Basic Body Plan of an Animal

Metabolism Basics
Digestive Processes

Bloodstream Interaction
Valves Prevent Backflow

Neural Controls
Important Membranes

- Peritoneal organs (intraperitoneal)

- Retroperitoneal organs

Prevents TORSION - "twisting" of an organ

notice that the membranes have simply "folded back", putting the organ in its own "pocket".
Splanchnic Circulation

Let's draw a schematic:

hepatic portal circulation
Histology Basics

Recall the tissue layers seen in a "Typical visceral organ":
Transverse section:

- lumen
- longitudinal layer
- circular layer
- thin, wet epithelial layer that secretes mucus = "mucosa"
- "submucosa" with glands & blood vessels
- "muscularis" composed of smooth muscle. Usually 2 layers ... a circular and a longitudinal layer. Together perform "peristalsis".

Mucosa
protect against invasion
secrete stuff into tube
absorb stuff you want

Muscularis (circular & longitudinal)

Serosa

Submucosa
Head & Neck Regions

Tongue & Taste buds

Sour
Bitter
Sweet
Umami (savory = glutamate)

H+ Base Sugar Presence of protein

complex carbohydrate

starch glycogen etc...
salivary amylase
H2O monosaccharide made available

monosaccharide made available

microscopic taste buds
Diarrhea

Salivary Glands

Salivary glands have both mucous and serous cells

Mucous cells
Salivary duct
Sorous cells
**Stomach Secretion**

**Activation of pepsin by HCl, & Positive Feedback Loop**

1. Put food in stomach

   
   - stomach fluid is buffered
   
   - "proteins, carbs tend to be a little alkaline"

2. HCl stimulates parietal cells

   - parietal cells produce HCl

3. HCl denatures pepsinogen

   - pepsinogen is activated to pepsin

4. Pepsin converts to small intestines for further digestion

   - partially digested protein

5. Pepsin stimulates production of HCl & pepsinogen

   - pepsin activates pepsinogen

6. Pepsin is a local hormone

   - stimulates production of HCl & pepsinogen

Notice that:

1. steps "2a & 2b" occur simultaneously, as do "5a & 5b"
2. when all the partially digested protein has moved to the intestines, the positive feedback loops will stop!
Regulating Gastric Secretions

3 PHASES
Note:
1. Involve the Nervous System & Hormones - Vagus n. = Parasympathetic output
2. Each phase has an excitatory path and an inhibitory path
3. The phases are named after what is controlling the stomach

1. Cephalic Phase
   - Brain controls stomach via vagus n. before food is in stomach.
   - Though of food, sight, smell, etc:
     - Increase parasympathetic output
     - Increase gastrin (G) + pepsinogen
   - Loss of appetite, depression
   - Lower parasympathetic output
   - Lower secretions

2. Gastric Phase
   - Stomach causes reflex & hormone secretion that excites & inhibits itself
   - Stomach distension activates stretch receptors
   - Chemoreceptors pick up H⁺, peptides, etc
   - Low pH (acid) in duodenum causes CCK release
   - Acidic growth factor
   - Increase antrectodinhibin (Ach) + histamine: see later

3. Intestinal Phase
   - Intestines affect stomach secretion both hormonally and nerurally

HCL Production

- Release of hydrochloric acid:
  * Is low if only one ligand binds to parietal cells
  * Is high if all three ligands bind to parietal cells

- HCL secretion is stimulated by Ach, histamine, and gastrin through second-messenger systems

- Ach stimulates the production of cyclic AMP (cAMP)
- Histamine activates the production of cyclic GMP (cGMP)

- More H⁺ pumped out
- Lots of H⁺ pumped out

- SKF 38393
- Histamine on histamine receptor
- ACh on ACh receptor
- GI on GI receptor

- Paracrine signal
- HCl secretion

- Activation of proton pump
- ATP hydrolyzed to ADP
- Protons pumped out

Gastric Motility

Contains its own pacemaker... just like the heart!

Control Movement into Duodenum

CCK also lowers stomach motility

A little fluid gets through
Small Intestines Basics

Increasing Surface Area with Folds
Duodenum Controls on Gall Bladder & Pancreas

Intestinal Crypts, Intestinal Glands & Intestinal Juice

- Villae
  - Enterendocrine cells secrete hormones
  - Goblet cells: secret mucus

- Intestinal Crypts
  - These cells have enzymes embedded in membrane that finish some digestion (brush border enzymes)

- Mucosa
  - Secret intestinal juice (see later)
  - Duodenal Glands in Submucosa: secrete alkaline mucus
Liver Anatomy & Hepatic Portal Circulation

[Diagram showing liver anatomy and hepatic portal circulation]

All blood sent to the digestive viscera is shunted to liver via hepatic portal v.
Microscopic Anatomy of the Liver - Lobules

Control of Bile Production & Release
Small Intestine Basics

Motility in the Small Intestines

Gastrin Controls the Ileocele Valve
Large Intestine Gross Anatomy

Defecation Reflex
Microscopic Anatomy of the Large Intestines

Paths of Absorption - Basic Concepts

And water will follow via osmosis. This forms a “current”, like a stream, and pulls other molecule too! This is called Solvent Drag, which helps bring in water and small molecules.
Emulsification & Absorption of Lipids

1. Fatty acids & monoglycerides enter the cells via diffusion
2. Chylomicrons are made by adding proteins
   These enter the lacteal, and end up in circulation via the lymph (remember the thoracic duct?)
3. Fatty acids & glycerol are water soluble, so they enter directly into the capillaries near the villi, moving to the hepatic portal vein
Lipid Transport in Bloodstream

Key for carrier vesicles:
- Generic Lipoprotein Vesicle
- Very Low Density Lipoprotein (carries triglycerides & cholesterol)
- Low Density Lipoprotein (carries cholesterol to body's cells)
- High Density Lipoprotein (absorbs cholesterol in the tissues, and carries it to the liver)