1. Describe the overall role of the gastrointestinal system with respect to the absorption of nutrients and excretion of waste products.
   a. Ingested material in
   b. Passes through smooth muscle lined tract
   c. Excreted out as feces
2. States the four general processes associated with GI function.
   a. Secretion - glands
   b. Digestion - chemical breakdown of food into molecules able to cross the mucosa (absorption) and gain entry into the blood
   c. Motility - movement of bulk down tract
   d. Absorption - nutrients
3. State approximate values of fluids entering and leaving the normal GI tract daily.
   a. Ingest - 2 l/day
   b. Secrete - 7 l/day
   c. Absorb - 8.8 l/day
   d. Feces - 0.2 l/day
4. Defines the cephalic, gastric and intestinal phases of GI tract regulation.
   a. Cephalic - mouth
   b. Gastric - stomach
   c. Intestinal
5. Describes the classes of luminal stimuli that trigger GI reflexes.
   a. Cephalic - taste, smell, sight, emotion
   b. Gastric and Intestinal
      i. Mechanoreceptors - volume, pressure
      ii. Chemoreceptors - AA, FA, pH
      iii. Osmoreceptors
   • Not identified as an objective but described: Splanchnic Circulation
      a. 25-30% of CO at rest
         i. Increases after a meal
         ii. Celiac, superior mesenteric, inferior mesenteric arteries
         iii. Venous drainage into portal vein to liver
   b. Microcirculation
      i. Abundant
      ii. High permeability
      iii. Fenestrated capillaries
   c. Lymphatics
      i. Abundant
      ii. 1 l/day of lymph to thoracic duct
      iii. Main route of absorbed lipids reaching circulation
6. Names and locates the myenteric and submucus plexus.
   a. Myenteric plexus is between longitudinal and circular muscle --> innervates muscle
   b. Submucosal is between muscle and muscularis mucosae --> innervates mucosa
7. Describes the relation between the CNS, ENS and effector organs of the GI tract.
   a. CNS
      i. ANS as efferent fibers via PNS/SNS that synapse on the ENS
      ii. Vagus nerve is primary neural control of GI tract
      iii. Visceral nociceptive fibers travel in sympathetic nerves and enter spinal cord
      iv. Vagus nerve synapses on ENS and can regulate GI function
b. ENS
   i. Myenteric --> smooth muscle
   ii. Submucosal --> mucosa

c. Effector organs

8. States the major excitatory and inhibitory neurotransmitters involved in the ENS.
   a. Excitatory: Ach, Substance P
   b. Inhibitory: NE, NO, Somatostatin

9. Defines the term "long reflex" and "short reflex" with respect to the GI tract.
   a. Long Reflex
      i. Information from receptors in smooth muscle relayed through ENS to higher centers via
         vagal afferents
      ii. Trigger response carried by vagal efferents resulting in alteration of motility, secretion or
         hormone release
   b. Short Reflex
      i. Within wall of GI tract
      ii. No CNS influence

10. Describes the similarities and differences in regulating GI function by nerves, hormones and paracrine
    regulators.
    a. Nerves synapse on the viscera themselves and have very localized effects
    b. Hormones are released into the blood stream and therefore have widespread effects
    c. Paracrine regulation involves release of substances from local cells and therefore has localized
        effects

11. Describes the location of the endocrine cells secreting gastrin, secretin, and cholecystokinin (CCK).
    a. Gastrin
       i. synthesized in G cells of stomach
       ii. released in response to protein and peptide or neural stimulation by Gastrin Releasing
           Peptide
       iii. Causes gastric acid secretion and gastric mucosal growth
       iv. Gastrinomas most common in pancreatic islets and lead to extreme acidity
    b. CCK
       i. synthesized in I cells of duodenum and jejunum
       ii. released in response to protein and fat in intestine
       iii. Causes gallbladder contraction, pancreatic enzyme secretion and inhibition of gastric
           emptying
    c. Secretin
       i. Synthesized by S cells in duodenal mucosa
       ii. Released in response to acid in the duodenal lumen
       iii. Stimulates bile and pancreatic HCO3 secretion and inhibition of gastric acid secretion
       iv. Gastric Inhibitory Peptide --> incretin
           1) Stimulates insulin secretion (main action)
           2) Inhibits gastric acid secretion
    v. Glucagon
       1) Found in both pancreas and gut, but in gut processed to GLP1 and 2
       2) GLP-1 is an incretin
          a) Stimulates insulin secretion
          b) Has been found to have weight loss effects
       3) GLP-2 has a trophic effect on gut
    vi. Vasoactive Intestinal Peptide
       1) Inhibitory to muscle but stimulates glandular secretion
       2) VIPomas result in secretory diarrhea

12. Describes the similarities in structure (identifies related hormones - does not memorize AA sequences)
    between gastrin, secretin, and CCK and between these and other hormones.
    a. Gastrin and CCK have a common amidated carboxyl terminal; all CCKs and some Gastrins are
       sulfated; also have multiple forms as a result of cleavage
b. Secretin-GIP-VIP-Glucagon are part of a family of enzymes as well
13. Defines the concept of "incretins" and states two GI hormones believed to function in this manner.
   a. Incretins cause the release of insulin
   b. GLP-2 and Secretin