Intestinal Villus

- Simple columnar epithelium
- Lacteal
- Blood capillary network
- Intestinal gland
- Goblet cells
- Arteriole
- Venule
- Lymph vessel
Fat Absorption

(1) Fatty acids resulting from fat digestion enter epithelial cell

(2) Fatty acids are used to synthesize fats in endoplasmic reticulum

(3) Fats collect in clusters encased in protein to form chylomicrons

(4) Chylomicrons leave epithelial cell and enter lacteal

(5) Lymph in lacteal transports chylomicrons away from intestine

Intestinal mucosa

Lumen of intestine

Epithelial cell

Endoplasmic reticulum

Chylomicrons

Nucleus

Lymph

Lacteal

To blood
Pancreatic Enzymes

• Pancreatic Lipase (fats)
  – Breaks down triglycerides

• Proteolytic enzymes (proteins)
  – Trypsin (activated form of trypsinogen)
    • Procarboxypeptidase -> carboxypeptidase
    • Chymotrypsinogen -> pepsinogen

• Pancreatic Amylase (carbohydrates)
Location of Liver

Liver

Stomach

Large intestine
Liver Functions

- Secretion of Bile
- Detoxification of blood
- Molecule Storage
- Synthesis of plasma proteins
  - Amino acid synthesis & conversion
- Urea formation
- Macrophages break down damaged RBC’s & phagocytize foreign antigens
- Synthesis of cholesterol & lipoproteins
Hepatic Lobule—Longitudinal Section

Central vein

Hepatic portal vein

Bile canaliculi

Bile duct

Branches of hepatic artery

Sinusoids
Gallstones
Bile Release

1. Chyme with fat enters small intestine

2. Cells of intestinal mucosa secrete the hormone cholecystokinin (CCK) into the bloodstream

3. CCK stimulates muscular layer of gallbladder wall to contract

4. Bile passes down the cystic duct and common bile duct to duodenum

5. Hepatopancreatic sphincter relaxes and bile enters duodenum
Homeostatic Imbalances

• Hepatitis (inflammation of the liver)
  – Viral infection (6 types, A-F)

• Cirrhosis
  – Chronic alcoholism or hepatitis
  – Liver transplants

• Jaundice
Rectum and Anal Canal

- Rectum
- Levator ani muscle
- Anal canal
- Anal columns
- External anal sphincter
- Internal anal sphincter
- Anus
Chemical Digestion

• Carbohydrates
  – Monosaccharides absorbed by small int.
    • Glucose, fructose, galactose
    • Disaccharides broken down into monosaccharides
  – Starch (most common carb)
    • Salivary (mouth) & Pancreatic amylase (duodenum)
    • Break starch into oligosaccharides
  – Brush border enzymes finish the job
Chemical Digestion

• Proteins
  – Sources = diet, enzymes, endothelial cells.
  – Begins in stomach (pepsin)
  – Continues in duodenum
    • Pancreatic trypsin & chymotrypsin
  – Finished off by brush border enzymes
    • Carboxypeptidases, Aminopeptidases & dipeptidases
Chemical Digestion

• Lipids
  – Triglycerides = most common dietary fats
  – Small intestine is site of lipid digestion
    • Pancreas is only supplier of lipases
      – Cleave off fatty acid chains from glycerol
  – Emulsification breaks up fats into small drops
    • Bile salts have polar and nonpolar regions
    • stick to fat droplets & disperse throughout soln.
  – Allow fats to be fully digested and absorbed
Chemical Digestion

• Nucleic Acids
  – Pancreatic Nucleases
    • Hydrolize DNA & RNA down to their nucleotides
  – Brush border enzymes dismantle nucleotides
    • Liberating free bases, pentose sugars & PO$_4$ ions
    • Nucleosidases & Phosphatases
Absorption

- Up to 10 L. enters small intestine daily
- 1 L or less leaves
- Mostly complete by Ileum
  - Ileum mostly reclaim bile salts
- ~9 L. water enter Small intestine daily
  - 95% absorbed