

The 11 Major structures

Oesophagus

Stomach

Small intestine:

Duodenum

Jejunum

Ileum

Large intestine:

Ascending colon

Transverse colon

Descending colon

Sigmoid colon

Rectum

Anus

Regulation of acid secretion

Atropine: Muscarinic antagonist

NSAID's & PG's: PGE decreases acid

Misoprostol=PGE2 analogue

Proglumide: Gastrin receptor antagonist

H2 receptor antagonists: Cimetidine

Ranitidine

Famotidine

Proton Pump Inhibitors: Omeprazole

Pantoprazole

Rabeprazole

Esomeprazole

Digestive Processes

6 basic processes in digestion:

1. Ingestion

2. Secretion

3. Motility

4. Digestion

5. Absorption

6. Defecation

Saliva

Constituents: Mostly water
99.5%

Saliva (cont)

Hormones in GI tract

Hormone:

Gastrin: Released by: G cells (in the stomach)

Triggered by: Food in the stomach (especially proteins), stomach distension

Main actions: Increases HCl (acid) secretion from parietal cells. Stimulates gastric motility. Promotes growth of stomach lining.

Secretin: Released by: Duodenum (when acidic chyme enters)

Hormones in GI tract (cont)

Triggered by: Low pH (acid from the stomach)

Main actions: Stimulates bicarbonate secretion from pancreas (to neutralize acid). Inhibits gastric acid secretion. Slows gastric emptying.

Cholecyst-okinin (CCK): Released by: Duodenum and jejunum

Triggered by: Fats and proteins in the chyme

0.5% Ions,
solutes: dissolved
gases, urea,
uric acid,
mucus,
immunoglo-
bulin A,
lysozyme
and salivary
amylase
(acts on
starch) &
muramidase
(anti-bac-
terial)

Not all Subman-
salivary dibular and
glands sublingual:
produce mucin rich
the saliva
same
saliva

Parotid:
salivary
amylase

**Control
of
saliva-
tion:** Controlled by
autonomic nervous
system

Parasympathetic
stimulation promotes
secretion of moderate
amount of saliva

Sympathetic stimu-
lation decrease
salivation



Hormones in GI tract (cont)		Overview of GI tract functions		Pancreas (cont)		Pancreas	
Main actions:	Stimulates bile release from gallbladder. Stimulates enzyme secretion from pancreas. Slows gastric emptying (so digestion has time to occur).	Mouth:	Bite, chew, swallow	Pancreatic juice secreted into pancreatic duct and accessory duct and to small intestine	Pancreatic duct joins common bile duct and enters duodenum at hepatopancreatic ampulla	Lies posterior to greater curvature of stomach	
Motilin:	Released by: Small intestine (cyclically, between meals) Triggered by: Fasting state	Pharynx and oesophagus:	Transport	Histology:	99% of cells are acini: Exocrine Secrete pancreatic juice -mixture of fluid and digestive enzymes 1% of cells are pancreatic islets (islets of Langerhans) Endocrine Secrete hormones glucagon, insulin, somatostatin, and pancreatic polypeptide	Pancreatic juice secreted into pancreatic duct and accessory duct and to small intestine	Pancreatic duct joins common bile duct and enters duodenum at hepatopancreatic ampulla
Main actions:	Stimulates migrating motor complexes (waves of contraction that clear the gut). Keeps the gut "clean" between meals.	Stomach:	Mechanical disruption; absorption of water & alcohol			Histology:	99% of cells are acini: Exocrine Secrete pancreatic juice -mixture of fluid and digestive enzymes 1% of cells are pancreatic islets (islets of Langerhans) Endocrine Secrete hormones glucagon, insulin, somatostatin, and pancreatic polypeptide
		Small intestine:	Chemical & mechanical digestion & absorption				
		Large intestine:	Absorb electrolytes & vitamins (B and K)				
		Rectum and anus:	Defecation				
		Histology of the Small Intestine					
		2 muscle layers:	Serosa not adventitia				
		Microvilli are microscopic folds in the apical surface of the plasma membrane on each simple columnar cell (about 200 million/mm ²). The plicae circulares, villi, and microvilli all contribute to increase the surface area of the small intestine, allowing for maximum absorption of nutrients. Digestive enzymes attached to the microvilli complete the digestive process of carbohydrates and proteins, called a brush border.					
		Pancreas					
		Lies posterior to greater curvature of stomach					

The Large Intestine			Phases of Digestion (cont)			Pancreatic Juice (cont)			Major Valves (Sphincters) (cont)					
The large Intestine has 4 parts:	The cecum		Intestinal Phase:	Neural and hormonal mechanisms	Activates the small intestine and inhibits gastric emptying and secretions	Proteolytic enzymes - trypsin (secreted as trypsinogen), chymotrypsin (chymotrypsinogen), carboxypeptidase (procarboxypeptidase), elastase (proelastase)			External anal sphincter		Voluntary skeletal muscle			
	The ascending colon:					Pancreatic lipase								
	Transverse					Ribonuclease and deoxyribonuclease								
	Descending													
	Sigmoid													
The rectum			Visceral Muscle Contractions Summary			Major Valves (Sphincters)			Pancreas:					
The anal canal			Oesophagus:	Peristaltic		Oesophagus:	Upper oesophageal sphincter	Pharynx and oesophagus	Exocrine:	Digestive enzymes: bicarbonate				
There are no circular folds or villi in the large intestine. The mucosa is mostly an absorptive epithelium (mainly for water), and microvilli are plentiful. Interspersed goblet cells produce mucous, but no digestive enzymes are secreted			Stomach:	Peristaltic						Lower oesophageal sphincter	Oesophagus and stomach	Bile salts:	E.g Deoxycholic acid emulsification of fats	
			Small intestine:	Segmental, MMC									Stomach:	Cardiac sphincter (LOS)
			Colon:	Segmentation, Mass movement		Large intestine valves:	Internal anal sphincter	Involuntary smooth muscle	Circular folds called the plicae circulares are permanent ridges of the mucosa and submucosa that encourage turbulent flow of chyme.					
Phases of Digestion			Pancreatic Juice									Control of Gastrointestinal Function		
Cephalic phase:	Stimulates salivary and gastric secretions and motility	Sight, smell and thought of food. Prepares mouth and stomach for food	Constituents:	Mostly water					Enteric nervous system (ENS):	Intrinsic set of nerves - "brain of gut"				
				Sodium bicarbonate - buffers acidic stomach chyme						Neurons extending from oesophagus to anus				
Gastric phase:	Neural and hormonal mechanisms	Activates gastric secretions			Enzyme: Pancreatic amylase									

Control of Gastrointestinal Function (cont)			Gastric glands and cell types in the stomach		Summary of Organs in the GI system (cont)	Summary of Organs in the GI system (cont)
2 plexuses			Surface mucous cell:	Secretes Mucus	Pancreas:	Stomach:
Myenteric plexus:	GI tract motility				Pancreatic juice buffers acidic gastric juice in chyme, stops the action of pepsin from the stomach, creates the proper pH for digestion in the small intestine, and participates in the digestion of carbohydrates, proteins, triglycerides and nucleic acid.	Mixing waves combine saliva, food, and gastric juice, which activates pepsin, initiates protein digestion, kills microbes in food, helps absorb vitamin B12, contracts the lower oesophageal sphincter, increase stomach motility, relaxes the pyloric sphincter and moves chyme into the small intestine.
	Submucosal plexus	Controlling secretions	Mucous neck cells:	Secretes Mucus		
Autonomic nervous system	Extrinsic set of nerves		Parietal cells:	Secretes hydrochloric acid and intrinsic factor		
	Parasympathetic stimulation increases secretion and activity by stimulating ENS		Chief cells:	Secretes pepsinogen and gastric lipase		
	Sympathetic stimulation decreases secretions and activity by inhibiting ENS		G cell:	Secretes the hormone gastrin		
			Summary of Organs in the GI system		Liver:	
			Tongue:	Manoeuvres food for mastication, shapes food into a bolus, manoeuvres food for deglutition, detects sensations for taste, and initiates digestion of triglycerides	Produces bile, which is required for the emulsification and absorption of lipids in the small intestine	Small intestine:
			Salivary glands:	Saliva produced by these glands softens, moistens, and dissolves foods; cleanses mouth and teeth: initiates the digestion of starch	Gallbladder:	Segementation mixes chyme with digestive juices: peristalsis propels chyme toward the ileocecal sphincter: digestive secretions from the small intestine, pancreas, and liver complete the digestion of carbohydrates, proteins, lipids and nucleic acids: circular folds, villi and microvilli help absorb about 90% of digest of nutrients
			Teeth:	Cut, tear, and pulverise food to reduce solids into smaller particles for swallowing	Mouth:	
					Buccal glands lining the mouth produce saliva	
					Pharynx:	
					Receives a bolus from the oral cavity and passes it into the oesophagus	
					oesophagus:	
					Receives a bolus from the pharynx and moves it into the stomach: this requires relaxation of the upper oesophagus sphincter and secretion of mucus	

Summary of Organs in the GI system (cont)

Large intestine: Haustral churning, peristalsis, and mass peristalsis drive the colonic contents into the rectum: bacteria produce some B vitamins and vitamin K: absorption of some water, ions and vitamin occurs: defecation



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