openings outline the trigone, the triangular floor of the bladder. This is the area commonly affected by bladder infections

25. Figure: 25.21; pg.987
26. Bladder Histology
   Mucosa: mucus producing to protect the epithelial tissue from acidic urine
   The epithelial lining is transitional epithelium, that allows it to stretch
   Muscularis: Three layers of muscle referred to as the detrusor muscle

   Bladder normally stores about 500mls. (pint) It can stretch to almost twice that size

27. Urethra
   Tube running from bladder to outside.
   Internal urethral sphincter – smooth muscle, when closed prevents urine from leaving the bladder to urethra
   External urethral sphincter – skeletal muscle, under voluntary control, when relaxed allows urine to pass from bladder to urethra