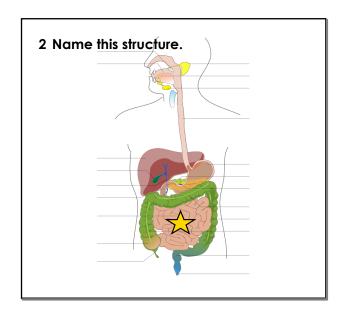
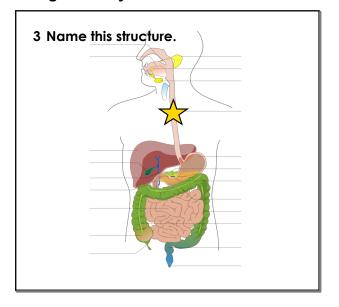
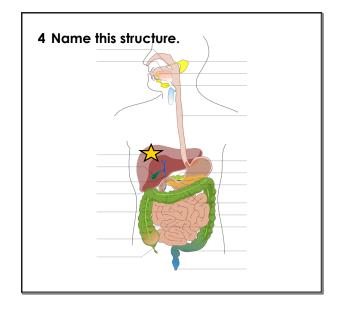


- 1 MATA: Which of the following NEVER touch food?
 - A esophagus
 - ^B liver
 - c pancreas
 - D colon
 - E gallbladder





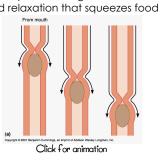


Pigestive Processes1. ingestion - taking food into the digestive tract

- 2. propulsion moves food through alimentary canal swallowing - voluntary

peristalsis - involuntary; alternating waves of contraction and relaxation that squeezes food

along GI tract

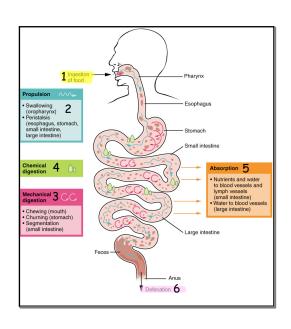


- **Pigestive Processes**3. mechanical digestion physically prepares food for chemical digestion (increases surface area) ex. chewing, stomach churning, segmentation
- 4. chemical digestion breaks food down into their chemical building blocks accomplished by enzymes starts in mouth and ends in small
- intestine 5. absorption - passage of nutrients through alimentary canal wall into blood or lymph most occurs in small intestine
- 6. defecation elimination of indigestible substances (fecal material) through anus

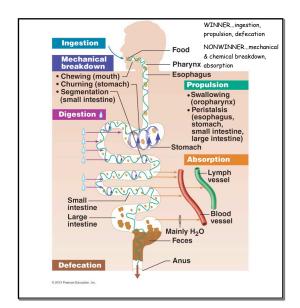




Chemical digestion *changes molecular form



Feeling lucky?...choose ODD OR EVEN



- 5 Increases surface area of food.
 - A mechanical digestion
 - **B** chemical digestion
 - c absorption
 - **D** propulsion

- 6 Moves food along alimentary canal (food tube).
 - A mechanical digestion
 - **B** chemical digestion
 - c absorption
 - **D** propulsion

- 7 Moves nutrients into blood or lymph.
 - A mechanical digestion
 - **B** chemical digestion
 - c absorption
 - **p** propulsion

Structure of Alimentary Canal

 4 basic layers (called tunics) from esophagus to anal canal

mucosa (mucous membrane)
 innermost layer
 epithelium, loose connective
 tissue, thin layer of
 smooth muscle
 may be folded to increase
 surface area (small intestine)

may be folded to increase surface area (small intestine) secretes mucus, digestive enzymes, and hormones

secretes mucus, digestive enzymes, and hormones absorbs end products of digestion into blood protects against infectious diseases

Structure of Alimentary Canal

• submucosa

loose connective tissue, blood vessels, lymphatic vessels, nerve fibers

nourishes surrounding tissues

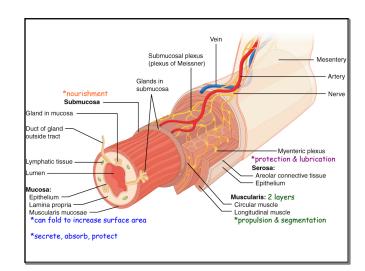
 muscularis externa (muscular layer)
 2 layers of smooth muscle responsible for peristalsis and segmentation forms sphincters (prevent backflow of food)

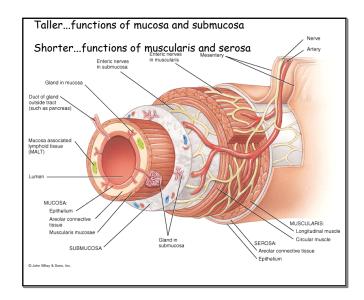
seroso

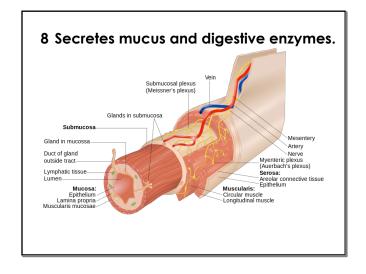
outermost layer

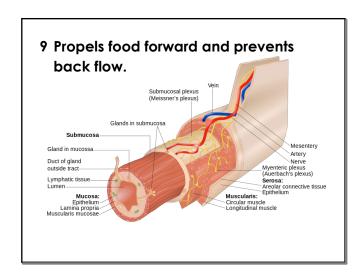
loose connective tissue, simple squamous epithelium protects underlying tissues

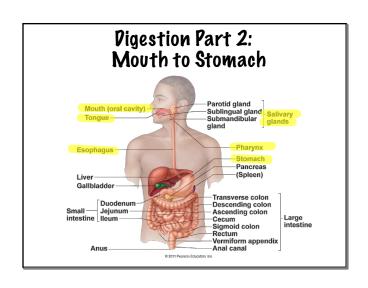
secretes serous (watery) fluid that lubricates the outer canal surface so that organs in abdominal cavity slide freely against one another











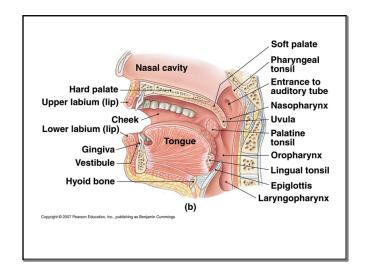
Mouth

- aka oral cavity
- start of chemical and mechanical digestion chemical - mixing food with saliva mechanical - chewing food
- boundaries

lips anteriorly, cheeks laterally, palate superiorly, tongue inferiorly

- lined with stratified squamous epithelium secretes defensins (antimicrobial protein) to keep mouth healthy
- cheeks and lips aid in expression, chewing, and sensory input
- palate

hard palate aids in swallowing soft palate closes off nasopharynx during swallowing



Tongue

• functions

positions food under teeth mixes food with saliva forming a bolus (lump) pushes bolus into pharynx during swallowing

- surface of the tongue (papillae) provides friction and houses taste buds
- attached to floor of mouth by lingual frenulum

• anchored to hyoid bone Follow Papellow Papellow Tropper

Salivary Glands • functions of saliva

cleanses the mouth

dissolves food chemicals so they can be tasted moistens food and aids in bolus formation contain enzymes (amylase) that begin carbohydrate digestion

• 2 types of secretory cells

serous: watery secretion containing enzymes mucous: stringy, viscous solution (mucus)

• 3 major glands

parotid (largest): anterior and inferior to ear (serous only)
submandibular: inside lower jaw

(mucus and serous)
sublingual: inferior to tongue
(mucus and serous)

 parasympathetic impulses stimulate the release of saliva when a person sees, smells, tastes, or thinks about food

Teeth

2 sets

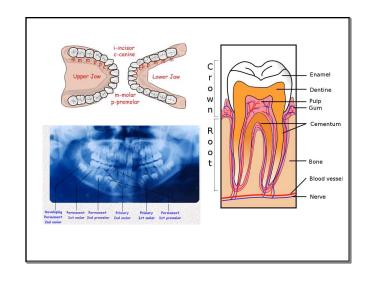
primary, baby, deciduous: 20 secondary, permanent, adult: 32 (w/wisdom teeth)

- begin mechanical digestion chewing increases surface area of food so that
- chemical digestion is more efficient
 classified based on shape and function incisors, canines, premolars, molars
- 2 main parts

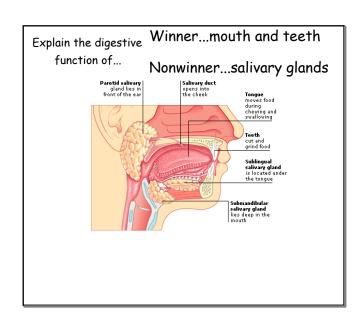
crown: above gum; covered in enamel (calcium salts

- hardest substances in body)

root: below gum; anchored to jaw by a periodontal ligament







- 1 The mouth is the beginning of
 - A mechanical digestion
 - **B** chemical digestion
 - c mechanical and chemical digestion
 - _D neither mechanical or chemical digestion

- 2 The mouth contains salivary amylase which begins to breakdown
 - A carbohydrates
 - **B** proteins
 - c lipids
 - D nucleic acids

Pharynx & Esophagus

· pharynx

no digestion takes place here passageway for food and aid in swallowing oropharynx and laryngopharynx

esophagus

no digestion takes place here straight, collapsible tube about 25 cm (10 in) long connects pharynx to stomach lubricated with mucus

gastroesophageal sphincter guards entrance to stomach

usually contracted to keep stomach contents from regurgitating into esophagus (heartburn) relaxed by peristaltic waves to allow food to enter stomach

Pigestive Processes: Mouth to Esophagus

- · mastication (chewing) mechanical digestion
- deglutition (swallowing)
 - food is chewed and mixed with saliva, forms a bolus (lump) on tongue, tongue placed against hard palate, tongue contracts forcing bolus into oropharynx (voluntary)
 - 2. food stimulates receptors that trigger the swallowing reflex (involuntary)
 - a. soft palate (uvula) closes off nasal cavity
 - b. epiglottis closes off larynx
 - c. tongue closes off oral cavity
 - 3. peristalsis moves food from esophagus into stomach



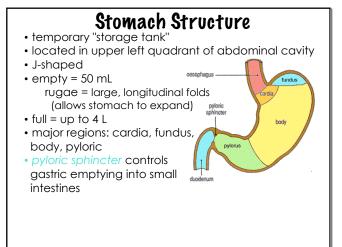
3 MATA: No digestion occurs in the

- A mouth
- **B** stomach
- c pharynx
- D larynx

4 Swallowing is both voluntary and reflexive.

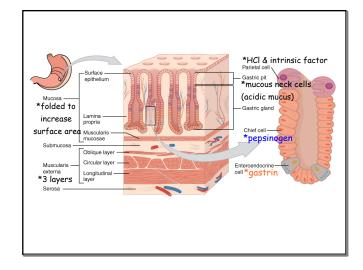
True

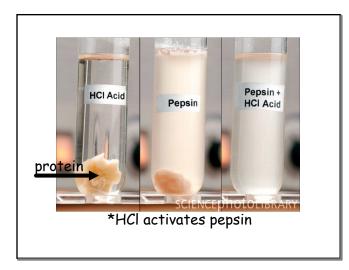
False



Microscopic Stomach Structure

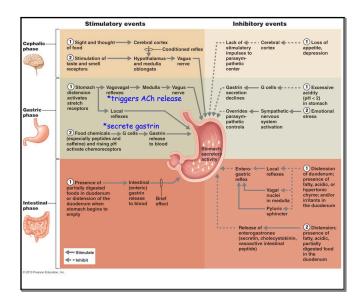
- mucous cells produce cloudy, protective 2-layer coat of alkaline mucus (keeps stomach from digesting itself)
- · gastric gland cells
 - 1. mucous neck cells produce thin, acidic mucus (function unknown)
 - parietal cells secrete HCl and intrinsic factor
 HCl increases acidity of stomach contents
 intrinsic factors allows for vitamin B12 absorption in small
 intestine
 - chief cells produce pepsinogen
 **pepsin most important digestive enzyme; breaks down proteins into polypeptides; secreted as pepsinogen (converted by HCI)
 - 4. enteroendocrine cells (G cells) secrete gastrin

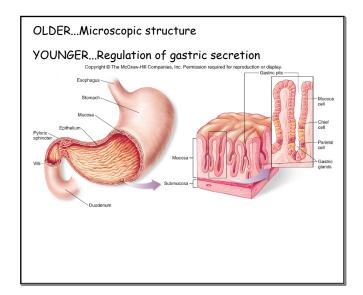




Regulation of Gastric Secretion

- gastric juice (HCl and pepsinogen) continuously secreted (up to 3L/day)
- Phase 1: Cephalic before food
- short (just a few minutes)
- aroma, taste, sight or thought of food
- Phase 2: Gastric food arrives
- 3-4 hours, two-thirds of gastric juice
- distention, peptides, low pH
- gastrin (main target parietal cells)
- Phase 3: Intestinal food leaving
- excitatory intestinal gastrin stimulates gastric glands and motility
- inhibitory put on the "brakes" so small intestine can keep up with stomach emptying





5 MATA: Chief cells secrete

- A HCI
- **B** pepsinogen
- c intrinsic factor
- D gastrin

6 Chief cells secrete pepsin in an inactive form to prevent the stomach from digesting itself.

True

False

7 Folding of the stomach mucosa increases surface area therefore increasing gastric output.

True

False

8 Name the hormone responsible for gastric secretion regulation.

Just for Kicks - Ulcers • gastric ulcer - erosion of the stomach wall • 10% caused by high HCl production or low mucus secretion aspirin, NSAID pain-relievers (ibuprofen), smoking, spicy foods, alcohol, coffee, stress • 90% caused by Heliobactor pylori (H. pylori) burrow like a drill bit through mucus and destroy protective mucosal layer H. pylori Gastric ulcer

Pigestive Processes: Stomach

• mechanical digestion

mixing movements of stomach wall produce a semifluid paste of food and gastric juice called **chyme**

chemical digestion

pepsin - protein digestion

absorption

water, certain salts, alcohol, aspirin

• propulsion

peristaltic waves push chyme toward pyloric sphincter, sphincter relaxes, stomach contractions push small amounts of chyme into small intestine rate of emptying depends on fluidity of chyme and the type of food present

Just for Kicks - Vomiting

- aka emesis
- triggered by extreme stomach stretching or irritants (bacterial toxins, excessive alcohol, spicy foods, certain drugs)
- emetic center (medulla oblongata) initiates motor responses

diaphragm and abs contract increasing abdominal pressure

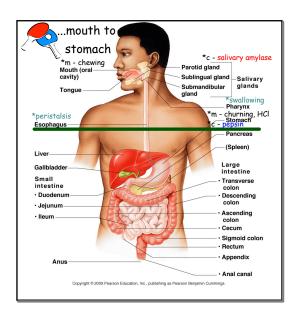
gastroesophageal sphincter relaxes soft palate closes off nasal cavity

stomach contents forced through esophagus, pharynx and mouth

before vomiting

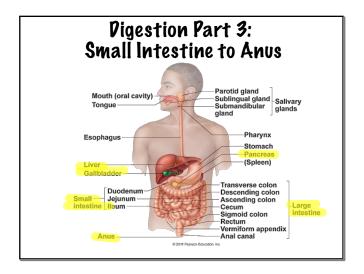
pale, nausea, salivating

 after vomiting dehydration, electrolyte imbalance



9 MATA: All of the following occur from mouth to stomach EXCEPT

- **A** ingestion
- **B** mechanical digestion
- ^c propulsion
- D chemical digestion
- E absorption (major)
- F defecation



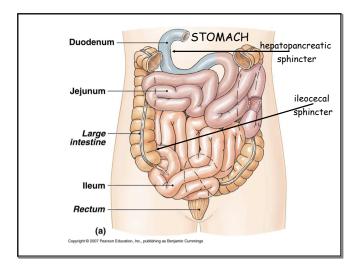
Small Intestine Anatomy

- body's <u>MAJOR</u> digestive organ completes digestion of nutrients in chyme responsible for virtually <u>ALL</u> absorption
- convoluted tube from pyloric sphincter to ileocecal sphincter (start of large intestine)
 2 - 4 m OR 7-13 ft in length

2.5 - 4 m OR 1 - 1.6 inches in diameter many loops and coils duodenum, jejunum, ileum

duodenum (shortest segment)

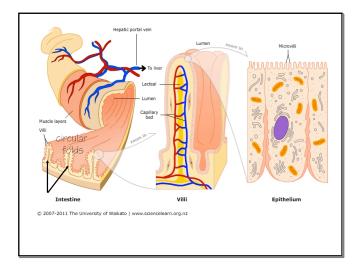
- 25 cm OR 10 inches long receives secretions from pancreas (pancreatic juice), and liver and gallbladder (bile) through hepatopancreatic
- jejunum 2.5 m OR 8 ft long
- ileum 3.6 m OR 12 ft long



Microscopic Anatomy

- highly adapted to nutrient absorption (extremely large surface area)
- circular folds (plicae circulares)
 deep, permanent folds in mucosa and submucosa slow chyme movement allowing time for full nutrient absorption
- villi
 fingerlike projections of the mucosa
 give small intestine a velvety appearance
 simple columnar cells, capillaties, nerves, lacter
 (lymph capillary)
- microvilli brush border
 villi on the villi
 brush border enzymes complete
 carbohydrates and proteins





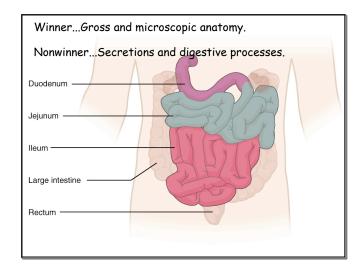
Small Intestine Secretions

- brush border enzymes (mucosa)
 peptidase: breaks peptides into amino acids
 sucrase, maltase, lactase: break disaccharides
 (sucrose, lactose, maltose) into monosaccharides
 (glucose, fructose, galactose)
 - intestinal lipase: break fatty acids into glycerol
- crypts of Lieberkuhn (mucosa) intestinal juice watery mixture containing mucus that serves as a carrier fluid for absorbing nutrients from chyme (no digestive enzymes)
- duodenal glands (submucosa)
 thick, alkaline (bicarbonate ions) that helps neutralize chyme
- regulated by distention or irritation of intestinal mucosa by acidic chyme

Digestive Processes: Small Intestine

- propulsion
 - peristalsis pushes food forward slowly (3-10 hours) if sm. intestine becomes irritated or over distended, a strong peristaltic rush sweeps contents into Ig intestine w/o normal absorption (diarrhea)
- mechanical digestion
 - segmentation mixes contents with digestive juices
- chemical digestion
 - peptidases peptides
 - sucrase, maltase, lactase disaccharides lipase - fat
- absorption
 - monosaccharides (simple sugars), amino acids, fatty acids and glycerol, electrolytes, some water





- 1 MATA: What sphincters are associated with the small intestine?
 - A gastroesophageal
 - **B** ileocecal
 - C pyloric
 - D hepatopancreatic

- 2 MATA: Which structures of the small intestine increase surface area?
 - A circular folds
 - B villi
 - C lateals
 - D microvilli

- 3 The small intestine does NOT secrete an enzyme that breaks down
 - A carbohydrates
 - **B** proteins
 - C nucleic acids
 - D lipids

4 The small intestine does peristalsis, chemical digestion, mechanical digestion, and absorption.

True

False

Accessory Organ - Liver

- · largest gland in the body (approx. 3 lbs)
- reddish-brown and blood-rich
- 2 major lobes (right and left)
- lies in upper right quadrant of abdominal cavity just inferior to diaphragm
- digestive function produce bile



Composition of Bile

- yellow-green, alkaline solution containing bile salts, bile pigments, cholesterol, triglycerides, phospholipids, and electrolytes
- only bile salts have digestive functions
- · bile salts emulsify fat
 - break up large fat globules (like dish soap)
- bile pigments (chiefly bilirubin) are waste products from the breakdown of hemoglobin
 - give fecal material its brown color
 - without it feces would be gray-white and have fatty streaks
- cholecystokinin (hormone) stimulates aallbladder to contract in response to proteins and fat in chyme
- peristaltic waves in duodenum cause hepatopancreatic sphincter to relax and bile is squirted (**) into small intestine

Accessory Organ - Gallbladder

- thin-walled, green, muscular sac about 10 cm (4 in) long
- · attached to ventral surface of liver
- · very strong muscular layer
- stores bile in-between meals, reabsorbs water to concentrate bile, contracts to released bile into small intestine

cystic duct connects gallbladder with common

- hepatic duct (liver)
- both join the common bile duct which leads to duodenum

Accessory Organ - Pancreas

- extends horizontally across the posterior abdominal wall in the Cshaped curve of the small intestine (duodenum)
- secretes pancreatic juice produced by pancreatic acinar cells secreted into duodenum through pancreatic duct

release into duodenum controlled by

- release controlled by secretin and cholecystokinin (CCK)
 - secretin stimulates release of pancreatic juice high in bicarbonate ions (alkaline) in response to acidic chyme in duodenum
 - CCK stimulates release of pancreatic juice high in digestive enzymes in response to proteins and fats in chyme

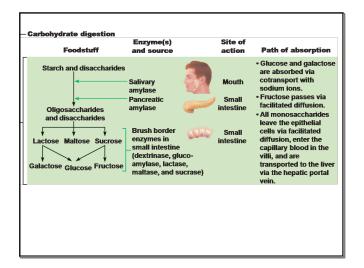
Composition of Pancreatic Juice

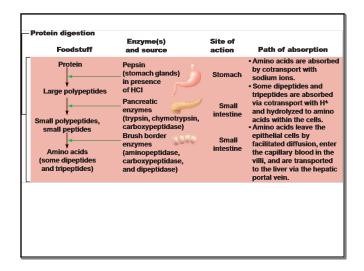
- mainly water
- contains enzymes (acinar cells) and electrolytes (bicarbonate ions that neutralize chyme)
- proteases (protein-digesting enzymes) secreted in inactive states to prevent pancreas from digesting itself
- enzymes

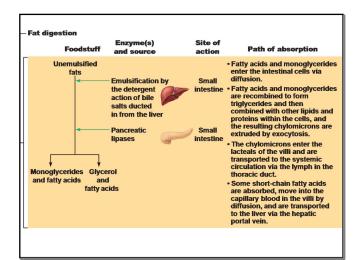
trypsin, chymotrypsin, carboxypeptidase - proteins amylase - carbohydrates

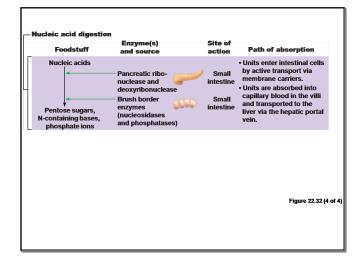
lipases - fats

nucleases - nucleic acids









- 5 MATA: The accessory organs secrete substances that help digest
 - A carbohydrates
 - **B** proteins
 - C lipids
 - D nucleic acids

- 6 ____ makes bile and ____ stores bile. Bile helps _ breakdown lipids.
 - A gallbladder, liver, mechanically
 - B gallbladder, liver, chemically
 - C liver, gallbladder, mechanically
 - D liver, gallbladder, chemically

- 7 MATA: Helps breakdown carbohydrates.
 - A amylase
 - **B** lipase
 - C maltase
 - D lactase

- 8 MATA: Helps break down proteins.
 - A peptidase
 - **B** trypsin
 - C chymotrypsin
 - D carboxypeptidase

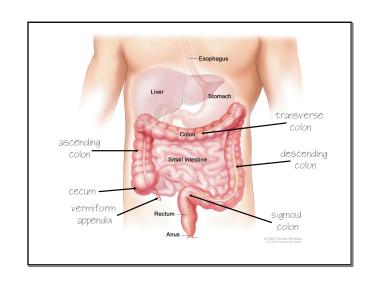
- 9 MATA: Helps breakdown lipids.
 - A pepsin
 - **B** bile
 - C lipase
 - D trypsin

Large Intestine Anatomy

- aka colon
- greater in diameter (7 cm) than small intestine, but much shorter (only 1.5 m)
- from ileocecal sphincter to anus
- walls lack villi
- functions absorb water, store and eliminate feces
- mucus is the only significant secretion protects the wall from abrasive action of material passing through, binds particles of fecal material, its alkalinity helps control pH
- 100 trillion bacteria call your colon home breakdown certain molecules that our bodies can't digest
 - bacteria produce gas as a byproduct of their metabolism

Parts of the Large Intestine

- cecum start of large intestine dilated pouch-like structure vermiform appendix - narrow closed tube that hangs from cecum; contains lymphoid tissue
- colon goes up on the right (ascending), across abdomen (transverse), down on left (descending), and turns in toward pelvis (sigmoid)
- rectum follows the curvature of the sacrum and ends about 5 cm below coccyx
- anal canal last 2.5 4 cm opening to outside called the anus guarded by 2 sphincters: internal (involuntary) and external (voluntary)



Pigestive Processes: Large Intestine

- propulsion
 - peristalsis slower (12 24 hours) mass movements occur 2 to 3 times a day
- absorption water and some vitamins
- defecation

hold breath (diaphragm contracts) and abs contract internal pressure rises and forces feces into rectum triggers sphincters to relax and feces is forced out control of external anal sphincter allows us to control defecation (YAY!!!)

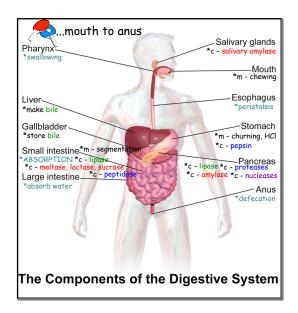
Feces

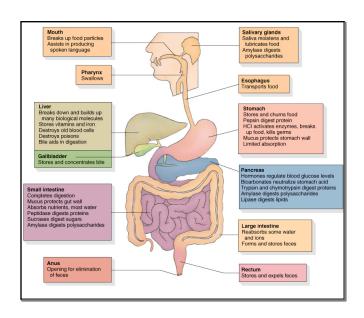
- materials not digested or absorbed plus water, electrolytes, mucus, intestinal cells, and bacteria
- about 75% water and bacteria
- odor comes from a variety of compounds that bacteria produce

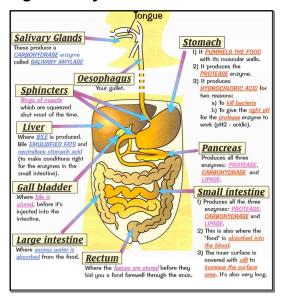


- 10 The large intestine does all of the following digestive processes EXCEPT
 - A chemical digestion
 - **B** propulsion
 - C defecation
 - D absorption

- 11 MATA: Compared to the small intestine, the large intestine
 - A has a larger diameter
 - B is longer in length
 - C lacks villi on it walls
 - D stores food (at least what's left of it) for a longer period of time







- 12 MATA: Secretes amylase.
 - A salivary glands
 - **B** small intestine
 - C pancreas
 - D liver

- 13 The most important digestive organ is the
 - A stomach
 - **B** small intestine
 - **C** pancreas
 - D large intestine