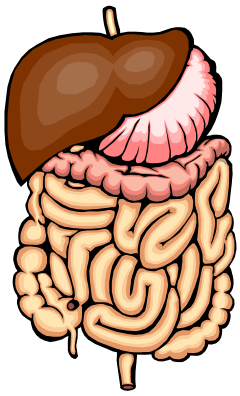
Digestive System



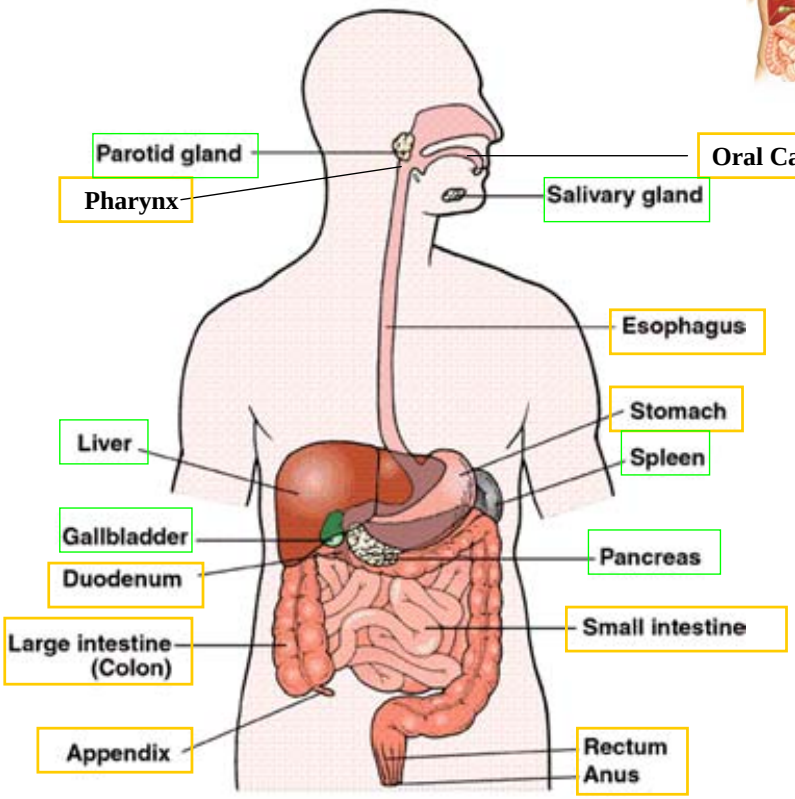
Objective

- Explain the structure and function of each digestive organ.
- Interpret the process of secretion and absorption of food inside the body.
- Discuss age-related changes in the digestive system towards physical activity, sports and daily activity.

General Structure

Gastrointestinal Tract (Digestive Organs)

Accessory Digestive Organs

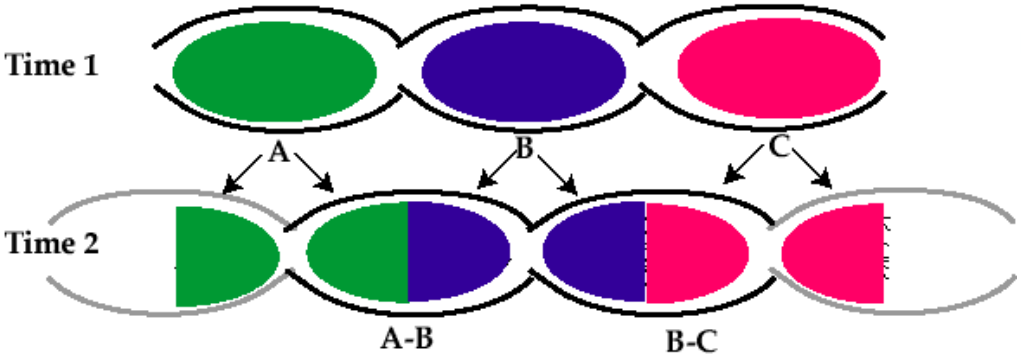


Functions

- Ingestion: introduction of solid and liquid nutrients into the oral cavity.
- Digestion: breakdown large food into smaller structures and molecules.
  - Mechanical –> smaller pieces
  - Chemical –>smaller molecules
- Peristalsis: process of muscular contraction to move material along GI tract.
- Segmentation: digested material combine with intestinal secretion.
- Secretion: process producing & releasing fluid product (acid, enzymes etc.)
- Absorption: electrolytes, nutrients & water across GI epithelium into GI tract blood & lymphatic vessels.

RHYTHMIC SEGMENTATION

Contractions are most vigorous (18-20/min) in duodenum to produce complete mixing of chyme with bile and pancreatic joice. The resultant chemical digestion breaks down food to its simple constituents.

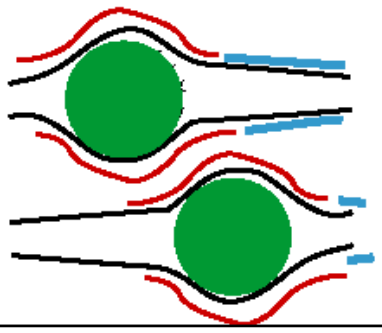


PROPULSIVE PERISTALSIS

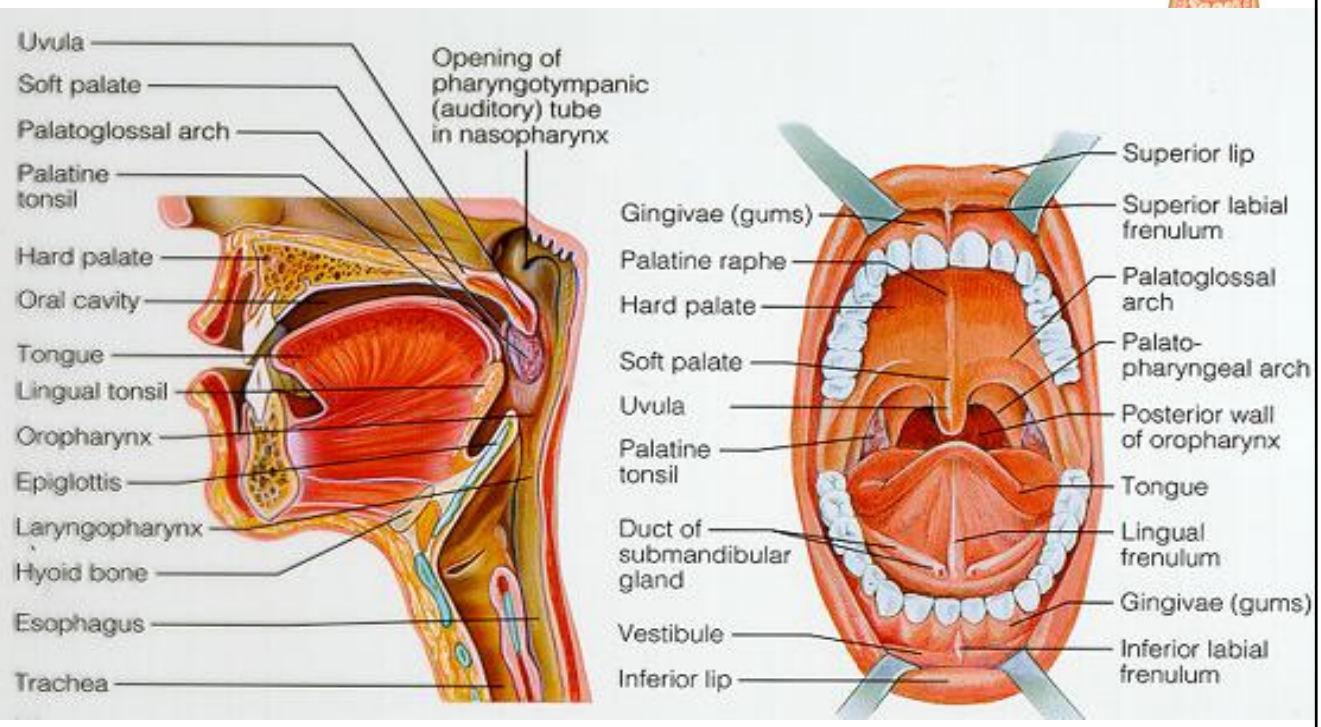
The products of digestion are propelled from the duodenum to jejunum and ileum for reabsorption into the bloodstream and lymphatic system.

Stretch of walls triggers stretch receptors and muscle contraction

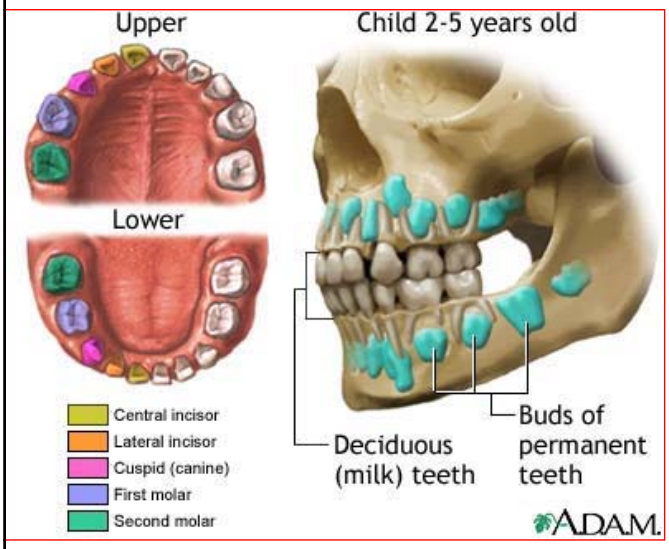
Simultaneously, feed forward inhibition of stretch receptors allows muscle contraction so bolus can enter distally

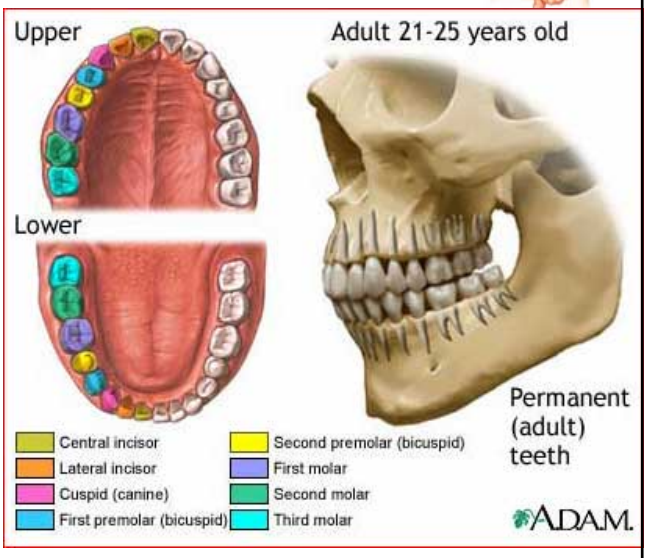


Oral Cavity

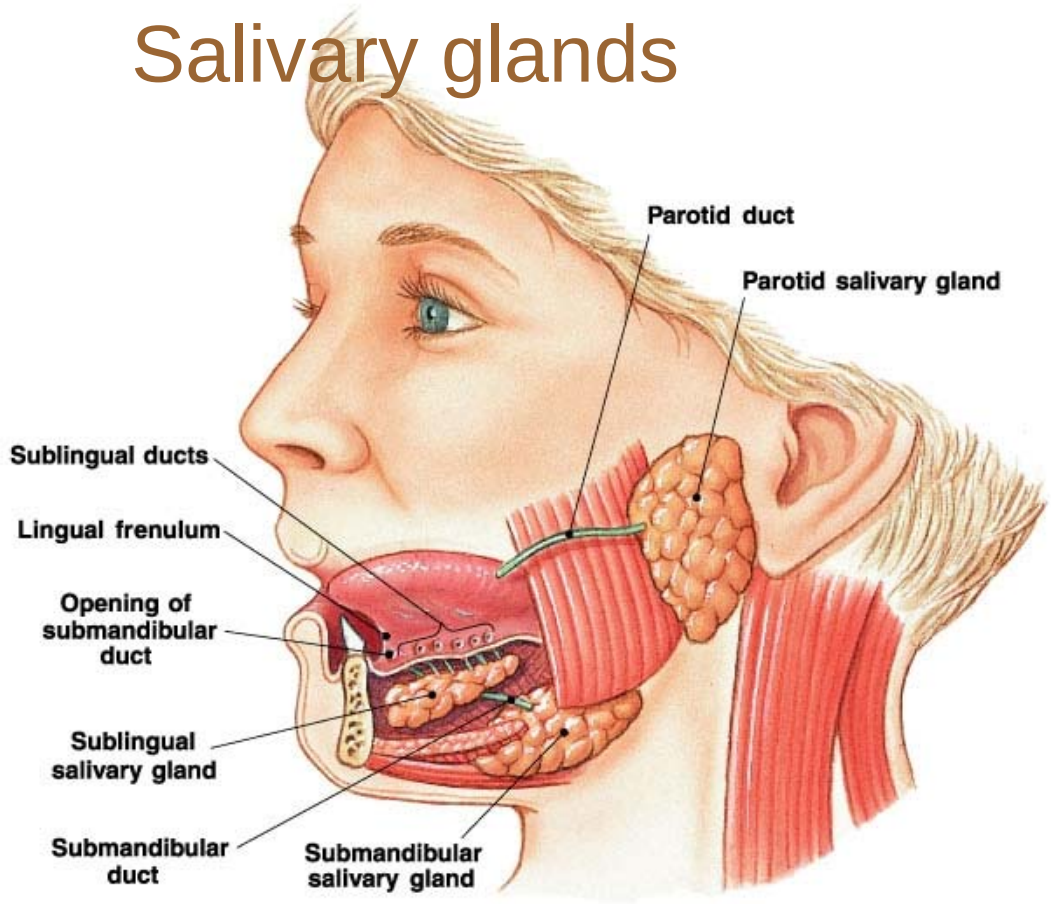

Uvula
Soft palate
Palatoglossal arch
Palatine tonsil
Hard palate
Oral cavity
Tongue
Lingual tonsil
Oropharynx
Epiglottis
Laryngopharynx
Hyoid bone
Esophagus
Trachea
Opening of pharyngotympanic (auditory) tube in nasopharynx
Gingivae (gums)
Palatine raphe
Hard palate
Soft palate
Uvula
Palatine tonsil
Duct of submandibular gland
Vestibule
Inferior lip
Superior lip
Superior labial frenulum
Palatoglossal arch
Palato-pharyngeal arch
Posterior wall of oropharynx
Tongue
Lingual frenulum
Gingivae (gums)
Inferior labial frenulum

Teeth


Upper
Child 2-5 years old
Lower
Central incisor
Lateral incisor
Cuspid (canine)
First molar
Second molar
Deciduous (milk) teeth
Buds of permanent teeth
A.D.A.M.


Upper
Adult 21-25 years old
Lower
Central incisor
Lateral incisor
Cuspid (canine)
First premolar (bicuspid)
Second premolar (bicuspid)
First molar
Second molar
Third molar
Permanent (adult) teeth
A.D.A.M.

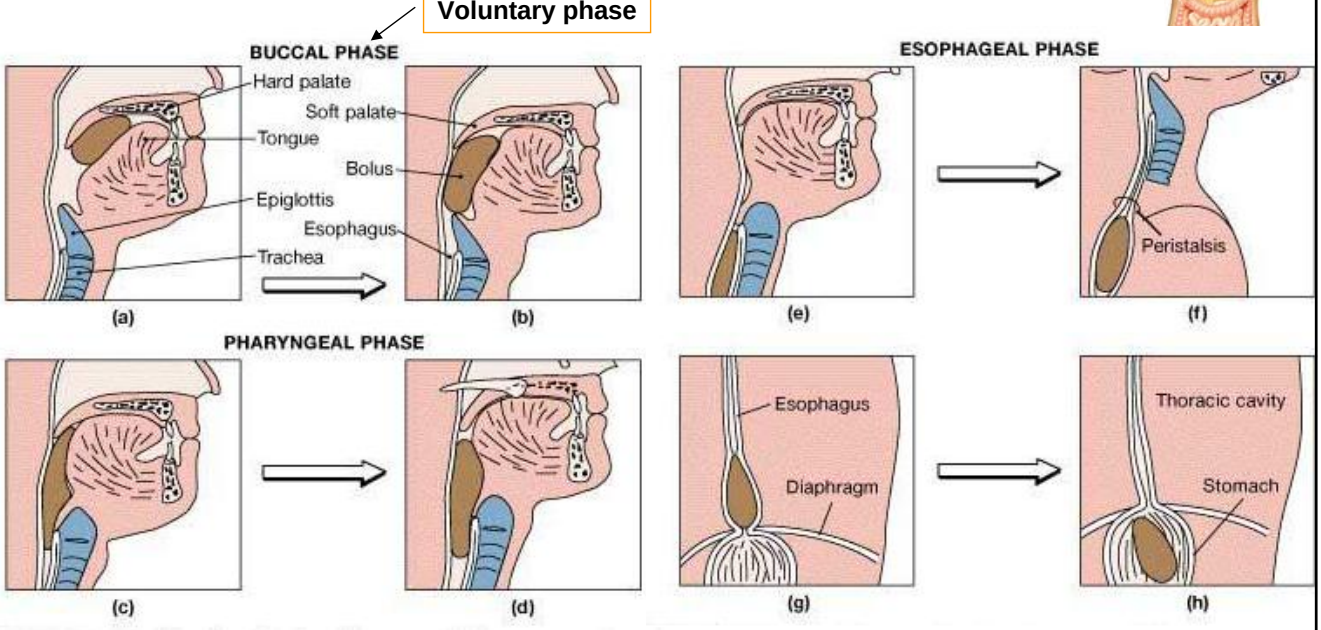
Salivary glands



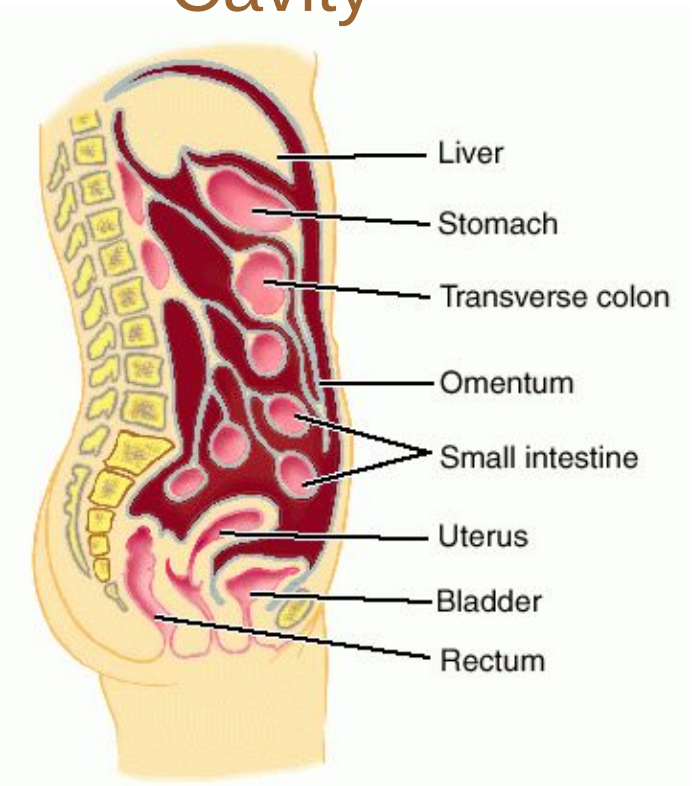
Salivary Galnds

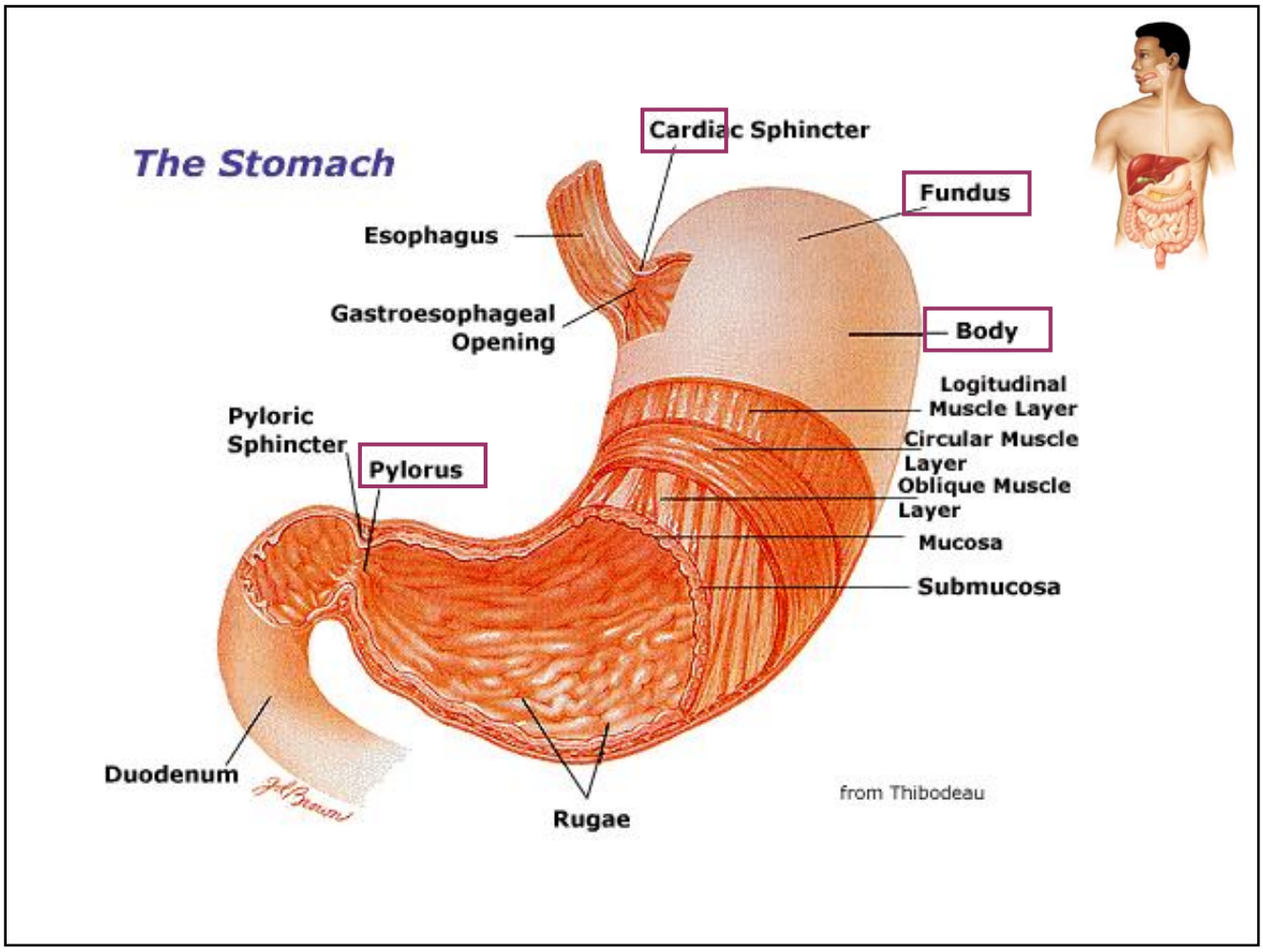
- Production rate: 1-1.5L/day
- pH: 6.4-6.8 (slightly acidic)
- Composition: 99.5% water, 0.5% solutes
- Solutes component: electrolytes (Na^+, K^+), immunoglobulin A (helps decrease bacterial infections), antibacterial enzymes, mucus, enzymes that breaks down carbohydrates.
- Neural control: Cranial nerve IX, VII, cervical ganglia.

Esophagus

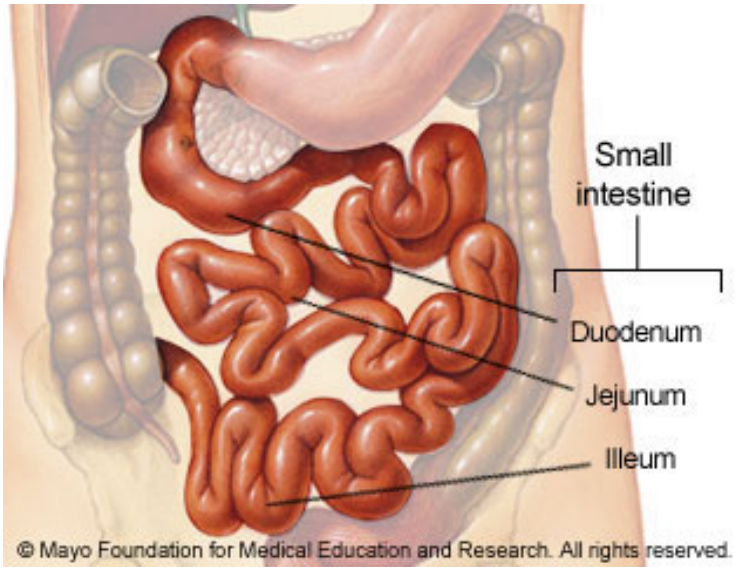

Voluntary phase
BUCCAL PHASE
Hard palate
Soft palate
Tongue
Bolus
Epiglottis
Esophagus
Trachea
(a)
(b)
ESOPHAGEAL PHASE
Peristalsis
(e)
(f)
PHARYNGEAL PHASE
(c)
(d)
Esophagus
Diaphragm
(g)
Thoracic cavity
Stomach
(h)

Peritoneum & Peritoneal Cavity



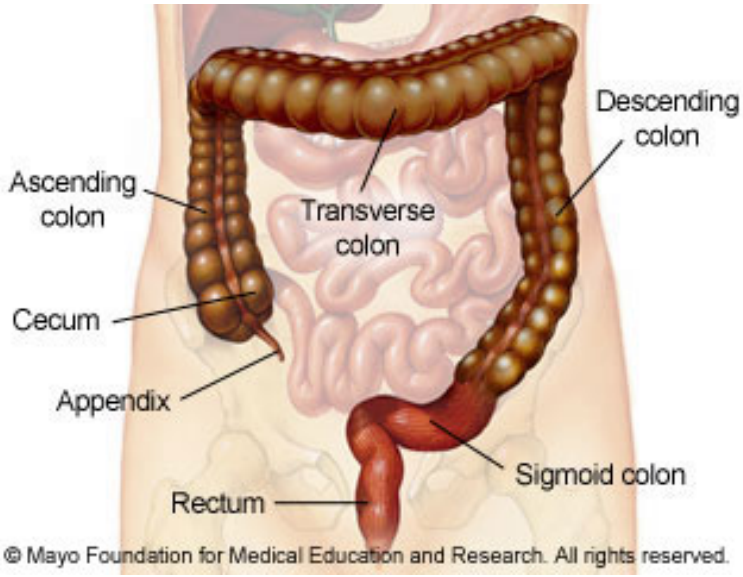

The Stomach
Cardiac Sphincter
Fundus
Esophagus
Gastroesophageal Opening
Body
Logitudinal Muscle Layer
Pyloric Sphincter
Pylorus
Circular Muscle Layer
Oblique Muscle Layer
Mucosa
Submucosa
Duodenum
Rugae
from Thibodeau

Small Intestine



- Duodenum
  - First segment
  - 25 cm
  - Receive some pancreatic juice
- Jejunum
  - Middle segment
  - 2.5 m
  - Chemical digestion & nutrient absorption.
- Ileum
  - Last segment
  - 3.6 m
  - Control the entry of material into large intestine.

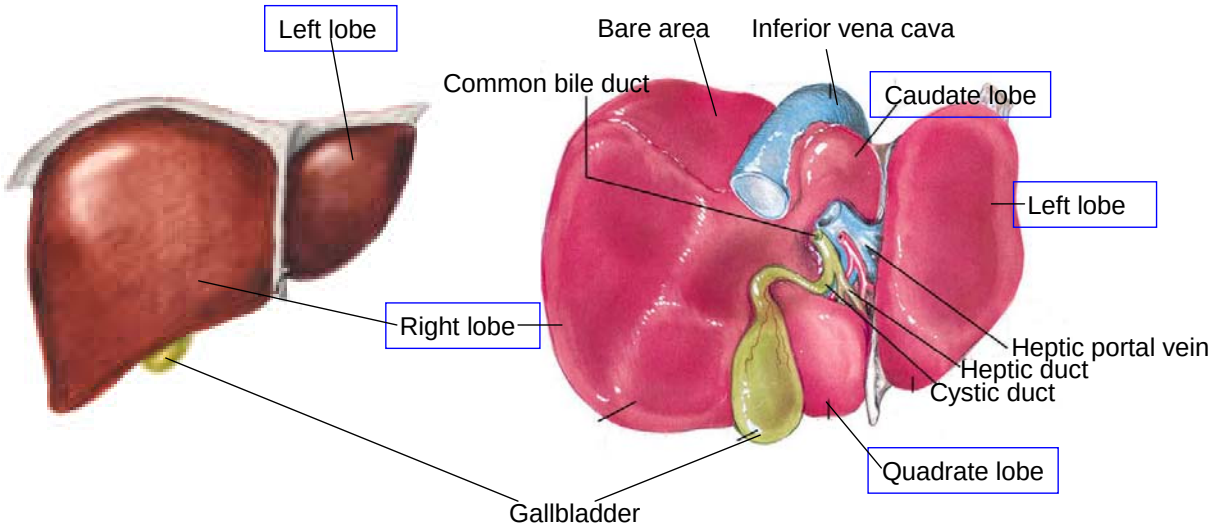
Large Intestine



- Material from small intestine enter cecum.
- Movement of material inside large intestine are regulated by gastrocolic reflex.
- Gastrocolicl reflex: peristaltic-like contraction of mass material which propel fecal material toward the rectum.
- It occur 2 or 3 times per day during or after meal.

Accessory Digestive Organs

- Liver



Accessory Digestive Organs

- Functions of Liver
  - Hepatocytes
    - Produce bile (breaks down fats)
    - Store excess nutrient & vitamins and release when need
    - Synthesize blood plasma proteins (albumin, globulins, protein for blood clotting).
  - Reticuloendothelial cell
    - Break down & recycle aged / damaged erythrocytes (in blood)

Accessory Digestive Organs

- Gallbladder
  - Store concentrates bile from liver.
  - Hold ~ 40-60 ml.
- Pancreas
  - Mixed gland -> exhibits both endocrine & exocrine functions.
  - Secrete pancreatic juice into duodenum -> neutralizes acidic chyme

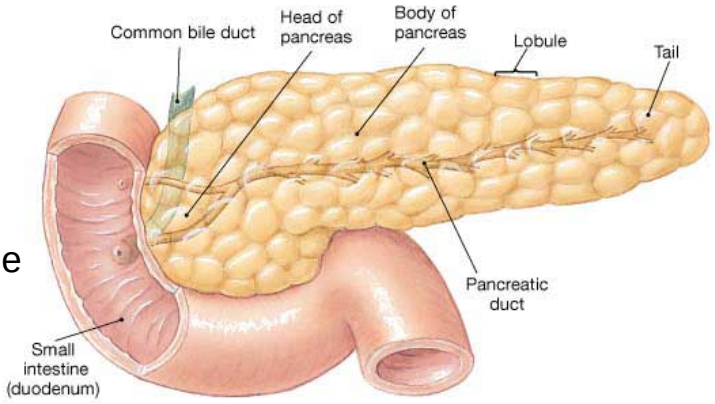


FIGURE 18-19 The Endocrine Pancreas. Gross anatomy of the pancreas.

Aging & Digestive System

- Age-related changes in the digestive system lead to reduction of secretions and diminished absorption of nutrients.
- What happen to physical activity? Sports? Daily activity?