Cheatography

Gastrointestinal Physiology Cheat Sheet

by MJC3 via cheatography.com/212269/cs/46140/

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
	Misoprost-ol=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

Consti-tuents:	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.
Cholec yst-okinin (CCK):	Released by: Duodenum and jejunum
	Triggered by: Fats and proteins in the chyme

	0.5% solutes:	Ions, dissolved gases, urea, uric acid, mucus, immunoglo-bulin A, lysozyme and salivary amylase (acts on starch) & muramidase (anti-bac-terial)
	Not all salivary glands produce the same saliva	Subman-dibular and sublingual: mucin rich saliva
		Parotid: salivary amylase
Control of saliva-tion:	Controlled by autonomic nervous system	
	Parasympathetic stimulation promotes secretion of moderate amount of saliva	
	Sympathetic stimul-ation decrease salivation	

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Hormones in GI tract (cont)

Main actions:	Stimulates bile release from gallbl-adder. Stimulates enzyme secretion from pancreas. Slows gastric emptying (so digestion has time to occur).
Motilin:	Released by: Small intestine (cyclically, between meals)
	Triggered by: Fasting state
Main actions:	Stimulates migrating motor complexes (waves of contraction that clear the gut). Keeps the gut “clean” between meals.

Overview of GI tract functions

Mouth:	Bite, chew, swallow
Pharynx and oesoph-agus:	Transport
Stomach:	Mechanical disrup-tion; absorption of water & alcohol
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/mm2). The plicae circul-ares, 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 carboh-ydrates and proteins, called a brush border.

Pancreas

Lies posterior to greater curvature of stomach

Pancreatic juice secreted into pancreatic duct and accessory duct and to small intestine	Pancreatic duct joins common bile duct and enters duodenum at hepatopan-creatic ampulla
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

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The Large Intestine

The large Intestine has 4 parts:	The cecum	
	The colon:	Ascending
		Transverse
		Descending
		Sigmoid
	The rectum	
	The anal canal	

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

Phases of Digestion

Cephalic phase:	Stimulates salivary and gastric secretions and motility	Sight, smell and thought of food. Prepares mouth and stomach for food
Gastric phase:	Neural and hormonal mechanisms	Activates gastric secretions

Phases of Digestion (cont)

Intestinal Phase:	Neural and hormonal mechanisms	Activates the small intestine and inhibits gastric emptying and secretions

Visceral Muscle Contractions Summary

Oesophagus:	Peristaltic
Stomach:	Peristaltic
Small intestine:	Segmental, MMC
Colon:	Segmentation, Mass movement

Pancreatic Juice

Volume:	1200-1500ml daily
Constituents:	Mostly water
	Sodium bicarbonate - buffers acidic stomach chyme
	Enzyme:
	Pancreatic amylase

Pancreatic Juice (cont)

Proteolytic enzymes - trypsin (secreted as trypsinogen), chymotrypsin (chymotrypsinogen), carboxypeptidase (procarboxypeptidase), elastase (proelastase)
Pancreatic lipase
Ribonuclease and deoxyribonuclease

Major Valves (Sphincters)

Oesophagus:	Upper oesophageal sphincter	Pharynx and oesophagus	Exocrine:	Digestiv enzyme bicarbonate
	Lower oesophageal sphincter	Oesophagus and stomach	**Liver:** Excretion of bile pigments:	Bilirubin Biliverdi
Stomach:	Cardiac sphincter (LOS)	Oesophagus and stomach	Bile salts:	E.g Deoxycholic aci emulsific ation of fats
	Pyloric sphincter	Stomach and duodenum		
Large intestine valves:	Ileocaecal sphincter	Ileum and caecum		
	Internal anal sphincter	Involuntary smooth muscle		

Major Valves (Sphincters) (cont)

External anal sphincter	Voluntary skeletal muscle

Accessory Organs

Salivary Glands:	Three sets:	Parotid, sublingu and subman dibular
Pancreas:	Endocrine:	Insulin, glucago

4 layers Anatomy of the small intestine

Circular folds called the plicae circulares are permanent ridges of the mucosa and submucosa that encourage turbulent flow of chyme.

Control of Gastrointestinal Function

Enteric nervous system (ENS):	Intrinsic set of nerves - "brain of gut"
	Neurons extending from oesophagus to anus

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Control of Gastrointestinal Function (cont)

2 plexuses		
	Myenteric plexus:	GI tract motility
	Submucosal plexus	Controlling secretions
Autonomic nervous system	Extrinsic set of nerves	
	Parasympathetic stimulation increases secretion and activity by stimulating ENS	
	Sympathetic stimulation decreases secretions and activity by inhibiting ENS	

Gastric glands and cell types in the stomach

Surface mucous cell:	Secretes Mucus
Mucous neck cells:	Secretes Mucus
Parietal cells:	Secretes hydrochloric acid and intrinsic factor
Chief cells:	Secretes pepsinogen and gastric lipase
G cell:	Secretes the hormone gastrin

Summary of Organs in the GI system

Tongue:	Manoeuvres food for mastication, shapes food into a bolus, manoeuvres food for deglutition, detects sensations for taste, and initiates digestion of triglycerides
Salivary glands:	Saliva produced by these glands softens, moistens, and dissolves foods; cleanses mouth and teeth: initiates the digestion of starch
Teeth:	Cut, tear, and pulverise food to reduce solids into smaller particles for swallowing

Summary of Organs in the GI system (cont)

Pancreas:	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.
Liver:	Produces bile, which is required for the emulsification and absorption of lipids in the small intestine
Gallbladder:	Stores and concentrates bile and releases it into the small intestine
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 requites relaxation of the upper oesophagus sphincter and secretion of mucus

Summary of Organs in the GI system (cont)

Stomach:	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.
Small intestine:	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

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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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