Objectives

To identify accessory organs involved with digestion and highlight their respective roles.
To list the secretions involved with the digestive system.
To identify some of the disorders of the digestive system.
Review for the exam.
- Focus on electrolytes

Accessory Organs - Liver

Involves complex blood circulation.
Filters the blood – detoxifies.
Storage of glycogen
Produces bile
Makes Heparin & plasma proteins
Stores vitamins, minerals & toxins.
Stores nutrients.
Catabolizes nitrogenous wastes.

Liver composition

Functions of Hepatocytes
- Process blood-borne nutrients
- Store fat-soluble vitamins
- Perform detoxification
- Produce ~900 ml bile per day
  Produced at hepatocytes and sent to networks called - Bile canaliculi

Liver: Microscopic Anatomy

Portal triad at each corner of lobule
- Bile duct receives bile from bile canaliculi
- Portal arteriole is a branch of the hepatic artery
- Hepatic venule is a branch of the hepatic portal vein
Accessory Organs – Gall Bladder

Storage organ for bile - produced by the liver
Bile leaves via Cystic duct.
→ Joins with hepatic duct.
→ Common bile duct
Bile sent to duodenum.
Stimulated to release by a hormone made in the small intestine.

Accessory Organs - Pancreas

Delivers digestive fluids and sodium bicarbonate to the duodenum.
Two tissue types:
- Islets of Langerhans (endocrine)
  make insulin and glucagon.
- Acinar tissue (exocrine)
  make pancreatic juices / digestive enzyme

Secretions of the Pancreas

Lipase – digests lipids.
HCO3-
Pancreatic Amylase – digests carbs.
Pancreatic enzymes (cleave lg polypeptides)

Carbohydrates

A compound composed of C, H and O
With the approximate chemical formula \((\text{CH}_n\text{O})_m\)
Example \(\text{C}_6\text{H}_{12}\text{O}_6\) – glucose

Digested by Amylase (an enzyme produced by the salivary glands and pancreatic secretions). Important for starch digestion.

Leftover cellulose is further metabolized by bacteria with necessary enzymes ⇒ Vitamins K & B12 are byproducts.
Proteins

Polymers of amino acids joined by peptide bonds. Important in structure and function of all living organisms – found in muscles. Generally obtained in the diet by eating animal products.

Digested by:
- Stomach: HCl, Pepsin
- Pancreas: Peptidases, Trypsin, Chymotrypsin

Lipids

Organic, hydrophobic molecules that are insoluble in water. Contain fatty acid subunits and a carboxyl group – COOH.
Includes:
- Triglycerides – fats and oils.
- Phospholipids – found in cell membranes.
- Cholesterol – important for steroid hormones.

Digestion of Lipids

Liver/Gall Bladder – Bile (emulsifies)
- Bile made of pigments & salts.

Pancreas – Lipase (an ENZYME)
- Breaks down lipids into fatty acids and glycerol.

Hormones involved with Digestion

Stomach
- Gastrin: stimulates acid secretion by cells in the stomach and distension of stomach.

Small Intestine -
- Secretin: stimulates HCO₃ production by pancreas and liver to neutralize acid, increases bile output.
- Cholecystokinin: stimulates secretion of pancreatic enzymes and bile by gallbladder. CCK
- Gastric inhibitory peptide: inhibits stomach acid.

Recap – What is where?

<table>
<thead>
<tr>
<th>Stomach</th>
<th>Small Intestine</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCl</td>
<td>Sodium bicarbonate</td>
</tr>
<tr>
<td>Mucus</td>
<td>Amylase</td>
</tr>
<tr>
<td>Pepsin</td>
<td>Peptidase</td>
</tr>
<tr>
<td>Pepsinogen</td>
<td>Trypsin</td>
</tr>
<tr>
<td>Gastrin – H secreted here</td>
<td>Chymotrypsin</td>
</tr>
</tbody>
</table>
## Review of Electrolyte Imbalances

<table>
<thead>
<tr>
<th>Hyperkalemia</th>
<th>Hypokalemia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elevated K+</strong></td>
<td><strong>Deficiency of K+</strong></td>
</tr>
<tr>
<td>Can occur due to acidosis</td>
<td>Can occur due to alkalosis, gastric suctioning, vomiting, diarrhea</td>
</tr>
<tr>
<td>Symptoms:</td>
<td>Symptoms:</td>
</tr>
<tr>
<td>Muscle weakness</td>
<td>Fatigue</td>
</tr>
<tr>
<td>Nausea</td>
<td>Muscle weakness</td>
</tr>
<tr>
<td>Cardiac arrhythmia</td>
<td>Anorexia</td>
</tr>
<tr>
<td>Intestinal colic</td>
<td>Cardiac arrest</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Hypercalcemia</th>
<th>Hypocalcemia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elevated Ca+</strong></td>
<td><strong>Deficient Ca+</strong></td>
</tr>
<tr>
<td>Can occur due to acidosis, overactive parathyroid.</td>
<td>Can occur due inactive parathyroid, low dietary calcium intake.</td>
</tr>
<tr>
<td>Symptoms:</td>
<td>Symptoms:</td>
</tr>
<tr>
<td>Poor coordination</td>
<td>Tingling in extremities</td>
</tr>
<tr>
<td>Poor appetite</td>
<td>Increased neuron excitability</td>
</tr>
<tr>
<td>Constipation</td>
<td>Tetany</td>
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<tr>
<td></td>
<td>Carpopedal spasms</td>
</tr>
<tr>
<td></td>
<td>Convulsions and seizures.</td>
</tr>
</tbody>
</table>