

## Ch. 23 – Digestive System

- Conversion of food into raw materials to build & fuel our body cells
- Digestion: takes in food, breaks down & absorbs nutrients, eliminates remains
- Alimentary canal (gastrointestinal/GI tract):
  - mouth, pharynx, esophagus, stomach, intestines
- Accessory digestive organs:
  - teeth, tongue, salivary glands, liver, gallbladder, pancreas

## Digestive Processes: Disassembly

- Ingestion
- Propulsion – swallowing & peristalsis
- Mechanical digestion – chewing, churning, segmentation
- Chemical digestion
- Absorption
- Defecation

## Organization of Digestive System

- Serous membranes – visceral & parietal peritoneums; peritoneal cavity
- Mesentery – double layer of peritoneum, extends to digestive organs from back wall
  - Attaches, contains blood vessels, lymph vessels, nerves
  - Most organs: *intraperitoneal* (some are retroperitoneal)
- GI tract: 4 basic layers
  - Mucosa, Submucosa, Muscularis, Serosa

## Mouth & Associated Organs

- Mouth (oral/buccal cavity)
  - Stratified squamous epithelium
  - Lips, cheeks, tongue – muscular
    - Grinding & compaction of food (into bolus) – mastication
    - Formation of speech
    - Tasting
  - Hard palate (anterior) & soft palate (& uvula)
  - Salivary glands – parotid, submandibular, sublingual; buccal glands
    - Cleans mouth, dissolves substances for tasting, facilitates grinding/compaction, begins enzymatic breakdown of starch

## Teeth

- Allow chewing (mastication)
  - Primary dentition (deciduous/baby teeth)
  - Permanent dentition
    - Incisors, Canines, Premolars, Molars
  - *Crown*: enamel-covered, exposed (above gingiva/gum)
  - *Root*: embedded in jaw
    - Root canal – pulp cavity extension into root – access for blood vessels, nerves
  - Dentin – bonelike; surrounds pulp cavity
  - Periodontal ligaments hold tooth into fibrous socket (gomphosis)

## Pharynx & Esophagus

- Swallowing (deglutition) & propulsion
  - Voluntary – buccal
  - Involuntary – pharyngeal-esophageal: peristaltic waves
- Oro/laryngo-pharynx – skeletal muscle
- Esophagus – soft muscular tube
  - Crosses diaphragm at esophageal hiatus
  - Joins stomach at cardiac orifice/sphincter
  - Mucosa: stratified squamous epithelium
  - Submucosa: secretes mucus
  - Skeletal muscle, mixture, smooth muscle

## Stomach

- Storage & breakdown (chemical & physical) of food
  - Cardia, Fundus, Body, Pyloric region
  - Mesenteries tether stomach in place (omenta)
  - Circular, longitudinal, & *oblique* smooth muscle layers – extensive churning & mixing
  - Converts food to *chyme*

## Mucosa of Stomach

- Simple columnar epithelial cells – “goblet” cells – produce [alkaline] mucus
- Gastric pits/glands secrete gastric juice
  - Mucous neck cells
  - Parietal cells – secrete HCl & intrinsic factor
  - Chief/zymogenic cells – secrete pepsinogen (converted to pepsin by low pH)
  - Enteroendocrine cells – release digestive hormones

## Regulation of Gastric Action

- Release of gastric juice stimulated neurally & hormonally
  - Gastrin: hormonally stimulates HCl and enzymes
  - 3 phases of gastric secretion:
    - cephalic (sight/ smell/thought)
    - gastric (fullness/distension)
    - intestinal (excitatory & inhibitory)
- Gastric motility (peristalsis, propulsion) & emptying to small intestine
  - Relaxation, Contractile activity, Emptying

## Small Intestine

- Stomach (pyloric sphincter) to large intestine (ileocecal valve)
- Duodenum, Jejunum, Ileum
  - Bile duct & Pancreatic duct
  - Mesenteries

## Absorption in the Small Intestine

- Plicae circulares – slow movement of chyme
- Villi - ~1mm projections
  - Home to blood & lymph capillaries (lacteals)
- Microvilli – microscopic projections of mucosal cells (brush border)
- Digestion completed of proteins, carbs

## Liver & Gallbladder

- Common hepatic duct, cystic duct, bile duct
- Liver lobules – functional units
  - Filtration & Processing of nutrients in blood
  - Corners: triads
    - Hepatic artery, Hepatic portal vein, Bile duct
- Liver cells: hepatocytes
  - Produce bile, Package glucose (& process other nutrients), Store vitamins, Detox
- Bile – bile salts emulsify fats
- Gallbladder – stores & concentrates bile

## Pancreas

- Deep to stomach – across abdomen – in curve of duodenum
- Main (& accessory) pancreatic duct
- Acini produce pancreatic enzymes – “pancreatic juice”
  - Alkaline (basic) ~pH8 – neutralizes chyme, activates pancreatic proteases
  - Hormonally activated by secretin & cholecystokinin
- Segmentation movements in small intestine

## Large Intestine

- Ileocecal valve to anus
- Absorbs water & eliminates indigestibles
- Cecum, appendix, colon, rectum, anal canal
- Bacterial flora – resident bacteria synthesize Vitamins K, B complex
- Peristaltic movements & defecation

## Chemical reactions of digestion & absorption

- Catabolic processes – hydrolysis of foods
- Carbohydrates, Proteins, Lipids
- Absorption:
  - Carbohydrates
  - Proteins
  - Lipids
  - Nucleic acids
  - Vitamins
  - Electrolytes
  - Water