LOWER GASTROINTESTINAL TRACT

General GI tract:

1. Name the two digestive organs of the lower GI tract.
2. Name the 3 accessory organs of the lower GI tract.
3. Just as in the upper GI tract, nutrients undergo both ___________ and ___________ digestive processes.
4. In what part of the digestive tract does the majority of digestion and absorption occur?
5. As acid chyme leaves the stomach and enters the duodenum, it stimulates the glands and cells of the duodenum to secrete _________ in order to protect itself and neutralize this introduced acid material.
6. What two types of cells/glands in the duodenum secrete mucus?
7. Where are these cells located? Be specific.
8. Here we must consider the accessory structures that contribute to the digestive actions that occur in the duodenum and other parts of the small intestine. Study the relationship between the pancreas, liver, gallbladder, and duodenum (Figure 24.14) in great detail.

The Pancreas

1. The pancreas is both an endocrine gland and an exocrine gland. What are its endocrine structures and their functions? (You may have to refer to Chpt. 18, Fig. 18.18, pg. 647 as well as your lab histology and your first semester notes).
   a. Islets of Langerhans
   b. Alpha cells—insulin or glucagon—increase or decrease glucose level?
   c. Beta cells—insulin or glucagon—increase or decrease glucose level?
   d. What are the differences between endocrine and exocrine glands?
2. The exocrine function of the pancreas concerns its digestive functions. What cells secrete the digestive enzyme portion of the pancreatic juice?
3. Tubule cells of the pancreas secrete ___________ ___________, which is responsible for giving the pancreatic juice its alkaline pH of _______________. What is the function of this alkaline secretion?
4. Trace the path of pancreatic juice from their formation to the duodenum. They are secreted through a duct called the duct of __________ which joins the __________ of __________. The duct of __________ is an accessory duct. They both empty into the __________.
5. The __________ from the liver/gall bladder also inters the ampulla of Vater. The ampulla of Vater is surrounded by a sphincter called the sphincter of __________. Its function is
6. Now let’s look at the function of the digestive enzymes of pancreatic juice. Remember, they are produced in the pancreas, but they do their work in the ______________.
7. Enzymes are produced by ___________ cells of the pancreas & are secreted into the duodenum; what does each do?
   a. Pancreatic amylase (amylopsin)
   b. Trypsin (as trypsinogen)
   c. Chymotrypsin (as chymotrypsinogen)
   d. Carboxypeptidase
   e. Pancreatic lipase
   f. Deoxyribonuclease and ribonuclease

8. What activates trypsinogen to become trypsin? Where is it formed and where does the action take place? Is it part of the pancreatic juice?

9. Describe/compare/contrast pancreatitis and acute pancreatitis. What is the relationship to trypsinogen/trypsin?

10. How does the parasympathetic stimulation via the vagus nerve during the cephalic and gastric phase of digestion influence the pancreas?

11. Control of pancreatic secretion via cholecystokinin (CCK) and secretin in a minute.

Liver and Gallbladder

1. Review the anatomy and histology of the liver and gallbladder from lab and in your text.

2. What is the function of Kupffer’s cells?

3. Make the connections between the liver, gallbladder, associated ducts, pancreas, and duodenum (Fig. 24.14) Trace the flow of bile from the liver to the duodenum and/or gallbladder. Use this to explain why someone can function without a gallbladder.

4. Trace the blood supply (HA and HPV) through the liver sinusoids, hepatocytes, central vein, and hepatic vein. Where does the bile duct fit into this picture? Note the different directions of flow (Fig. 24.14 a, b, and c. and Figure 24.15).

5. What are the functions of bile? What does it mean to describe it as an excretory product and a digestive secretion? Refer to blood/bilirubin/RBCs etc.

6. What’s the cholesterol connection?

7. We’ll talk about regulation of bile secretion in a minute with CCK and secretin.


9. Describe gallstones—what they are, what they can do and how they are treated.

10. Parasympathetic impulses of the _______ nerve stimulate bile production by the _____.

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Cholecystokinin (CCK) and Secretin
Describe the action on each of the targets. Note how they work together and how they are different in the action they stimulate. See Table 24.8.

1. Cholecystokinin (CCK)
   a. Produced by
   b. Where are they found?
   c. Stimuli
   d. Targets/actions
      • Gallbladder
      • Sphincter of Oddi
      • Pancreas acinar cells
      • Digestive enzymes
      • Satiety
      • Stomach/gastric emptying
      • Secretin

2. Secretin
   a. Produced by
   b. Where are they found
   c. Stimuli
   d. Targets/actions
      • Liver/bile
      • Pancreas tubule cells
      • Bicarbonate
      • Stomach/gastric juice

While you’re thinking about hormones that control digestion—summarize the gastrin story.

Small Intestine

1. Review the anatomy and histology of the small intestines. What are the three areas of the small intestines and how do they histologically differ from each other?

2. What are the Crypts of Lieberkuhn?

3. What is the function of Paneth cells?

4. What are Peyer’s patches and where are they most numerous?
5. Much of what happens in the small intestine is a continuation of what went on before in the mouth, stomach, and by pancreatic secretions. Note where things are continued and where they are started from the beginning. Frequently there are several avenues one may take to digest a specific food product. If you didn’t get it earlier, the small intestine may be able to get it from the beginning to the end. Some enzymes are found in cells of the brush border cells of the microvilli and are called brush border enzymes. What does each do?

   a. Alpha dextrinase
   b. Maltase
   c. Sucrase
   d. Lactase
   e. Enterokinase
   f. Dipeptidase (erepsin)
   g. Aminopeptidase

6. Describe lactose intolerance.

7. Describe the mechanical digestion that takes place in the small intestine.
   a. Peristaltic contractions
   b. Segmenting contractions
   c. Distention of the ileum causes ileocecal valve to relax and thereby allows peristaltic and segmenting contractions to move chyme into the large intestines.
   d. The villi are constantly shifting and moving. What function does this have?

8. Regulation of intestinal secretions and motility.
   a. Vasoactive intestinal peptide (VIP) stimulates the intestinal secretion of electrolytes (various ions). Water follows the electrolytes by osmosis, allowing more nutrients to dissolve.
   b. Brunner’s glands are stimulated by the presence of acid chyme to secrete ________.
   c. Crypts of Lieberkuhn are stimulated by the presence of chyme to produce large volumes of fluid/intestinal juices.
   d. Intestinal distention stimulates parasympathetic impulses and (increases/decreases) intestinal motility.
   e. Sympathetic stimulation (increases/decreases) intestinal motility.
Absorption in the Small Intestines
See Figure 24.20 a and b.

1. Describe absorption of monosaccharides.
2. Describe absorption of amino acids, dipeptides, and tripeptides.
3. Describe absorption of lipids (this is a little more involved).
4. How does the absorption of end products of lipid digestion differ from the absorption of the end products of carbohydrate and protein digestion?
5. Electrolytes are also absorbed in the small intestine (don’t obsess over this)
6. How are fat-soluble vitamins A, D, E and K absorbed? Compare this to Vitamin C.
7. Don’t forget about Vitamin B<sub>12</sub>—what’s it’s story (remember from blood lectures)
8. How is water absorbed? Look at Fig 24.21 for summary of quantities.

The Large Intestine
1. Review the anatomy and histology of the large intestine.
2. What is the opening between the ileum and the cecum?
3. What are the functions of absorptive and goblet cells?
4. What are the haustra?
5. What are the taenia coli?
6. Describe appendicitis.
7. Describe the gastrocolic reflex and mass peristalsis.
8. What role do bacteria play in the large intestine?
9. How is gas (flatus) produced?
10. Why do feces have an odor and what gives them their color?
11. Which vitamins are produced by bacterial action in the colon?
12. Feces are normally 65-75% water. What effects the composition of feces? Why is this important? Relate this to constipation and diarrhea.
13. What is the importance of dietary fiber in the diet?
14. Describe the defecation reflex and relate it to the two types of muscle making up the internal and external anal sphincters. How can defecation be involuntary or voluntary?

Other Disorders of the GI tract
Describe the following disorders.

1. Anorexia nervosa
2. Colorectal cancer
3. Viral Hepatitis types A, B, and C)
4. Chemical Hepatitis (Alcohol, bile salts)
5. Diverticulitis
6. Peptic ulcer disease