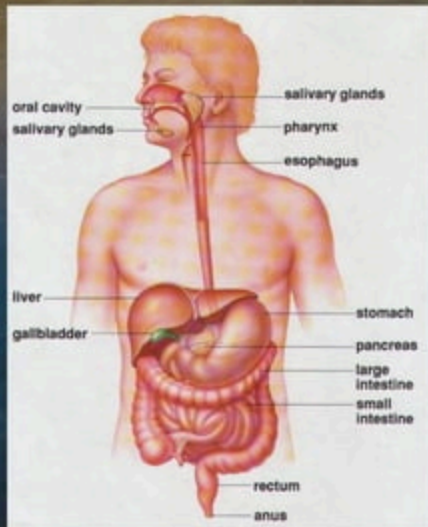


The Digestive System



The Digestive System

- Alimentation
 - Ingestion
 - Digestion
 - Egestion

Digestive System

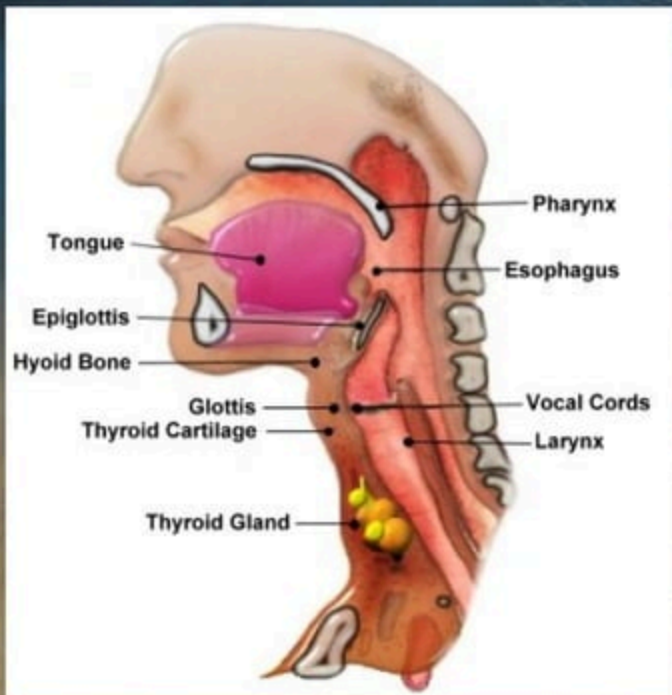
- **Ingestion**

- *What controls when and how much you eat?*
- **The Nervous System**
- **Cultural Conditioning**
- “**set point**”: normal level for body weight and amount of fat
 - Depends on concentration of glucose in the blood
 - Hypothalamus and hunger (meal to meal control)
- **Distension of the stomach**

Digestive System Structures

The Mouth

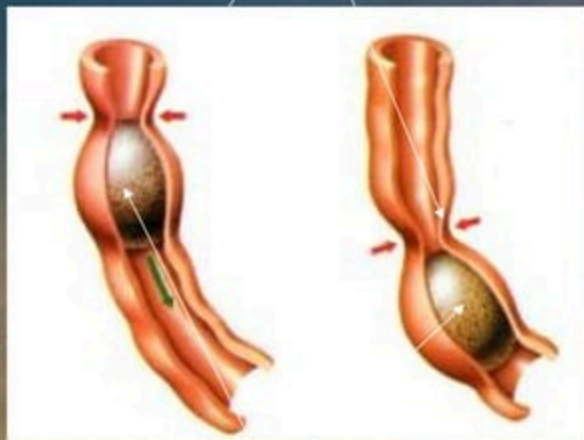
- **Teeth**
- **Saliva Glands** (Parotid, Sublingual, submaxillary)
- **Tounge** (Papillae)
- **Hard/Soft Palate**
- **Uvula**
- **Pharynx**
- **Epiglottis**



The esophagus

- Connects the pharynx to the stomach
- Three Layers
 - Mucosa,
 - Submucosa
 - muscularis
- Peristalsis
 - (animation)

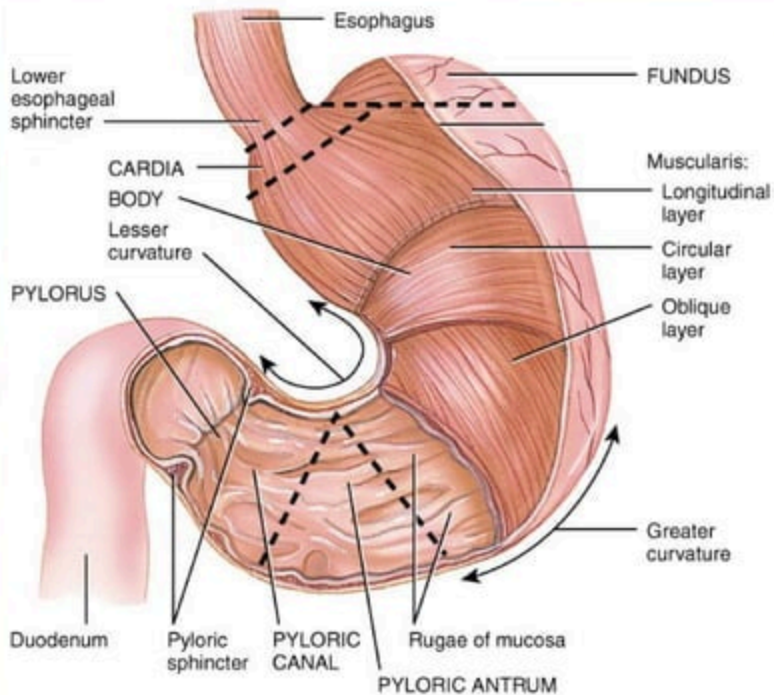
Peristaltic Contractions



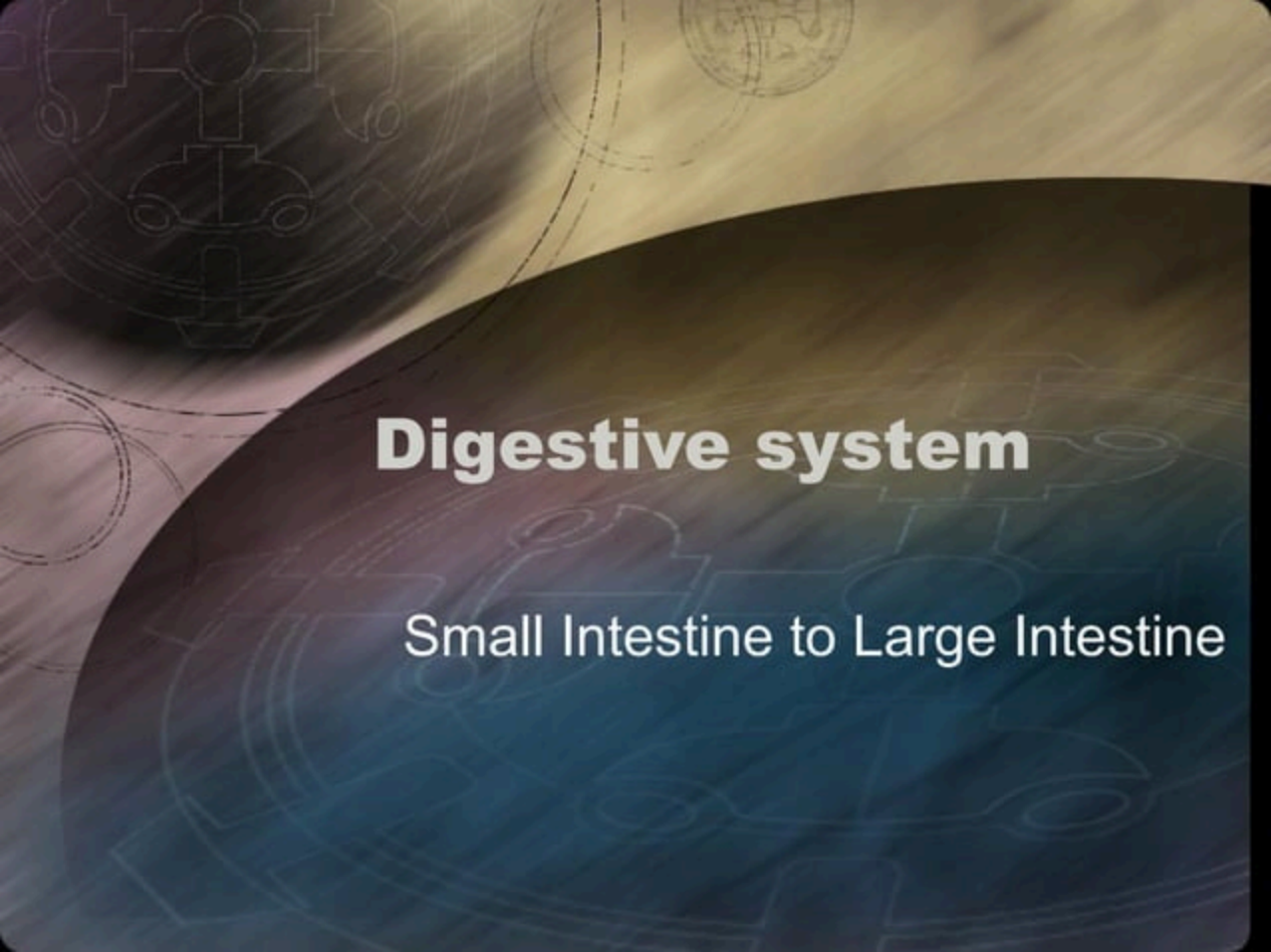
Bolus

The Stomach

- A muscular bag that stretches as it fills with food
- Three muscle layers:
 - Longitudinal, Circular, and Oblique Muscles
- Rugae
 - folds and ridges that contain gastric glands
- Sphincters: (cardiac and pyloric)



(a) Anterior view of regions of the stomach

The background features a complex pattern of faint, light-colored technical drawings and diagrams, including various geometric shapes, lines, and circular motifs. A large, dark blue, semi-circular shape is positioned in the lower half of the frame, serving as a backdrop for the text.

Digestive system

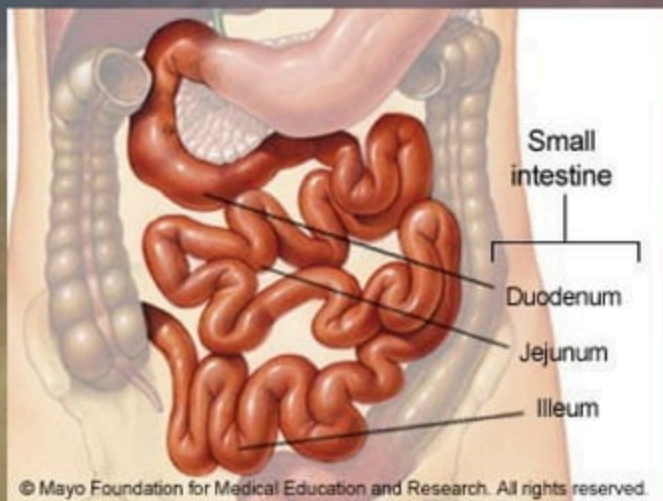
Small Intestine to Large Intestine

Small Intestine

- **Structure and Function**

Why is the small intestine so convoluted?

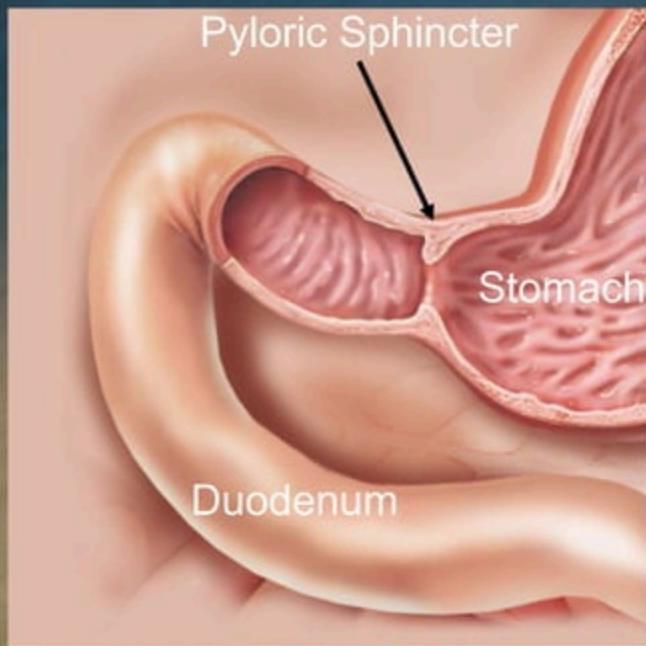
- 2-3 m long
- absorbs 90% of products of digestion
- takes 5 hrs



Small Intestine

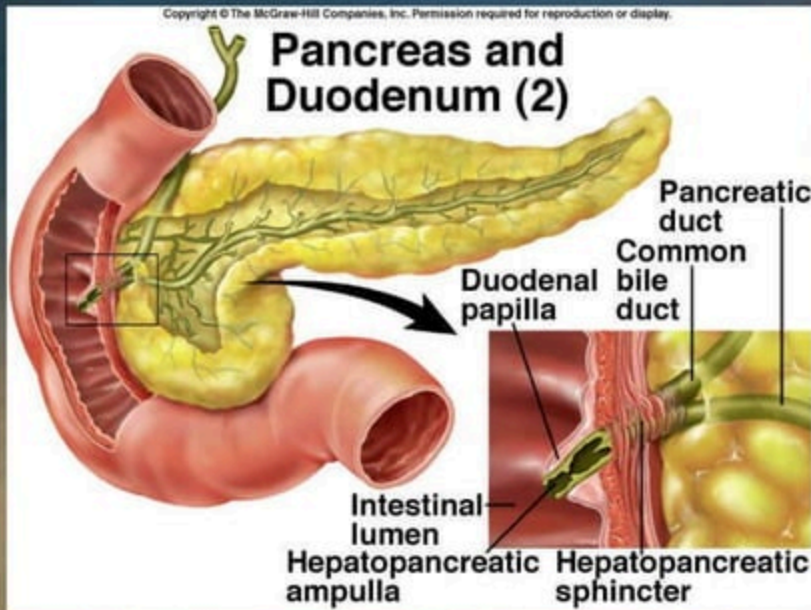
- **Duodenum:**
 - approx. 20 cm long
 - receives digestive enzymes from pancreas and liver/gall bladder
- **Jejunum**
 - approx. 1.7m long
 - most absorption occurs in Duodenum and Jejunum
- **Ileum**
 - approx. 1.1m long

Duodenum



Bile & Enzyme Secretion into the Duodenum

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The background features a complex pattern of faint, light-colored chemical structures and molecular diagrams. A large, semi-transparent blue circle is positioned in the lower half of the frame, serving as a backdrop for the text. The overall color palette is a mix of muted blues, greys, and light browns.

Chemical Digestion

Enzymes

pH Changes in Dig. Tract

Mouth

pH 7

Saliva buffered
around pH 7

Stomach

pH 1-2

HCl secretion by
parietal cells

Duodenum

pH 7-9

Partially
digested food
neutralized by
bicarbonate ions

**Lower
Intestine**

pH 5-7

pH varies

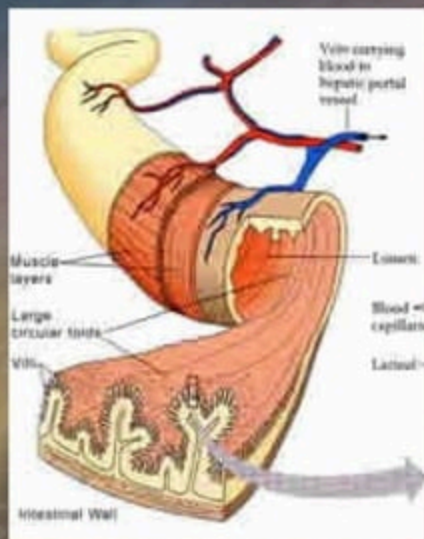
Enzymes

Source	Enzymes	Substrates
Saliva	Amylase	Starch → Maltose
	Maltase	Maltose → Glucose
Stomach	Pepsin	Proteins → a.a
	Renin	Clots milk
	Lipase	Triglyceride → f.a. + Glycerol

Source	Enzymes	Substrates
Liver	Bile	Neutralizes acids & Emulsifies fats
Pancreas	NaHCO_3 28 enzymes	Neutralizes acids See p. 225
Small Intestine	Several enzymes	See p. 225

Absorption & Increased SA

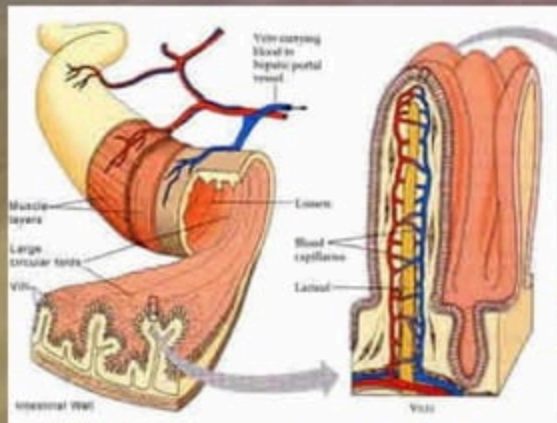
- **Mucosal folds:** the folded inner surface of the small intestine
 - increase surface area
 - aid in mixing the chyme by acting as baffles.



Absorption & Increased SA

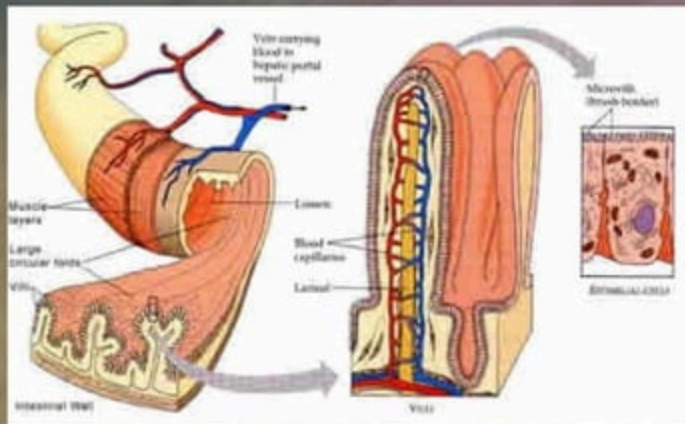
- Villi

- fingerlike structures on the mucosa that project into the lumen and are covered with epithelial cells.



Absorption & Increased SA

- **Microvilli:** the luminal plasma membrane of absorptive epithelial cells is studded with densely-packed microvilli.



Modification

Surface area

cm²

None:
plain tube

3300

Folding of
surface

10,000

Addition of villi

100,000

Addition of
microvilli

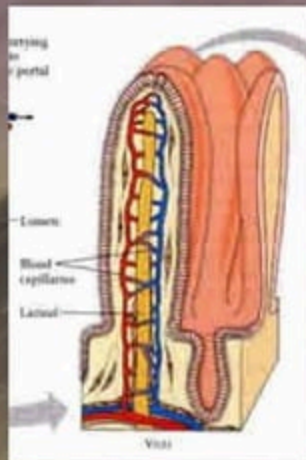
2,000,000

Absorption

- Peristaltic contractions in the intestinal walls move the chyme through the SI and increases the contact between the digested nutrients and absorptive surfaces
- Movement of sugars (glucose) and amino acids into villi is accomplished through active transport

Absorption

- Once absorbed out of the SI, nutrients need to be transported throughout the body.
- Two systems are involved:
 - The circulatory system
 - lymphatic system

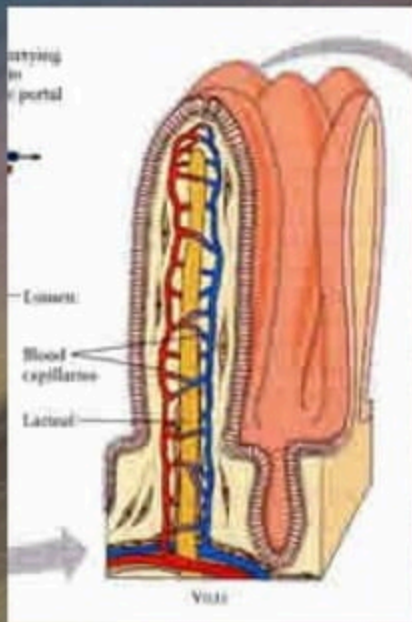


Absorption

- These transport structures are located in close proximity to absorptive surfaces
 - Capillary Network
 - within the villi, absorbed glucose and amino acids enter directly into the blood of the capillaries that will then be transported to the liver before being distributed throughout the body.

Absorption

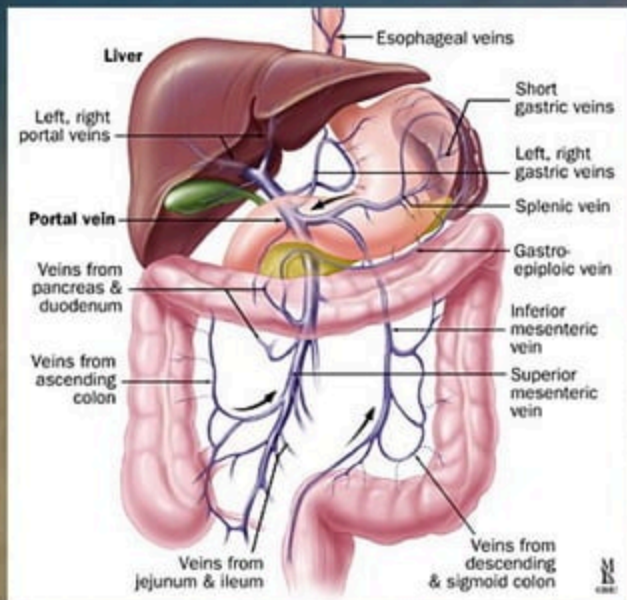
- Lacteal:
 - vessel in the villi that takes absorbed fats and transports them to larger lymphatic vessels that lead to the liver



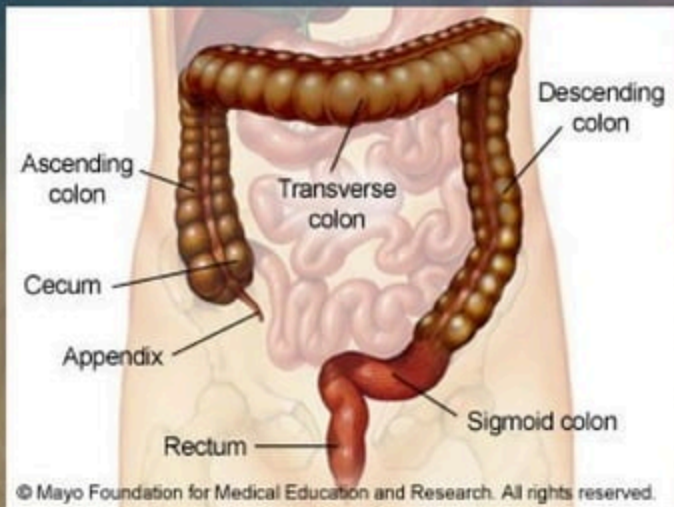
Enzymes secreted by S.I.

- carbohydrases
(list 3)
- enterokinase*
- peptidases

Absorption



The Large Intestine (Colon)

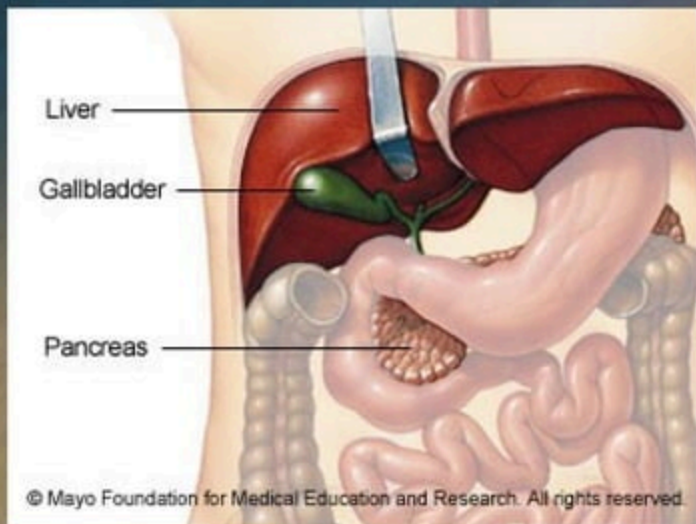


The Large Intestine

Four major functions

1. Complete absorption of digested material
2. To make vitamins (bacteria (vitamin K))
3. To recover water back into the blood
4. To form and expel feces

Accessory Organs



Accessory Organs

- Functions of the Liver
 - Production of bile (stored in the gallbladder)
 - The liver helps to maintain balance of nutrients in the body by regulating the concentration of nutrients in the blood before being sent out to the body.

Functions of the Liver

- Interconversion of carbohydrates to fats and a.a.'s to carbohydrates or fats.
- Glycogen
 - Low glucose levels in the blood cause the release of the hormone glucagon that stimulates the breakdown of glycogen into glucose.
 - When no glucose or glycogen is available, a.a.'s are converted into glucose in the liver. The process of deamination removes the amino groups from amino acids. Urea is formed and passed through the blood to the kidney for export from the body.

Functions of the Liver

- Storage of fat soluble vitamins and iron
- Synthesizes cholesterol and modifies lipids coming from fat-storage tissues
- Responsible for break down of amino acids and converts ammonia to urea
- Detoxifies poisonous chemical substances such as alcohol and drugs
- Produces proteins found in the blood that fight against infection and clotting

The Pancreas

- The pancreas produces pancreatic juice.
 - Fluid that contains the majority of the digestive enzymes used in the small intestine along with Bicarbonate ions
 - Table 6.3 p225
 - amylases
 - lipases
 - Trypsin*
 - peptidase

