The Digestive System

We need food for cellular utilization:
→ nutrients as **building blocks** for synthesis
→ sugars, etc to break down for **energy**

most food that we eat cannot be directly used by the body
→ too large and complex to be absorbed
→ chemical composition must be modified to be useable by cells

Functions of Digestive System:
1. physical and chemical digestion
2. absorption
3. collect & eliminate nonuseable components

**Anatomy of Digestive System**

organs of digestive system form essentially:

a long continuous tube open at both ends

→ **alimentary canal** (gastrointestinal tract)

*mouth*→*pharynx*→*esophagus*→*stomach*→*small intestine*→*large intestine*

attached to this tube are assorted **accessory organs**
and structures that aid in the digestive processes

*salivary glands*  
*teeth*  
*liver*  
*gall bladder*  
*pancreas*  
*mesenteries*

The GI tract (digestive system) is located mainly in **abdominopelvic cavity**
surrounded by **serous membrane** = visceral peritoneum

this serous membrane is continuous with parietal peritoneum and extends
between digestive organs as **mesenteries**

→ hold organs in place, prevent tangling
The wall of the alimentary canal consists of 4 layers:

- outer
  - serosa:
    - visceral peritoneum,
      - mainly fibrous and areolar CT
  - muscularis
    - several layers of smooth muscle
  - submucosa
    - blood vessels, lymphatic vessels, nerves, connective tissue

- inner
  - mucosa:
    - mucous membrane lining

These layers are modified within various organs:
- some have muscle layers well developed
- some with mucous lining modified for secretion of digestive juices
- some with mucous lining modified for absorption

1. **Mouth (Buccal Cavity, Oral Cavity)**

bordered above by **hard** and **soft palate**
- forms partition between mouth and nasal passages

- **fauces**
  - opening of buccal cavity into throat

- **uvula**
  - is suspended from rear of soft palate
  - blocks nasal passages when swallowing

- **tongue**
  - lines ventral border of mouth cavity
  - is skeletal muscle covered with mucous membrane
  - rough elevated projections = **papillae**
  - types of papillae: fungiform, foliate, vallate
  - on some are taste buds
  - **frenulum** is thin fold of mucous membrane on ventral surface of tongue that anchors the tongue to the floor of the mouth
short frenulum → “tongue tied”

**Teeth**

two sets

- **deciduous** (=baby teeth)
  - 20
  - begin at 6 months; shed 6-13 yrs

- **permanent** teeth
  - 32

each tooth has a **crown** (above gum) and a **root** (below gum)

- **neck** is the line where crown, gum and root meet

imbedded in socket = **alveolus**

**gingivitis** = inflammation of gum surrounding teeth; can lead to periodontal disease

kinds of teeth modified for specific functions

- **incisors** – cut, knip
- **canines** – holding onto prey
- **premolars** – cutting, crushing
- **molars** – chewing, grinding, crushing

each tooth is composed of several layers:

- **enamel**
  - very hard
  - outer surface
  - on upper exposed crown only
  - not living tissue, noncellular secretion deposited before tooth erupts from gum
  - resists bacterial attack
  - cannot regenerate if damaged

- **dentin**
  - below enamel
  - living connective tissue with cells that line pulp cavity that send processes into the calcified matrix through tiny parallel tubes
  - less hard, similar to bone matrix
  - decays quickly of enamel is penetrated

- **pulp**
  - living portion of tooth
consists of blood vessels, nerves

cementum
on root of tooth only
outer surface
living connective tissue with cells in lacunae
holds root into socket in jaws

Salivary Glands
3 Pairs of salivary glands:
  sublingual
  submandibular
  parotid
    largest, below ears
mumps = acute infection of parotid gland

secrete saliva (enzymes and mucous for digestion)

2. Pharynx (throat)
already discussed

3. Esophagus
collapsible tube ~ 10” long
extends from pharynx to stomach
  → gets food through thorax to abdominal cavity
pierces diaphragm
posterior to trachea and heart
uses peristalsis to move food to stomach
  → can swallow upsidedown

4. Stomach
muscular sac just below diaphragm and liver
alimentary canal expands to form stomach
divided into regions:
  fundus
  body
  pyloris
**Muscle layers** are very well developed in stomach
  circular
  longitudinal
  oblique

Help to break up food by churning action

results in milky white liquid = **chyme**

**sphincter muscles** close both stomach openings

  **cardioesophageal sphincter**

  **pyloric sphincter**

within the mucous lining of stomach are glandular tubes called **gastric pits**

  → within gastric pits are numerous microscopic **gastric glands**:

    epithelial cells → secrete **mucous** for protection
    chief cells → secretes various **digestive enzymes**
    parietal cells → secretes HCl

5. **Small Intestine**

longest part of alimentary canal:
  → 1” diameter x 10’ long (living) or 20’ long (cadaver)

small intestine fills most of abdominal cavity

held in place by **mesenteries** (=serous membranes)

subdivided into 3 functional regions:

  **duodenum**
    10” long
    uppermost
    drains pyloric stomach
    receives ducts from gall bladder and pancreas

  **jejunum**
    8’
    central portion
    mostly in umbilical region
ileum
12’
mainly in hypogastric region
joins to caecum of large intestine

6. Large Intestine

2.5” diameter x 6’ long

valve like sphincter separates small from large intestine = ileocecal valve

subdivided into 3 regions:

cecum
blind ended sac that extends from point of attachment to small intestine
contains appendix → ~3.5” (9cm) long
significant source of lymphocytes
herbivorous primates such as gorillas and orangutans have
an enormous cecum packed with bacteria that digest plant fiber

colon
subdivided into:
ascending colon
transverse colon
descending colon
sigmoid colon

rectum
last 7-8”
ends at anus
external anal sphincter of skeletal muscle

7. Serous Membranes

body wall and organs of abdomen are lined with peritoneum
→ parietal peritoneum
→ visceral peritoneum

most, but not all, of the visceral organs are completely lined with visceral peritoneum
when an organ is lying against the dorsal body wall
and is covered by serosa on the ventral side only = retroperitoneal

eg. duodenum, most of pancreas, parts of large intestine

these layers are continuous with thin flaps of serous tissues = mesenteries

mesenteries
allow free movement while holding organs in place and prevent
them from tangling

greater omentum
fold of mesentery extending from stomach and duodenum
loosely covers the small intestine like an apron
contains fat deposits

lesser omentum
smaller fold of mesentery between liver and stomach

Accessory Organs of Digestive Tract

A. Liver
is the largest gland in body
lies immediately under the diaphragm
consist of 2 lobes separated by falciform ligament

B. Gall Bladder
lies on undersurface of liver
→gall bladder stores and concentrates bile

C. Pancreas

most digestion is carried out by pancreatic enzymes

in curve of duodenum and dorsal to greater curvature of the stomach

composed of 2 kinds of glandular tissue:
endocrine → secretes hormones
islets = 2% of total mass of pancreas
their secretions pass into circulatory system
secrete insulin and glucagon
exocrine → digestive function

pancreatic digestive secretions are collected in pancreatic duct
and usually a smaller accessory pancreatic duct that both drain into the duodenum