

Unit 2: Digestive System - Notes

1 · Introduction to the Digestive System

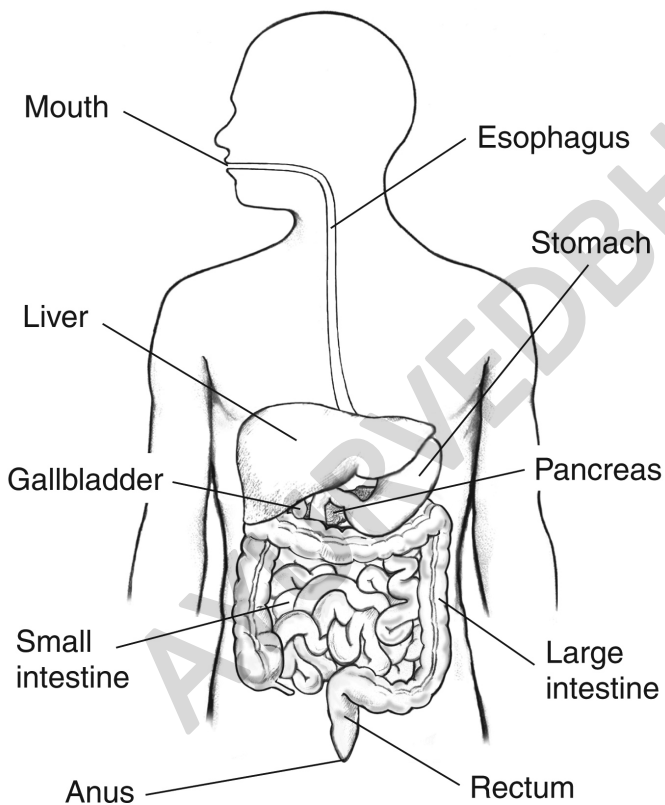
The digestive system is a highly coordinated physiological system responsible for **ingestion, digestion, absorption, assimilation, and excretion**. It transforms complex dietary substances into absorbable molecules and maintains nutritional homeostasis.

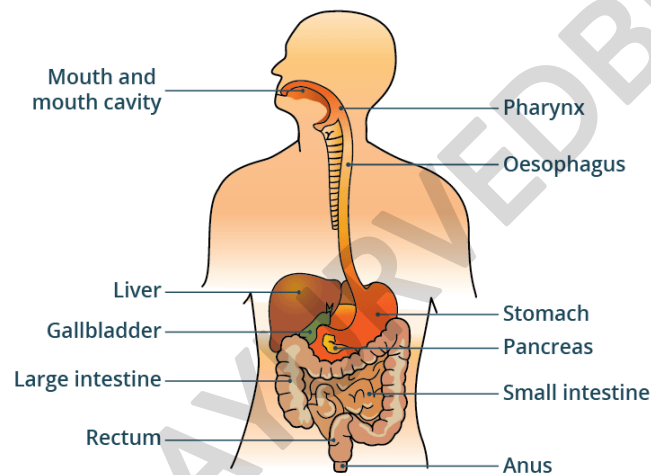
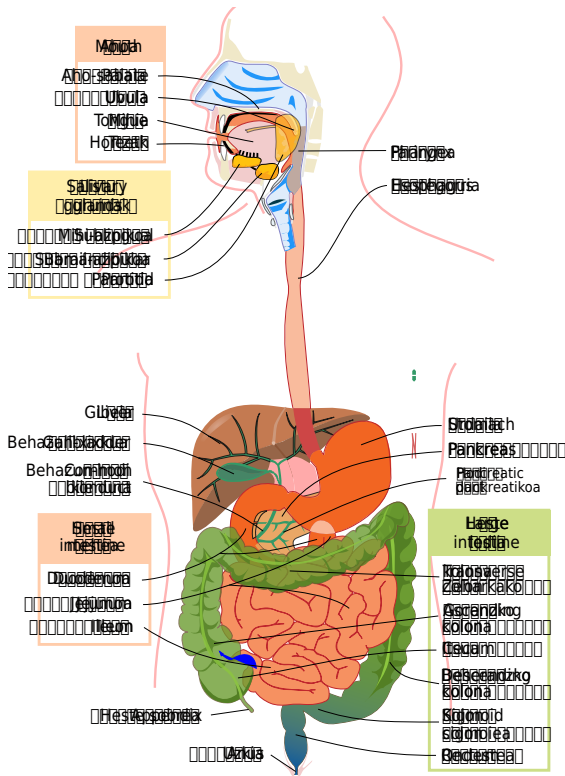
It consists of:

1. **Alimentary canal (GI tract)**
2. **Accessory organs**

2 · Structural Organisation

2.1 Alimentary Canal (Gastrointestinal Tract)

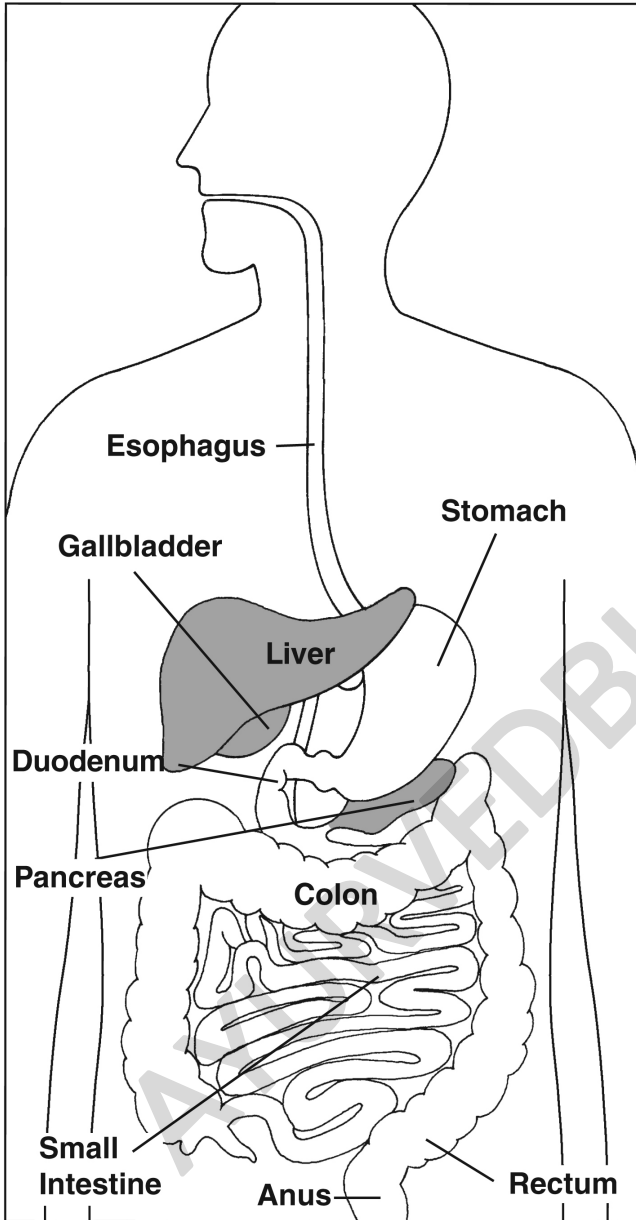


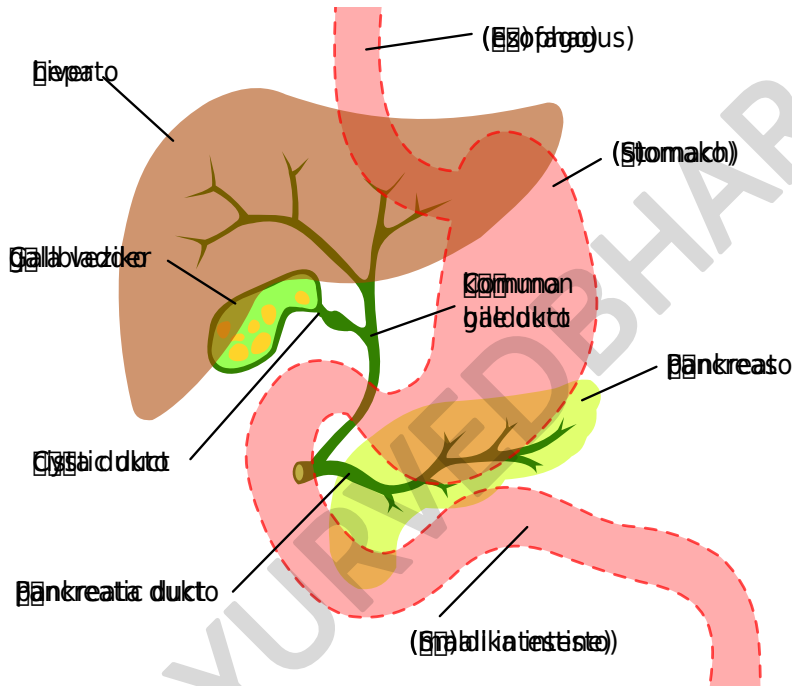
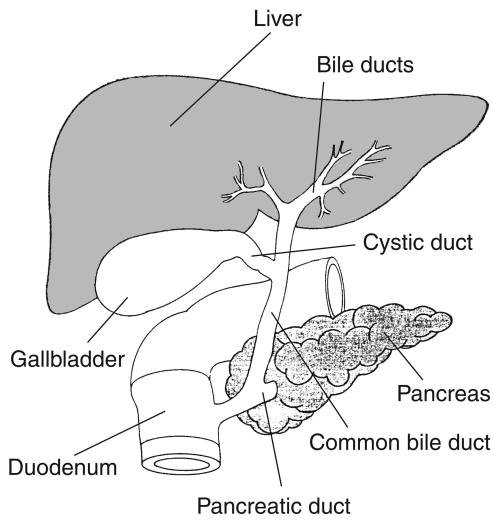


The alimentary canal is a continuous muscular tube (~8-10 meters) extending from mouth to anus:

Region	Main Functions
Oral cavity	Ingestion, mastication, salivary digestion
Pharynx	Passage of food
Esophagus	Transport via peristalsis
Stomach	Mechanical mixing, protein digestion
Small intestine (duodenum, jejunum, ileum)	Major digestion and absorption
Large intestine	Water absorption, feces formation
Rectum & Anus	Storage and elimination

2.2 Accessory Organs





Organ	Secretions / Functions
Salivary glands	Saliva (amylase, mucus)
Liver	Bile production, metabolism
Gallbladder	Bile storage and concentration
Pancreas	Digestive enzymes + bicarbonate

3 · Histological Structure of GI Tract

All regions of the alimentary canal share a common layered structure:

Layer	Components	Function
Mucosa	Epithelium + lamina propria + muscularis mucosae	Secretion, absorption
Submucosa	Connective tissue, blood vessels, nerves	Support, glandular secretion



Layer	Components	Function
Muscularis externa	Circular + longitudinal muscle layers	Peristalsis, segmentation
Serosa/Adventitia	Outer covering	Protection

4 · Functions of the Digestive System

Function	Description
Ingestion	Intake of food
Secretion	Enzymes, acids, mucus, bile
Motility	Peristalsis and segmentation
Digestion	Mechanical + chemical breakdown
Absorption	Transfer of nutrients into blood/lymph
Defecation	Elimination of waste

5 · Digestive Processes (Integrated View)

5.1 Mechanical Digestion

- Mastication (teeth)
- Gastric churning
- Intestinal segmentation

5.2 Chemical Digestion

- Enzymatic breakdown of macromolecules
- Acid hydrolysis in stomach

6 · Motility Patterns

Type	Location	Function
Peristalsis	Entire GI tract	Propulsion of food
Segmentation	Small intestine	Mixing & absorption
Mass movements	Large intestine	Fecal movement

7 · Regulation of Digestion

7.1 Neural Control

- Enteric nervous system (ENS) - “brain of gut”
- Parasympathetic (vagus) → stimulates digestion
- Sympathetic → inhibits digestion

7.2 Hormonal Control

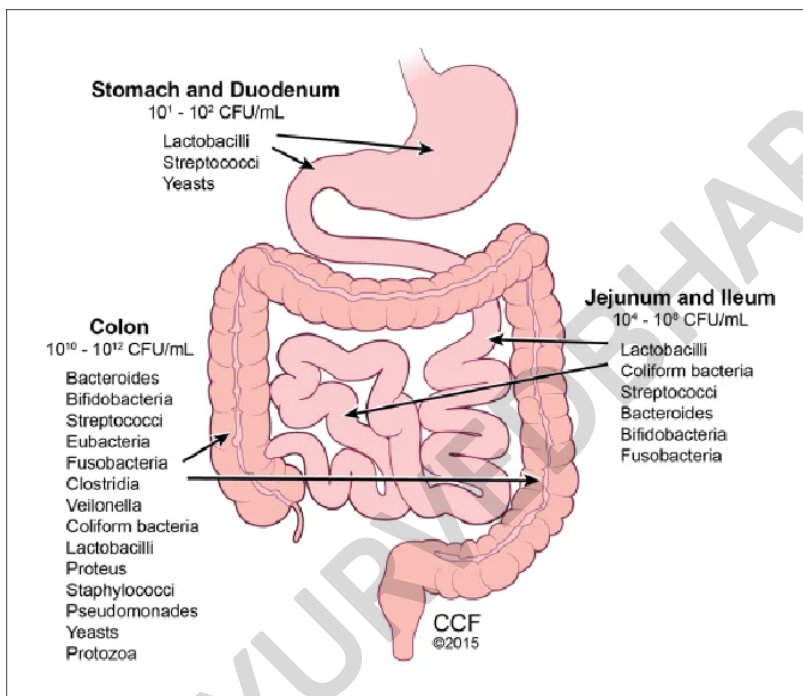
Hormone	Source	Function
Gastrin	Stomach	↑ HCl secretion
Secretin	Duodenum	↑ bicarbonate (pancreas)
CCK (Cholecystokinin)	Duodenum	↑ enzyme secretion, bile release

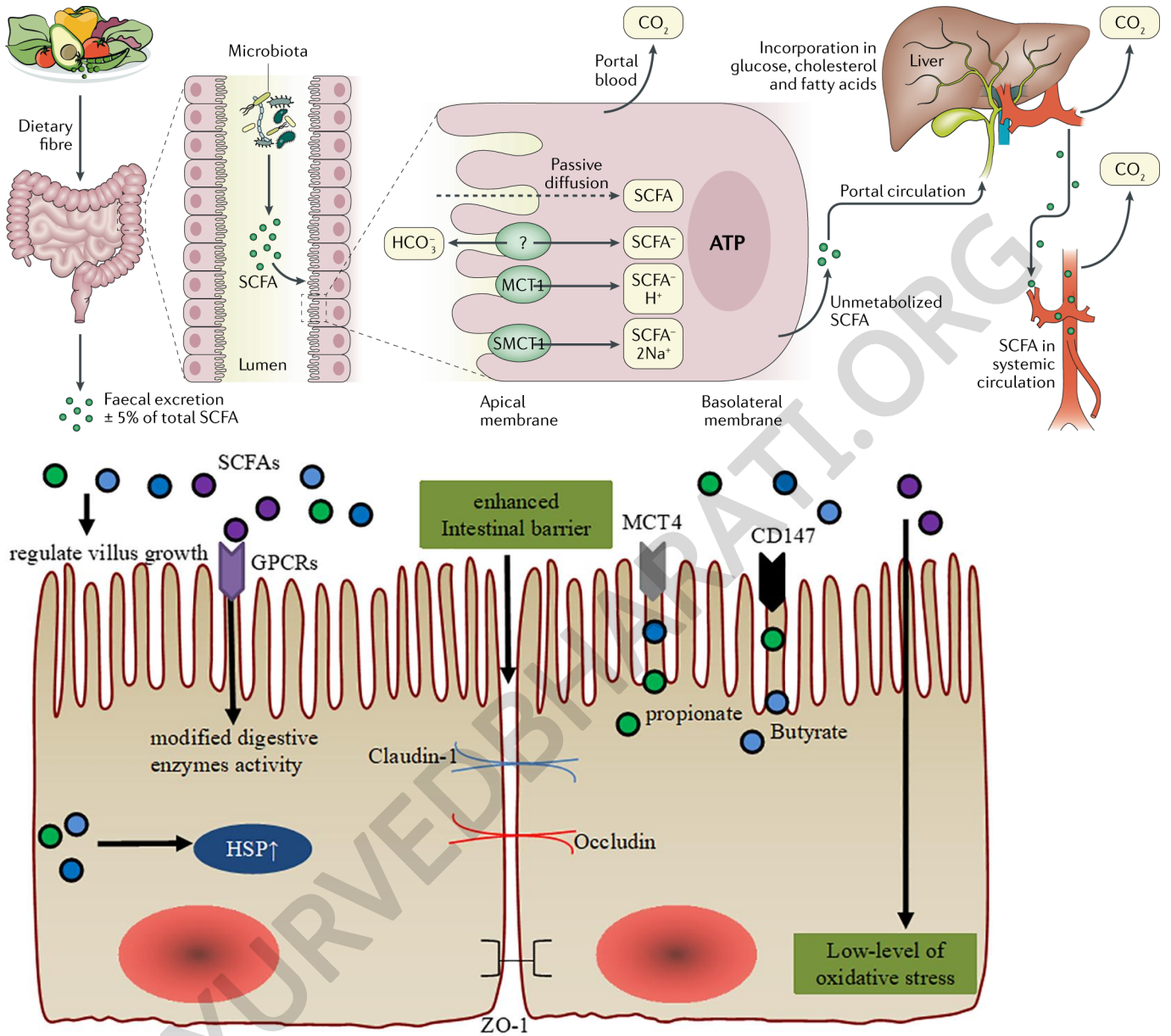
Hormone	Source	Function
GIP	Intestine	↓ gastric activity, ↑ insulin
Motilin	Small intestine	Migrating motor complex

8 · Digestion & Absorption Summary

Macronutrient	Digestion Site	Absorption Form	Transport
Carbohydrates	Mouth, small intestine	Monosaccharides	Portal blood
Proteins	Stomach, intestine	Amino acids	Portal blood
Fats	Small intestine	Fatty acids, monoglycerides	Lymph (chylomicrons)

9 · Gut Microbiota





- Trillions of microorganisms in large intestine
- Functions:
 - Fermentation of fibre → SCFA (butyrate, acetate)
 - Vitamin synthesis (K, B12 partial)
 - Immune modulation
 - Barrier protection

10 - Clinical Correlation

Condition	Pathophysiology
GERD	Lower esophageal sphincter incompetence



Condition	Pathophysiology
Peptic ulcer	HCl vs mucosal defense imbalance
Malabsorption	Enzyme deficiency or mucosal damage
Liver disease	Impaired metabolism & bile production
Pancreatitis	Enzyme autodigestion

11 · Integration with Nutrition

- Efficient digestion determines **bioavailability**
 - Liver acts as **metabolic hub**
 - Gut hormones regulate **satiety & metabolism**
 - Microbiota influences **immunity, obesity, mental health**
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12 · Key Takeaways

1. Digestive system is both **mechanical and biochemical processor**.
 2. Small intestine is the **principal site of absorption**.
 3. Liver and pancreas are **central metabolic regulators**.
 4. Gut microbiome is now considered a **functional organ**.
 5. Digestion is tightly regulated by **neural and hormonal integration**.
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Self-Assessment

1. Explain the role of bile salts in fat digestion.
 2. Differentiate peristalsis and segmentation with examples.
 3. Describe how CCK and secretin coordinate pancreatic function.
 4. Discuss the role of microbiota in nutrient metabolism.
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