



University of Babylon Hammurabi Medical college



Gastrointestinal tract

S4-Phase 1

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Structural & functional adaptations of the digestive system



OBJECTIVES

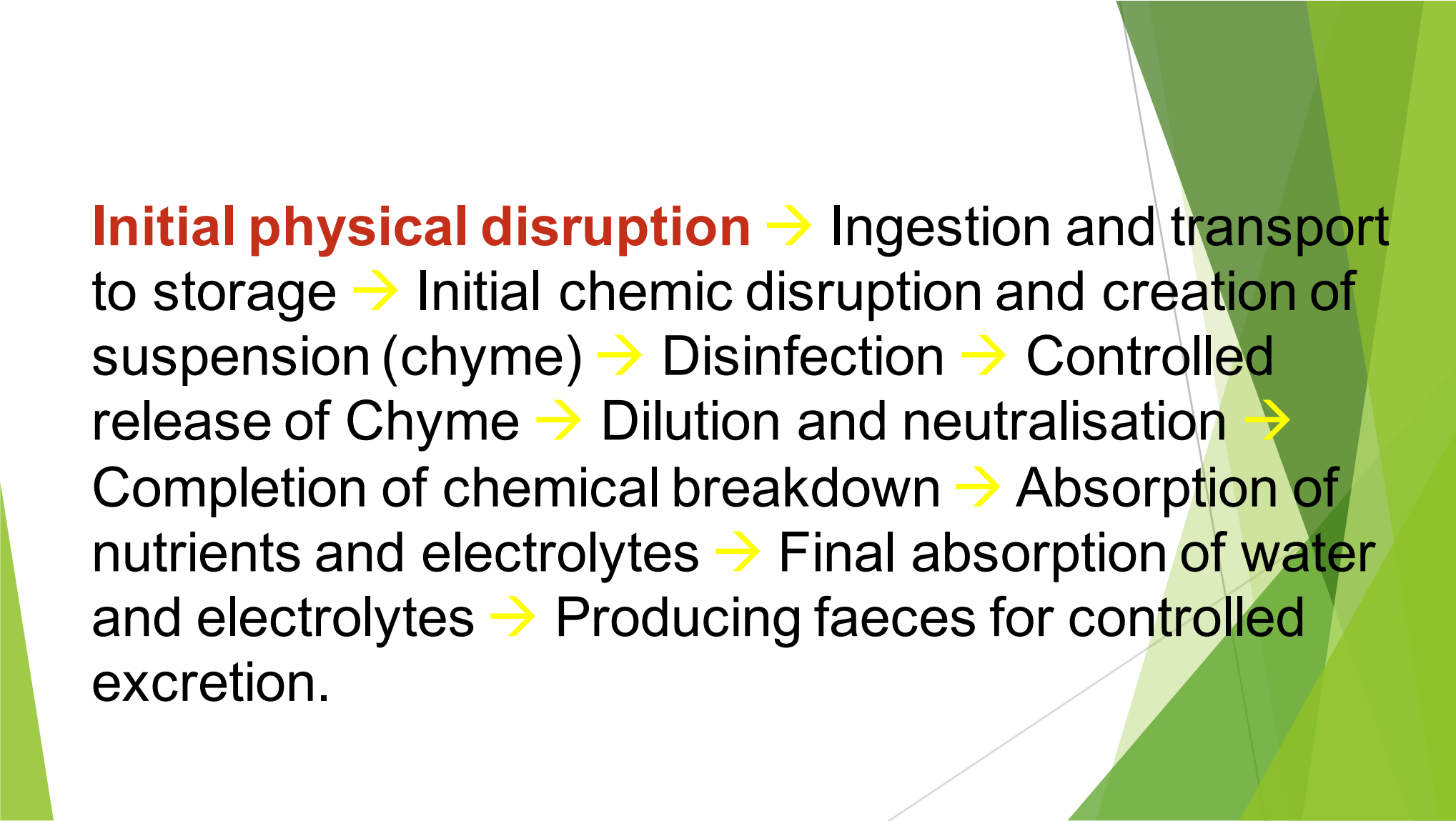
1. Outline function & a general structural plan of the digestive tract.
2. Introduce some regional variations in structure that relate to functional.
3. describe the fluid balance of the gut
4. Describe properties of hormonal and enteric nervous system.

Function of GIT system

► **Digestion** allows food to be converted to a sterile, neutral, and isotonic structure containing small, sugars, amino acids, small peptides, small particles of lipids and other small molecules. This is now ready for **absorption** and **excretion**, which is accomplished by the action of **HCl**, **bile** and **a variety of enzymes** secreted by exocrine glands – **secretion**

Motility the contractions of the smooth muscles in the walls of the tract, mix and move the ingested food from mouth to anus.

Absorption products of digestion are then taken into the blood.



Initial physical disruption → Ingestion and transport to storage → Initial chemic disruption and creation of suspension (chyme) → Disinfection → Controlled release of Chyme → Dilution and neutralisation → Completion of chemical breakdown → Absorption of nutrients and electrolytes → Final absorption of water and electrolytes → Producing faeces for controlled excretion.

Digestion

- ▶ The process of digestion can be divided into :
 - ❖ The non-specific phase involves making the larger food particles physically smaller, and
 - ❖ the specific phase breaks down the food molecules chemically via specific enzymes to smaller molecules.
- ▶ This process involves the production of **chyme**, which is a semiliquid form of ingested food & it is sterile due to the action of the stomach acid on any ingested microbes.

Digestion



Absorption

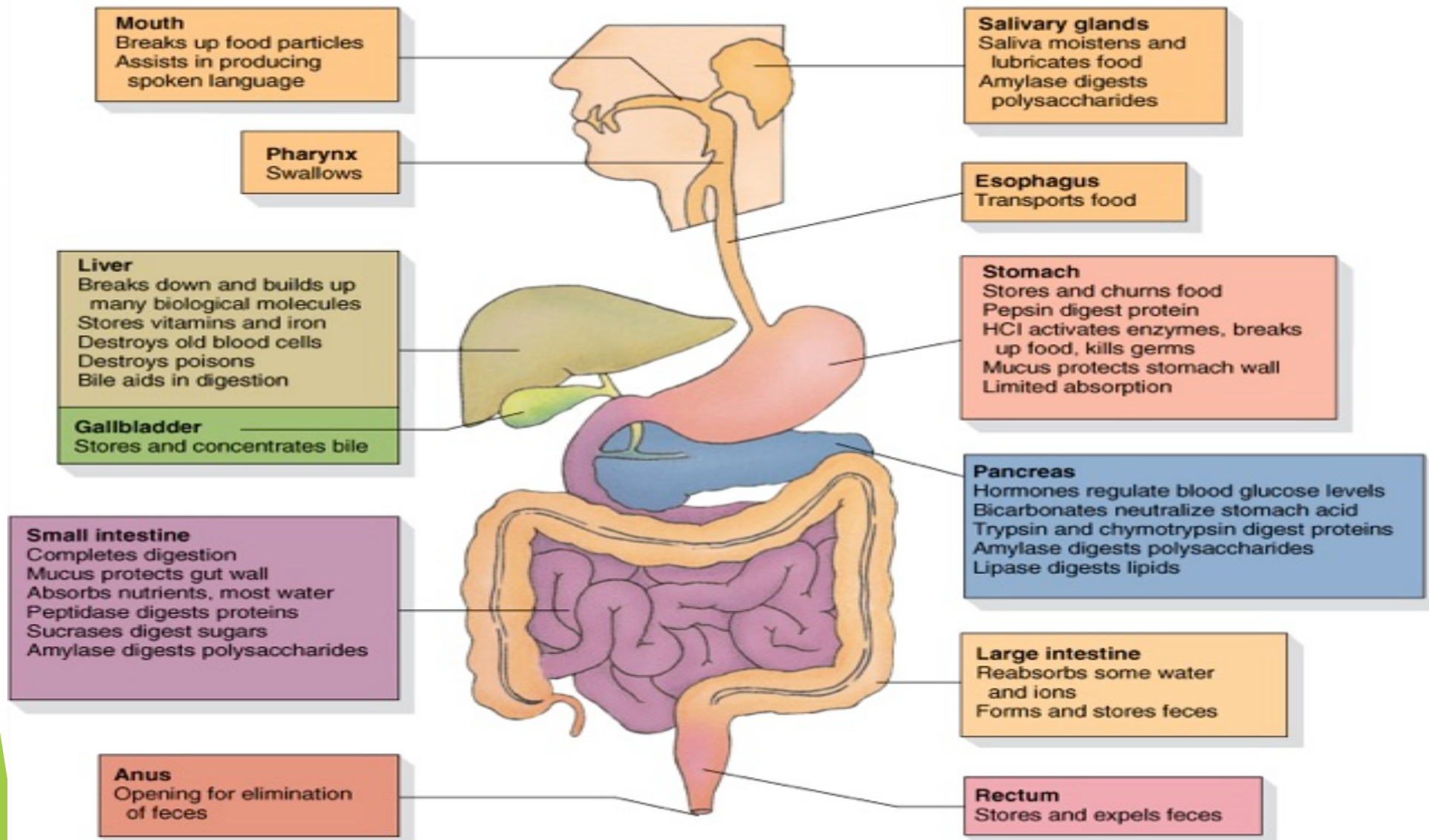
- ▶ Absorption is the specific (active or passive) uptake of nutrients molecules, water, and electrolytes.
- ▶ Fluid passes very slowly through the **small intestine** and the small intestine also has a very high surface area due to the villi and microvilli, allowing for greater rate of absorption.
- ▶ In the **large intestine**, the remaining water and electrolytes are absorbed. The slow transit through the large intestine allows water to be reabsorbed by the gut and leaves dry faeces to accumulate in the sigmoid colon and anal canal.

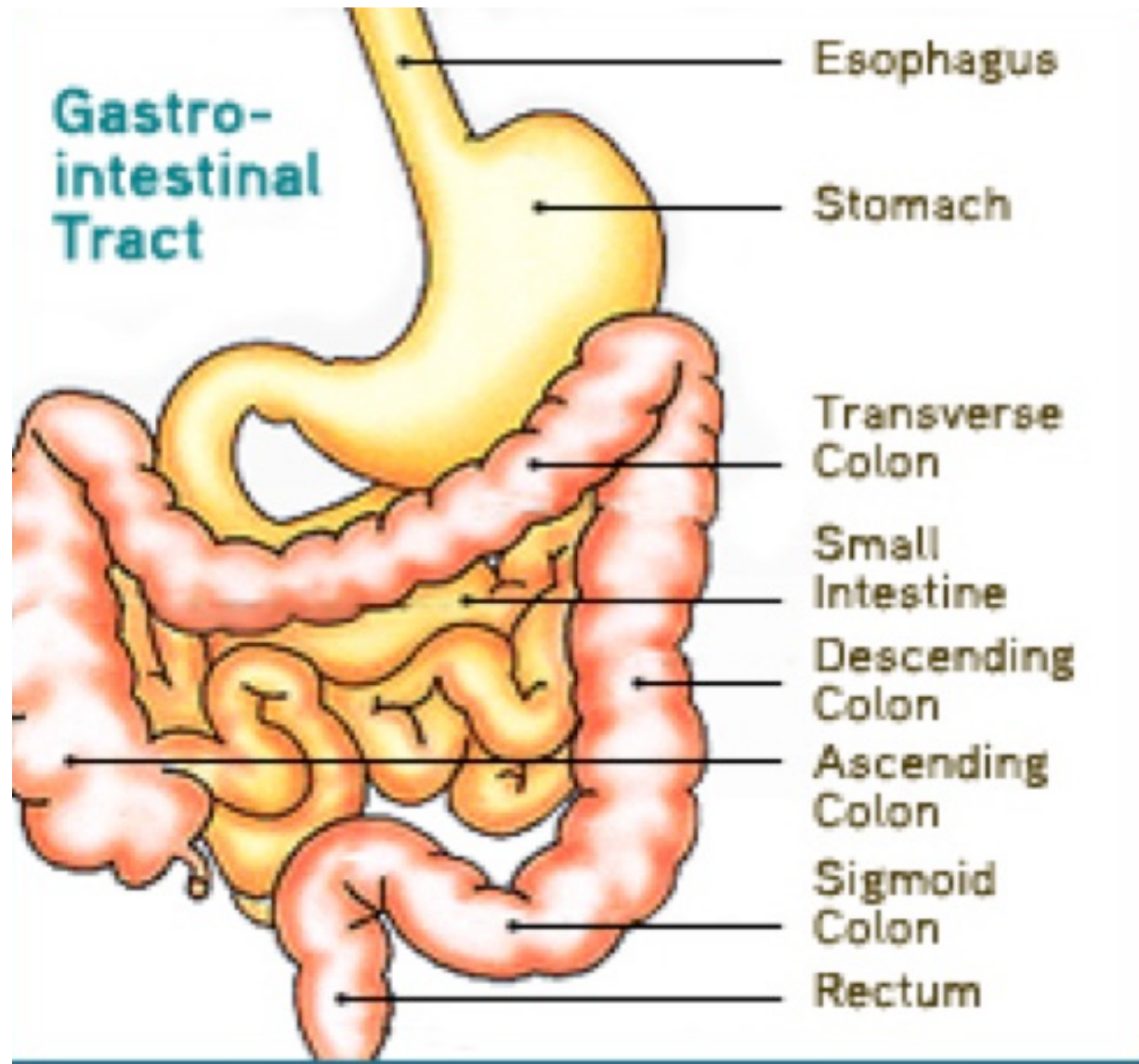
Small intestine absorbs about (12.5L)of the fluid,

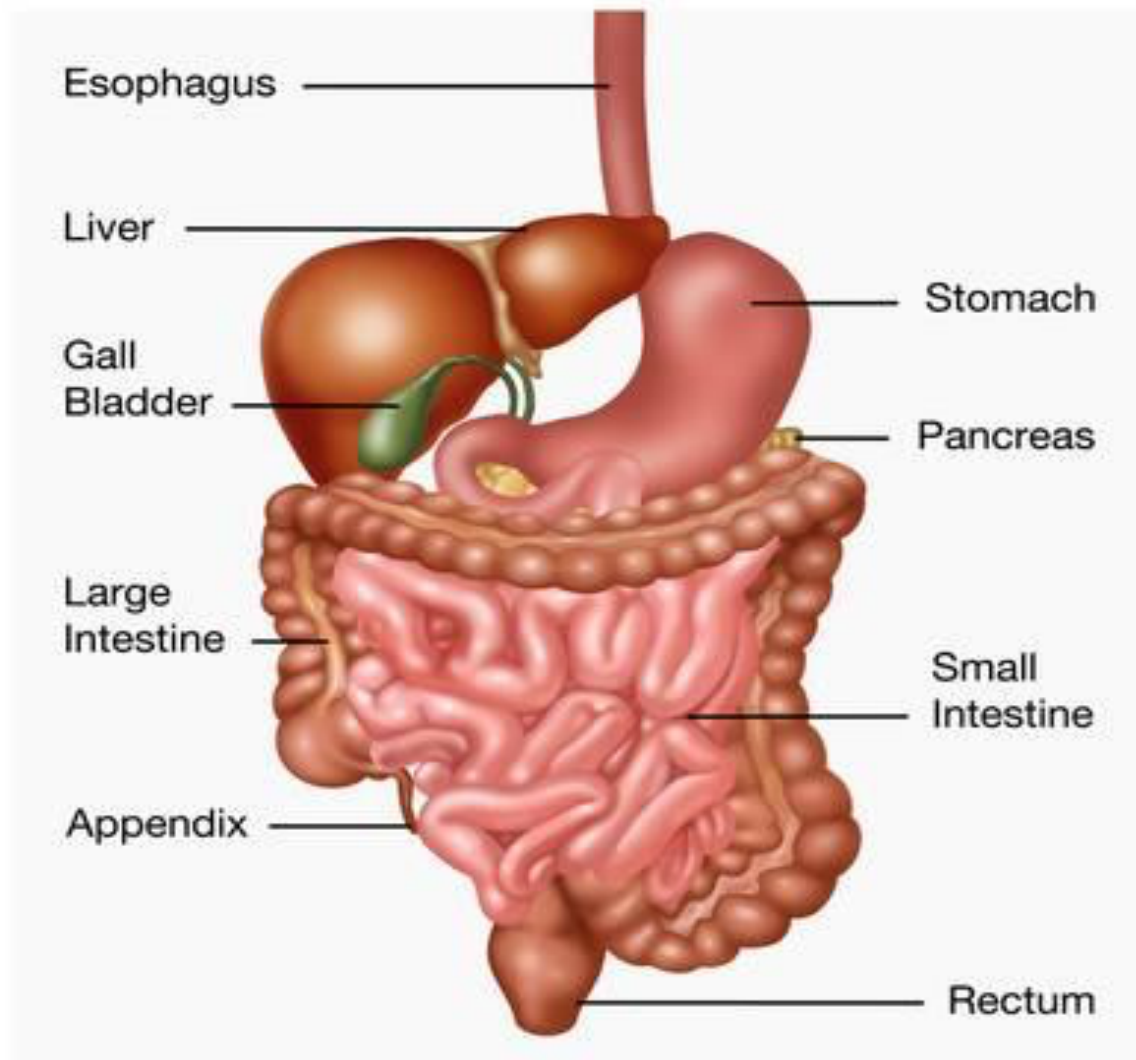
Large intestine absorbs about 1.35L.

Excretion

- ▶ Faeces are propelled periodically into the rectum, causing an urge to defecate. When the sphincters relax around the anus, the faeces are expelled.
- ▶ From the table , it is easy to understand why diarrhoea and vomiting are major causes of dehydration as water added to the solution is lost before being reabsorbed. There will also be GI disturbances such as constipation as a result.







broad functions of the various regions of the GI tract

Mouth and Oesophagus

▶ **Mastication**

▶ **Saliva production**

1. Protects mouth
 - Wets / Bacteriostatic / Alkaline / High Ca^{2+}
2. Lubricates food for mastication and swallowing
 - Wet / Mucus
3. Starts digestion
 - Sugars

▶ **Swallowing**

- ▶ Formation of bolus
- ▶ Rapid oesophageal transport



Stomach

Storage

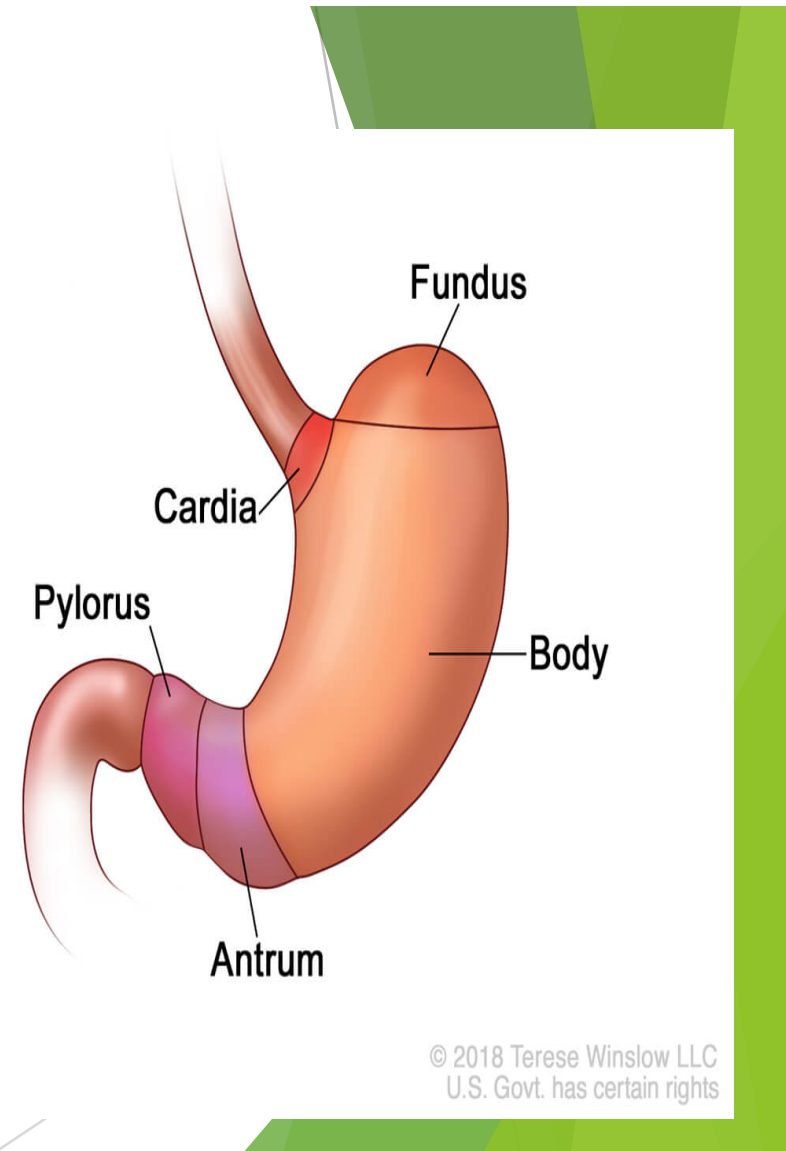
Relaxes to accommodate food

Initial disruption

- Contracts rhythmically to mix and disrupt
- Secretes acid and Proteolytic enzymes to break down tissues & disinfect as Chyme

Delivers

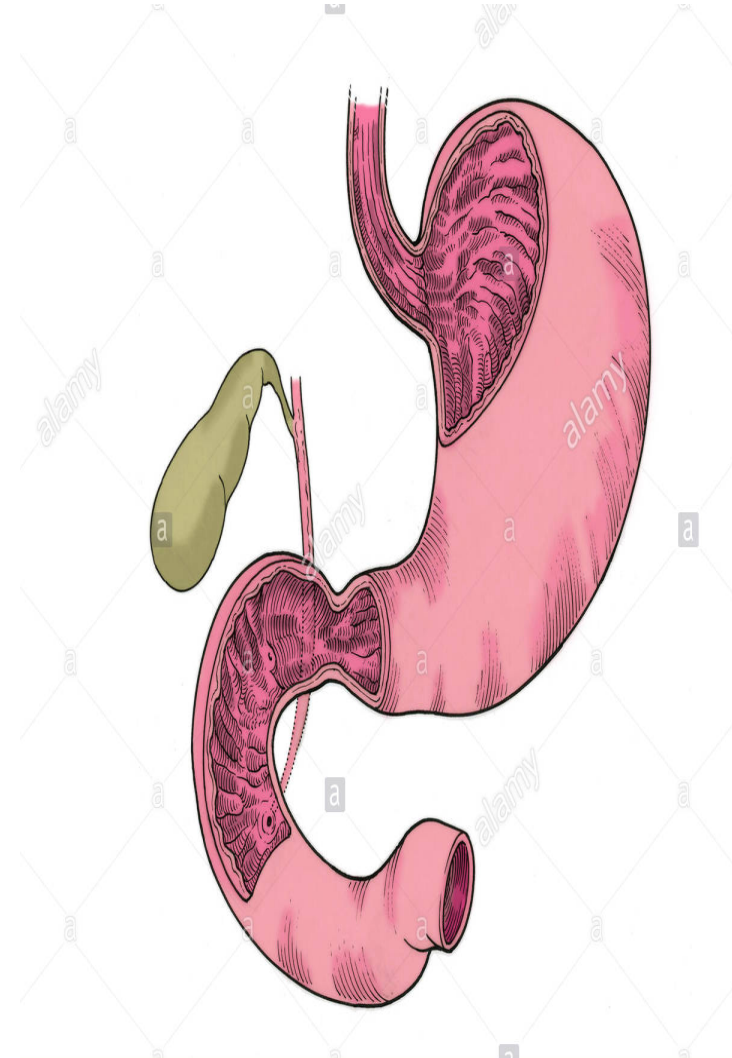
Chyme slowly into the Duodenum



Duodenum

Dilution and neutralisation of Chyme

- Water drawn in from ECF. Stomach impermeable, Duodenum permeable.
- Alkali (bile) added from Liver and Pancreas
- Enzymes added from pancreas

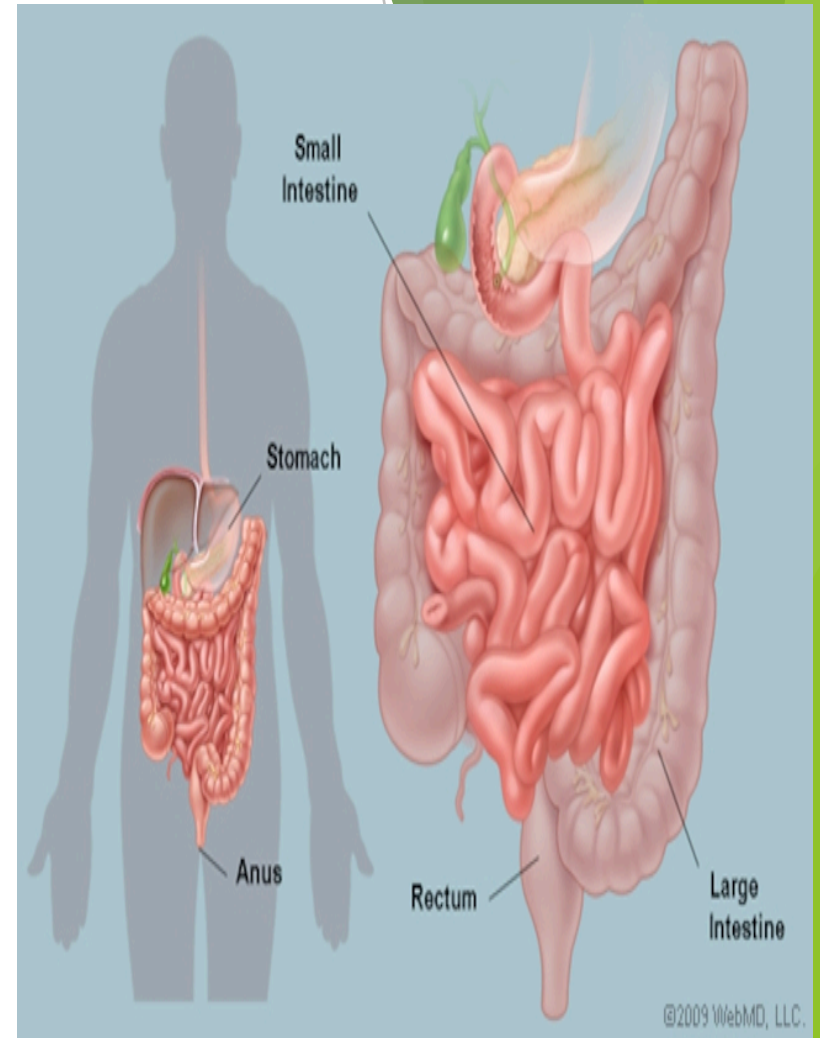


Balance of gut

Description	Water in GI tract lumen
Eat 1kg a food per day	1L
Add 1.5l of saliva	2.5L
Add 2.5l of gastric secretion	5L
Addition of 9l of fluid for isotonic and neutral	14L
Small intestine absorbs 12.5l of water	1.5L
Large intestine absorbs 1.35l	0.15 L
Remaining in faeces	0.15kg

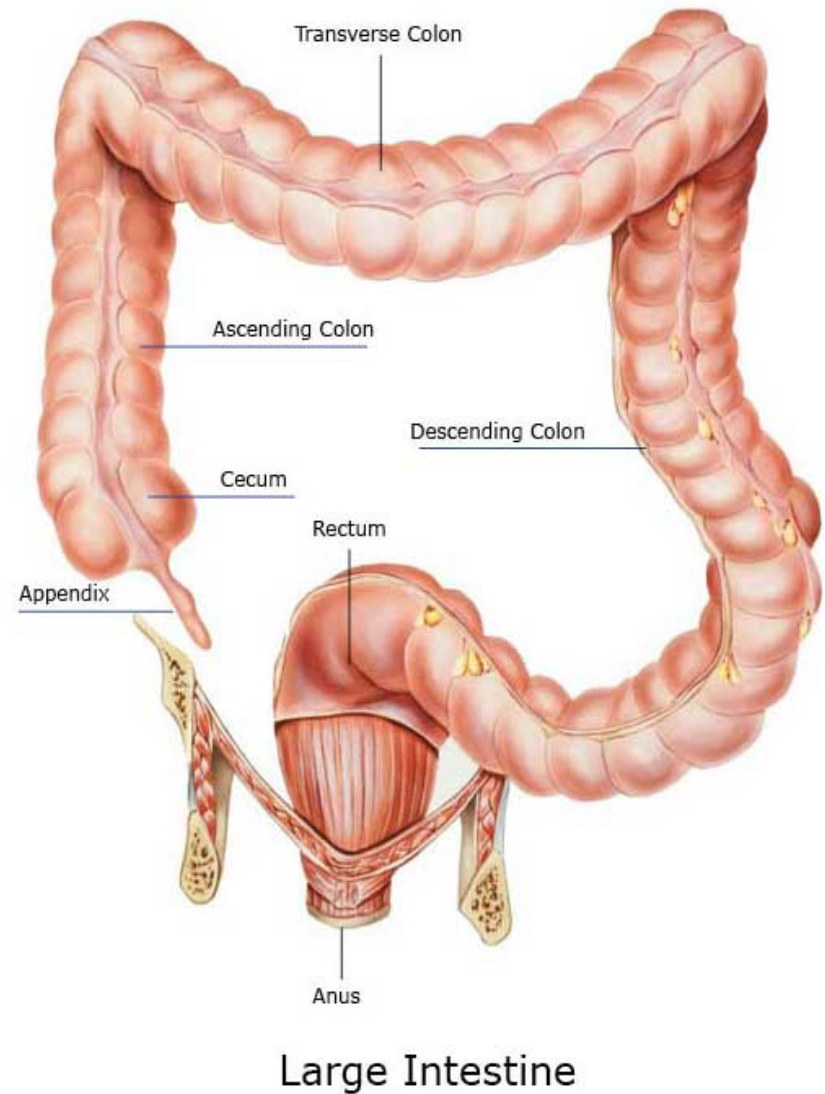
Small Intestine

- ❖ **Absorption of nutrients & electrolytes**
 - Fluid passes very slowly through the small intestine
 - Large surface area
 - Epithelial cells absorb molecules, some actively some passive
 - Often coupled to Na^+ , absorption pass into hepatic portal circulation (first pass...)
- ❖ **Absorbs the majority of water** (1.5L vs. 0.15L large intestine)



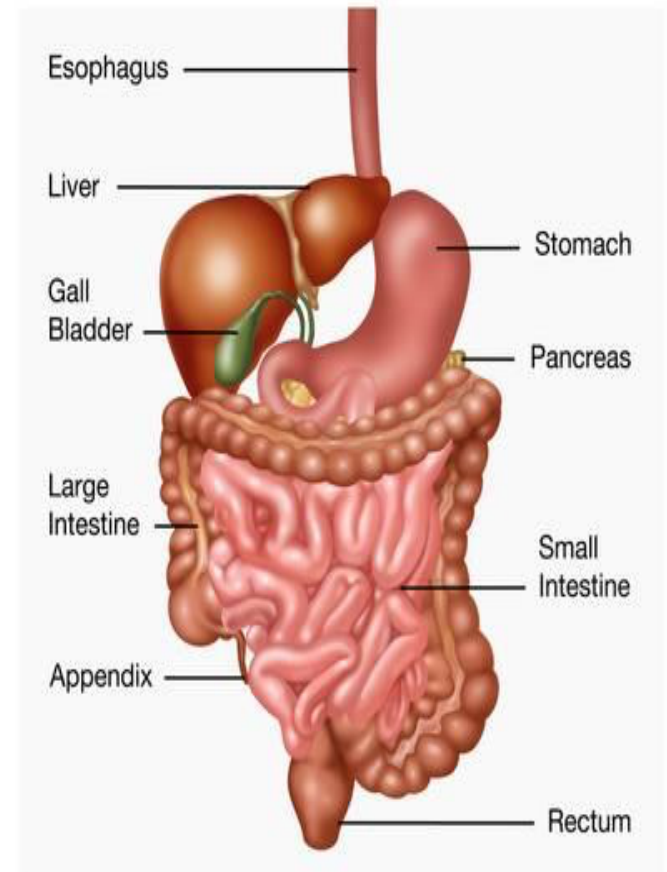
Large Intestine

- Final absorption of water (0.15)
- Very slow transit
- Faeces form and accumulate in the descending and sigmoid colon



Rectum

- Faeces propelled periodically into rectum
- Urge to defecate
- Controlled relaxation of sphincters and expulsion of faeces



Enteric nervous system and its relationship to the autonomic nervous system

The enteric nervous system is a subdivision of the autonomic nervous system that directly controls motility the GI system.

The enteric nervous system is made up of two nerve plexuses in the wall of the gut which may act independently of the CNS (short reflex pathway).

Parasympathetic control is the most significant. It coordinates both secretion and motility using a range of neurotransmitters.

Hormonal Activation

- ▶ A dozen or more peptide hormones are released by endocrine cells in the walls of the gut. Some of these

1. - a paracrine action,
2. - hormone with true endocrine action.

hormones comprise 2 structurally related "groups" :

gastrin group and **secretin group**.

- ▶ These hormones are released from one part of the gut to affect the secretions or the motility of other parts.

THANK YOU

