Ask Weber

Topic 16

Digestion

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Alimentary canal

The alimentary canal is 9m long, but it covers 30-40m2 surface area – what structure within this canal allows it to maximise its surface area in this manner?

- Rugae (macro structures) and microvilli (micro structures) maximise the surface area by 'folding' the mucosa
- Villi as well

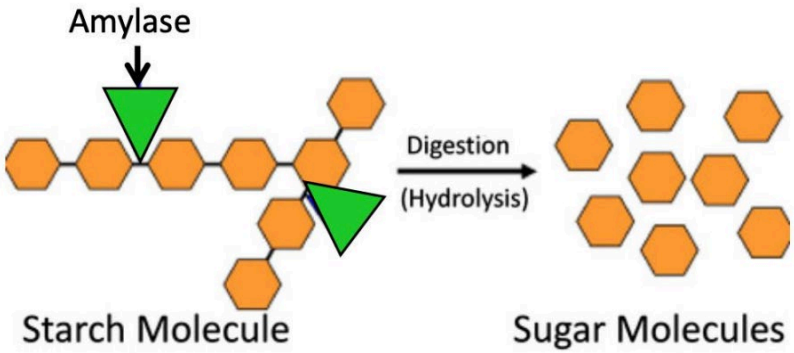
Name the 3 pairs of major salivary glands, and relate their names to their anatomical locations

- Parotid
- Sublingual
- submandibular

Biomolecular metabolism

How are starch molecules metabolized in the body?

- Serous fluids in saliva moistens the food, dissolves it, and contains enzymes (e.g. amylase) to convert carbohydrates like starch into sugar



Swallowing physiology

If you drank water whilst hanging upside down, the water would still flow against gravity – what process allows your body to achieve this?

- Peristaltic contractions along the oesophagus allows the pushing of a food bolus into the stomach – the remainder of the movement is enabled by continued peristaltic movement in the gut

Based on your understanding on peristalsis, what type of musculature would you guess the oesophagus is made of (i.e. what types of muscle cells – skeletal, smooth or cardiac?)

- Upper oesophagus is skeletal muscle (as you can control the initiation of swallowing), but the lower 2/3 of the oesophagus is not under conscious control – this component is smooth muscle

Stomach anatomy

What part of the stomach secretes HCl?

- Body of the stomach (from the parietal cells, which are from the gastric mucosa) forms HCl

Given that the stomach is described as a 'muscular sac', what kind of muscle cells is the stomach made of?

- Smooth muscle – no part of stomach contraction is under conscious control

Why does the stomach need to be made of muscle?

- Digestion and 'churning' involves muscular movements
- Movement of food down the canal requires peristalsis, which involves muscular contractions

Digestive physiology

What are the components of 'gastric juice'

- HCl (acid)
  - Antimicrobial, aids in hydrolysis and proenzyme activation
- Enzymes (e.g. pepsinogen)
  - Pepsin is largely a protease
- Alkaline mucus
  - Protection of stomach lining from HCl and pepsin
- Intrinsic factor
  - Allows VB12 absorption

When elderly people (e.g. with knee pain) take Non-steroidal anti-inflammatories (e.g. Nurofen, Diclofenac, Voltaren), the side effect of these drugs is that the stomach lining stops producing alkaline mucus – what issues will this cause

- HCl and pepsin can attack the stomach wall, break down the stomach tissue, leading to stomach ulcers, etc.

Digestive neurophysiology

Stage 1: Pre-consumption hunger

- Why do you get hungry BEFORE you eat food?
  - Sight, smell, thought of food stimulates medulla (midbrain)
  - Midbrain activates Cranial Nerve X (Vagus nerve)
  - Vagus nerve is parasympathetic (think rest and digest) which will activate digestive organs and increase blood flow for digestion
  - Gastrin is released, which stimulates hunger and further gastric 'juice' secretion

Stage 2: Acid release upon eating food

- Eat food – bolus fills the muscle bag that is the 'stomach'
- Stomach stretch induces a local reflex which causes gastric glands to further secrete gastrin and other gastric 'juices'
- This can also propagate movement of substances down into the intestine

Intestinal secretions

What are the accessory organs connected to the small intestine, and what do they secrete?

- Gall bladder and liver
  - Stores 'bile' – which is basic, and allows dissolving of fats
- Pancreas
  - Creates enzymes – breaks down fats, proteins, etc.
  - Creates HCO3- which is basic

What causes the accessory organs connected to the intestines to secrete?

- Acid in duodenum
  - Wants the secretion of basic substances -> causes GB to secrete bile and causes pancreas to secrete HCO3-
  - Secretin
- Fat in duodenum
  - Wants the breakdown and dissolution of fat -> causes GB to secrete bile, and causes pancreas to secrete enzymes
  - cholecystokinin

Digestive endocrinology

Which hormones INCREASE gastric motility, and which ones REDUCE gastric motility?

- Gastrin – pushes stuff OUT of the stomach
- Secretin and cholecystokinin – STOPS movement of stuff out of the stomach

Digestive biochemistry

Guess the function of the following enzymes

- Peptidase
- Sucrase
- Maltase
- Lactase
- Carboxypeptidase
- Amylase
- Lipase

Why do you think people with lactose intolerance get diarhoea after eating lactose?

- Lactose is not broken down as they lack lactase – this results in an osmotic drawing of fluid from the gut into the lumen, causing diarrhoea

Small intestinal physiology

What are the two absorption routes for nutrients in the digestive system?

- Water soluble nutrients can be absorbed through the capillaries along the intestines
- Long chain fatty acids are too big to fit in these capillaries – they generally need to be absorbed by nearby lymphatic vessels

What is the route taken by substances that are water soluble?

- Capillaries surrounding the intestines
- These join together to form the superior or inferior mesenteric veins
- These will join to form the portal vein
- These will then move through the liver (where first-pass hepatic metabolism takes place)