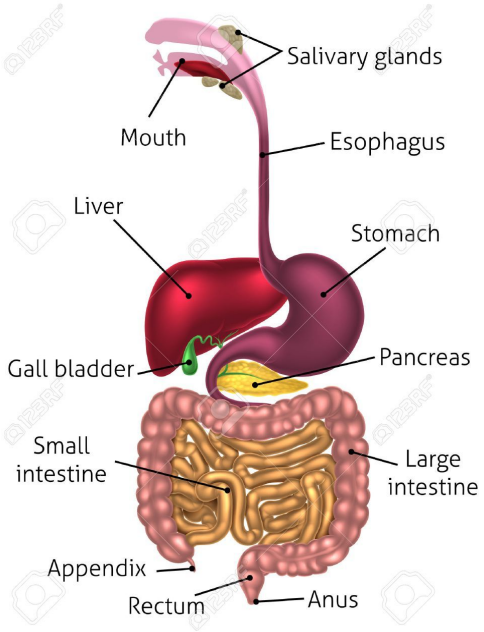
Digestion

"Though your beginning was small, Yet your latter end would increase abundantly." Job 8:7

- "From the roota to the toota"
- complex nutrients must be broken down into smaller water-soluble substances before they can be absorbed and used by the body
- carbs → simple sugars, proteins → aa, fats → fatty acids
- entire digestive tract can stretch 20-40ft.



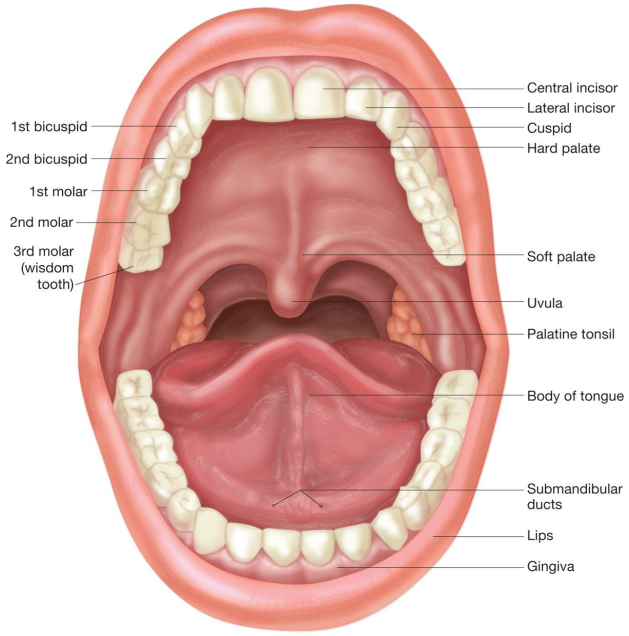
Alimentary canal

- mouth, esophagus, stomach, small intestine, colon, rectum
- aids body with digestion, nutrient absorption, and elimination of wastes

Digestion

- process of changing food substances to simpler molecules to be absorbed and diffuse through cell membranes
- primarily a chemical process
- enzymes: proteins
  -catalyst which speeds up chemical change but is not used up in the process
  -digestive enzymes produced by digestive glands; digestive enzymes secreted in small quantities but digestive juices secreted in large quantities

Oral cavity



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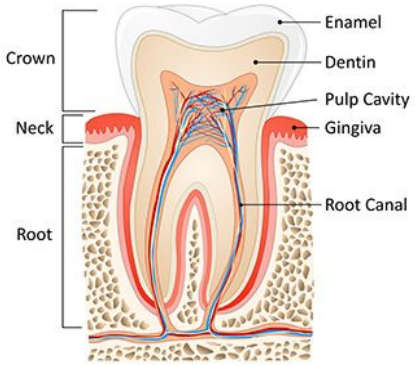
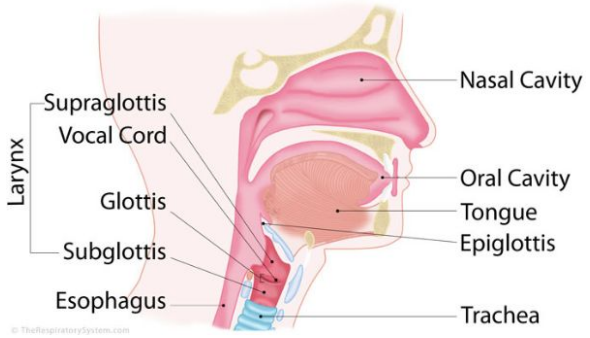
- mouth - food is lubricated by mucus and ground by teeth
- tongue pushes food between teeth and helps mix the food with mucus and saliva, forming a bolus and pushed to the back of the mouth for swallowing
- papillae: special nerve endings in taste buds which help taste sweet, salty, bitter, sour
- salivary glands: six pairs in mouth
  -"gleeking": voluntary contraction of salivary glands
  - salivary amylase is digestive enzyme in saliva
- teeth: cut/break/crush food
  -4 incisors, 2 cuspids, 4 bicuspids, 6 molars
  -mastication (chewing) increases surface area and aids digestion
  -parts: 1) crown, 2) neck, 3)roots
  -pulp inside consists of blood vessels and nerves
  -dentine is bonelike layer surrounding pulp
  -enamel is hardest substance in the human body
  -root fastened to jaw by cementum
  -fluoride causes teeth to become more resistant to decay



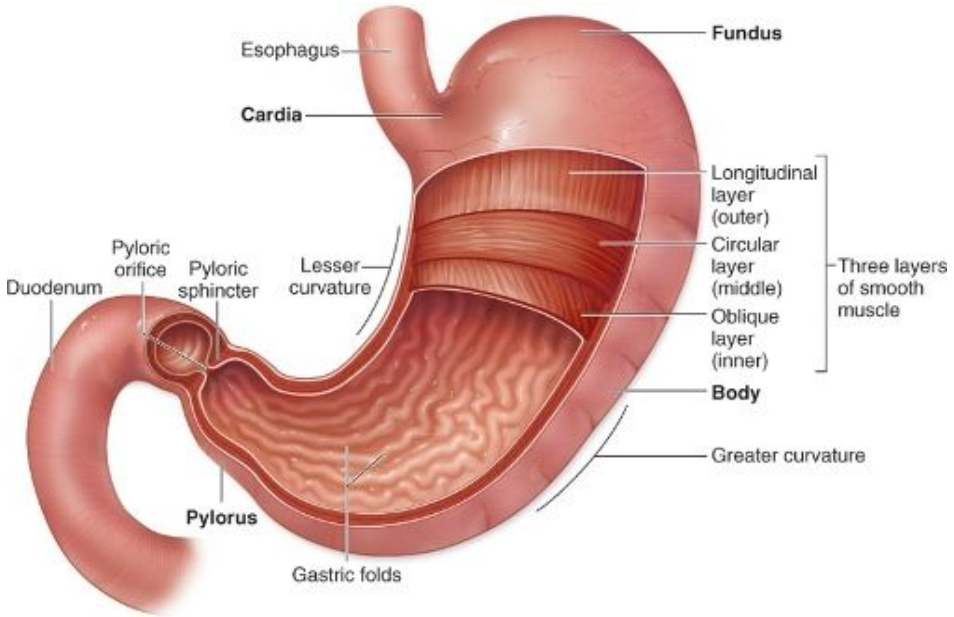
- pharynx: throat
- six openings: mouth, nasal passage, two Eustachian tubes, windpipe, esophagus

<u>Esophagus</u>



- foot long muscular tube which connects pharynx to stomach
- lies behind trachea
- peristalsis: rhythmic wave of muscular contractions of esophagus and digestive tract
- epiglottis: small flap of cartilage in the pharynx which closes over the top of the windpipe when food is swallowed to prevent it from entering the respiratory tract; swallowing is an automatic reflex response

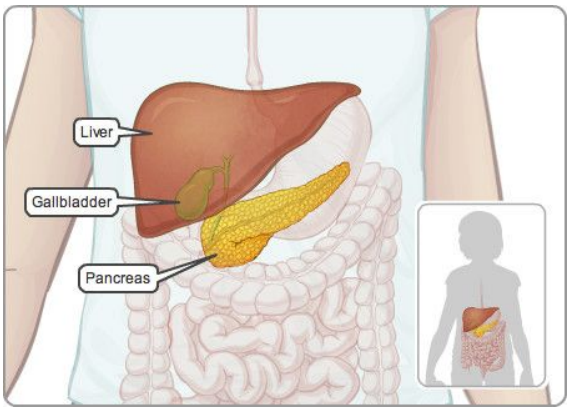
<u>Stomach</u>



- capacity = 3 pints
- largest (in diameter) section of the gastrointestinal tract
- three muscle layers: 1)runs length of stomach, 2)encircles stomach, 3)diagonally across stomach
- peristaltic contractions mix food and digestive juices

- major function to store food and release it to small intestine at the required rate because we usually eat much more quickly than the intestines can digest and absorb food
- gastric juice: cells in stomach secrete mucus or HCl (hydrochloric acid) or gastric enzymes
- hydrochloric acid breaks down food and provides acid medium which pepsin (gastric enzyme) requires to break down proteins
- mucous membrane and alkaline mucus provide protection to stomach from corrosive action of H Cl
- peristaltic movements in stomach and gastric juice secretions reduce bolus to thick liquid called chyme
- pyloric sphincter is where esophagus joins to stomach muscular valve which allows food to pass to stomach and prevents food from returning to esophagus
- pyloric sphincter is located at lower end of stomach; closed until food sufficiently mixed with gastric juice and ready to enter small intestine
- food stays in stomach from 2-4 hours

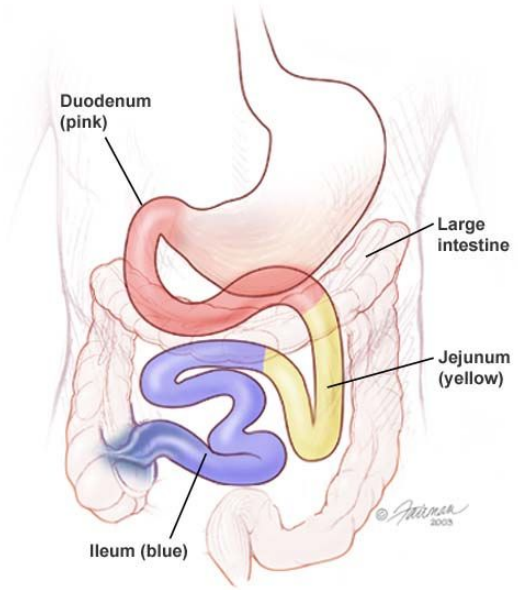
<u>Liver and Pancreas</u>



- liver produces bile which helps in digestion of fats in the small intestine (emulsification)
- lipase breaks down fats
- bile stored in gallbladder; gallbladder releases bile salts at precise time according to hormone released by duodenum; bile enters small intestine through common bile duct
- pancreas produces pancreatic juice and secretes to small intestine through pancreatic duct; pancreatic juice contains several important enzymes:
  pancreatic lipase digests fats
  pancreatic amylase digests carbs
  trypsin/chymotrypsin/carboxypeptidase digest proteins
  sodium bicarbonate (baking soda) neutralizes HCl
- insulin is a hormone made by the pancreas that allows your body to use sugar (glucose) from carbohydrates in the food that you eat for energy or to store glucose (glycogen) for future use

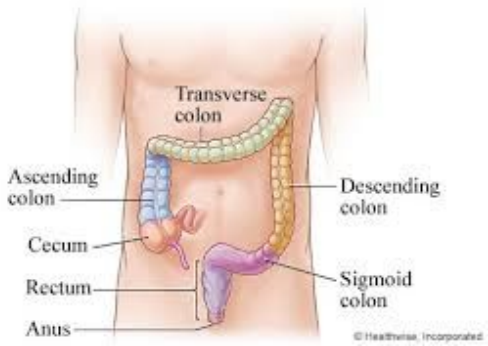
-insulin signals liver to remove glucose from blood when levels too high and store as glycogen
-when levels of glucose fall below normal, pancreas releases hormone glucagon that signals liver to convert glycogen back to glucose and release into bloodstream
-insulin helps keeps your blood sugar level from getting too high (hyperglycemia) or too low (hypoglycemia)

<u>Small intestine</u>

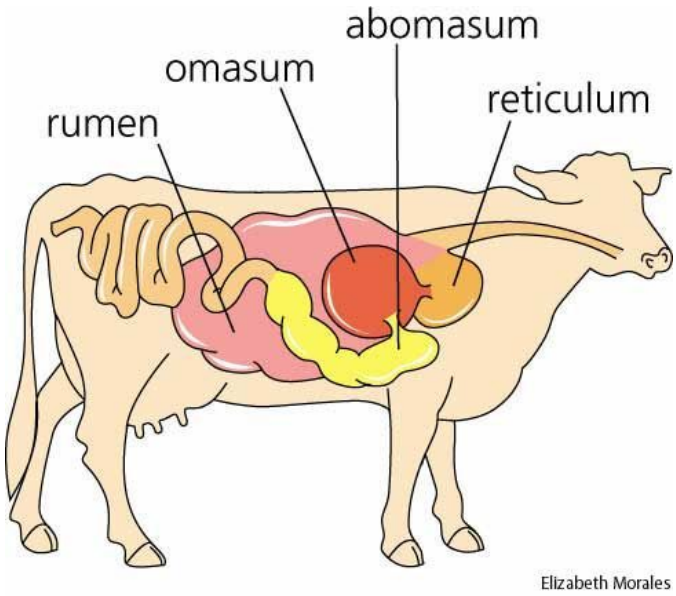


- primary organ of digestion and absorption
- avg 10 ft long; coiled to fit into abdominal cavity
- duodenum: first 10"
  jejunum: middle section
  ileum: longest part
- intestinal juice produced by glands in duodenum and pancreatic juice begin final phase of digestion
- absorption: movement of water, digested food, and other dissolved substances into the bloodstream; most absorption occurs in jejunum
- villi: tiny, hairlike projections whose primary function is to absorb digested food
  -villi wave back and forth to come in contact with as many food molecules as possible
  -molecules move through epithelial cells of villi into capillaries and are carried away by bloodstream
- lacteal: vessel in the center of each villus which receive fatty acid molecules; digested fats distributed to tissues by bloodstream and used immediately or stored in adipose cells
- excess proteins converted by liver into fuels and urea

Colon



- large intestine; larger in diameter but shorter than small intestine
- sections: ascending, transverse, descending
- large intestine joins small intestine at cecum (location of appendix)
- primary function to absorb water
- rectum: stores indigestible materials called feces until passed through anus
- anus: valve composed of pair of sphincter muscles
- feces odor comes from bacterial waste

Cow stomach

Beef tripe is usually made from only the first three chambers of a cow's stomach:
1) the rumen (blanket/flat/smooth tripe): serves as the primary site for microbial fermentation of ingested feed; largest section
2) the reticulum (honeycomb and pocket tripe): waste removal and movement
3) the omasum (book/bible/leaf tripe): absorption of water, nutrients, and fatty acids
4) abomasum (reed) tripe is seen much less frequently, owing to its glandular tissue content; chemical digestion of food