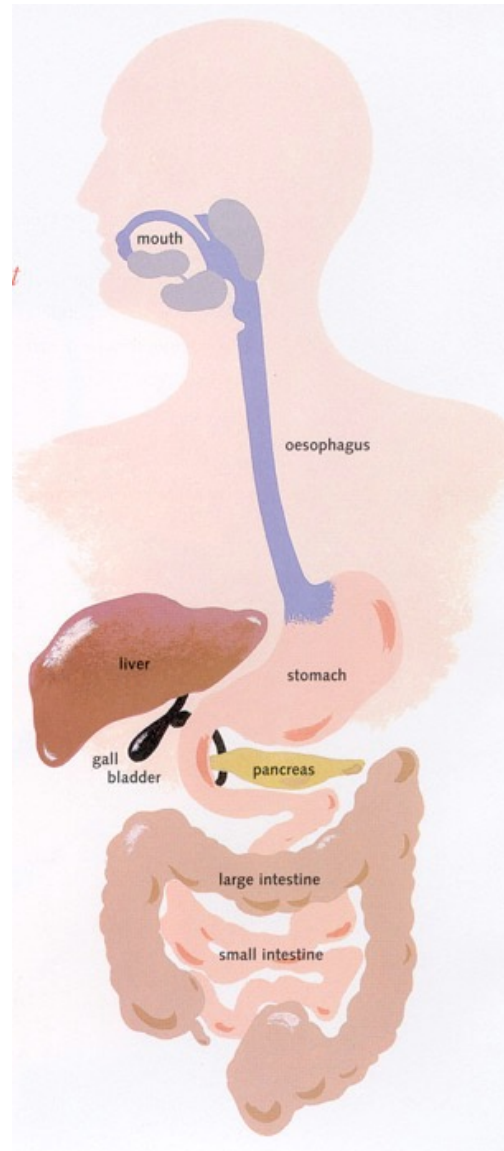
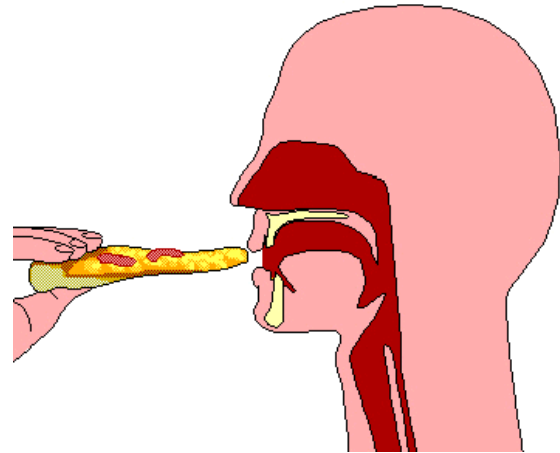


The Human Digestive Tract



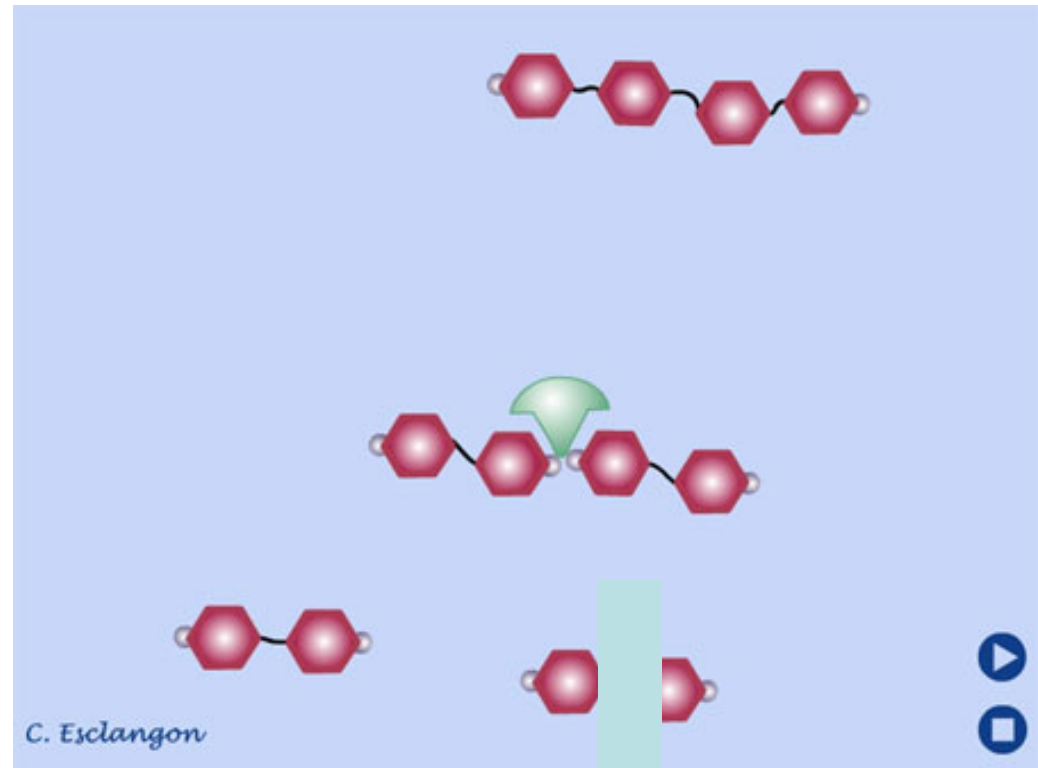
4 parts of digestion:

1. **ingestion** - the taking in of nutrients
2. **digestion** - breakdown of complex organic food into small components



4 parts of digestion:

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4 parts of digestion:

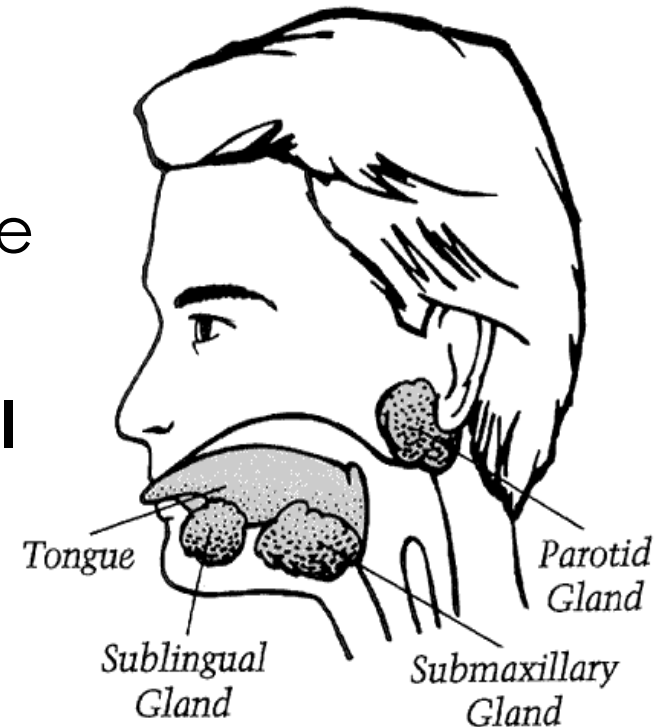
1. **ingestion** - the taking in of nutrients
2. **digestion** - breakdown of complex organic molecules into small components
 - **mechanical digestion** - physically breaking down food into smaller pieces to increase surface area
 - **chemical digestion** - breaking the bonds that hold large complex molecules together to smaller components eg. proteins into amino acids

4 parts of digestion:

1. **ingestion** - the taking in of nutrients
2. **digestion** - breakdown of complex organic molecules into small components
 - mechanical digestion - physically breaking down food stuff
 - chemical digestion - breaking the bonds that hold large complex molecules together to smaller components
3. **absorption** - the transport of nutrients from the digestive tract into the blood stream
- 4 **egestion** - the removal of waste from materials

The Mouth

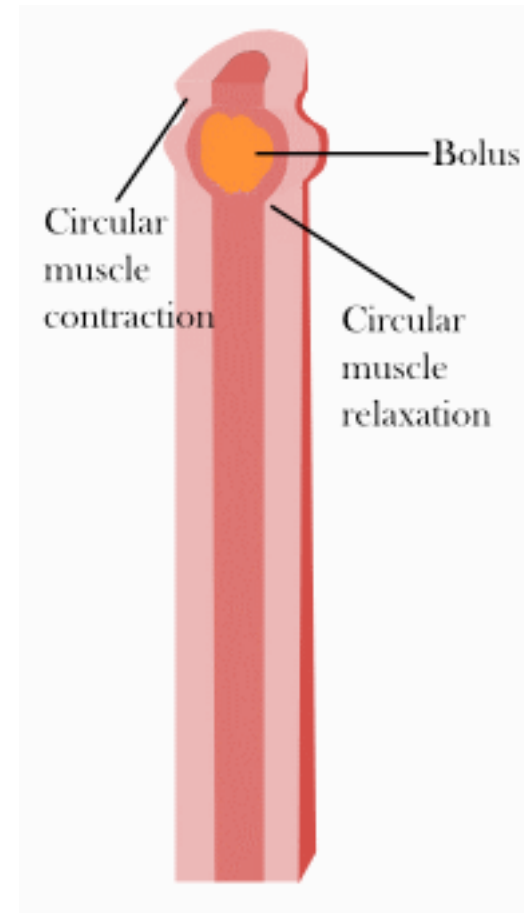
- salivary glands (*parotid, sublingual, submaxillary*) - produces saliva
 - > **lubricate** food
 - > **dissolves** food particles
 - > allows us to **taste** food
 - > contains **amylase** (enzyme)
breaks down starch---> disaccharide
= **chemical** digestion
- teeth are important for **mechanical** digestion



The Esophagus

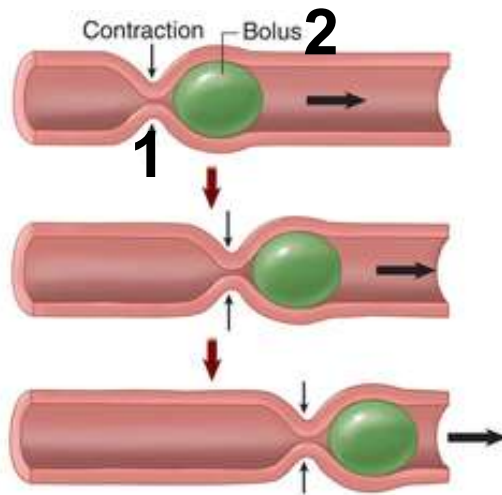
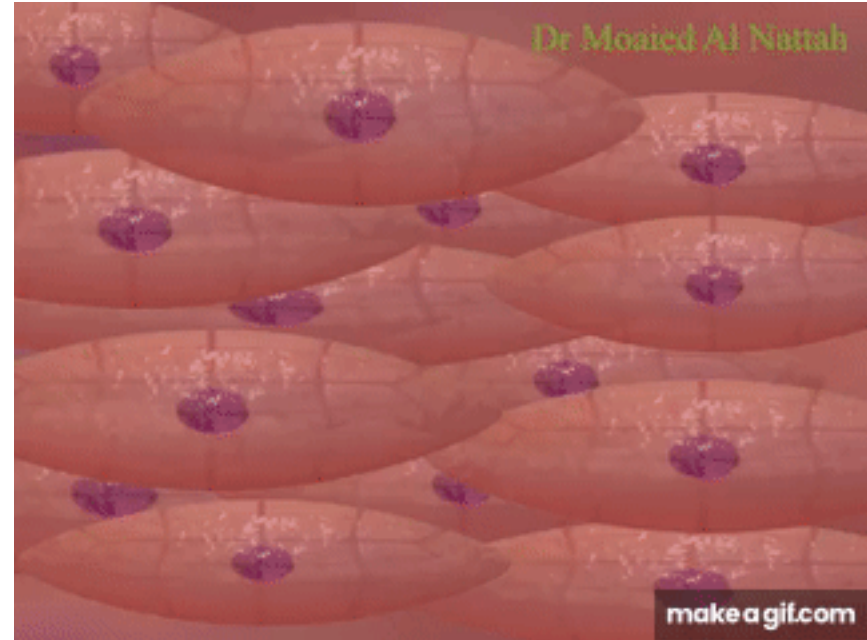
- mucin is secreted by cells (lubricate path)
- lined with circular & longitudinal muscles
- work together to push food (called the **BOLUS**) down

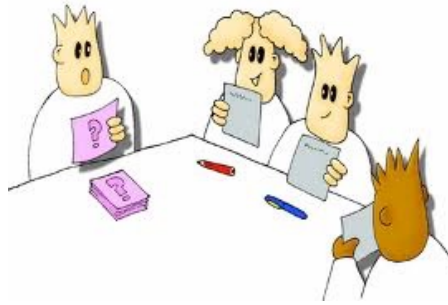
peristalsis - wave like muscular contraction that moves food



Peristalsis

- » Conducted by smooth muscle
- » circular muscle upstream of food bolus constrict to prevent backward movement **1**
- » circular muscle downstream relax to allow movement forward **2**
- » longitudinal muscles contract to push the bolus forward



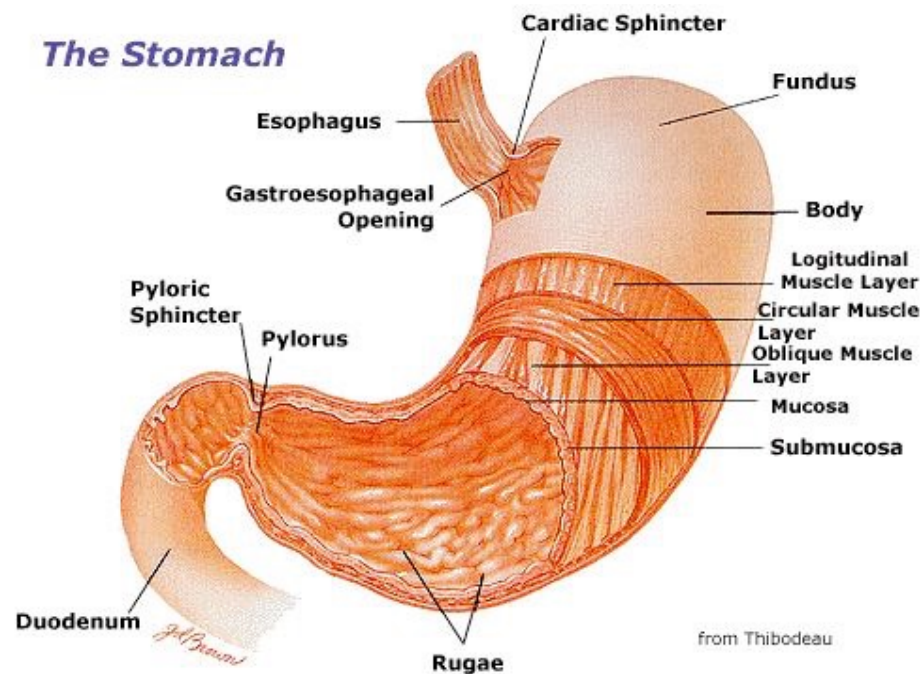


- Infer how food reaches an astronaut's stomach when s/he is floating in zero gravity.
- Your friend is convinced that digestion begins in the stomach. Is this true or false? Explain and include two facts to support your answer.

The Stomach

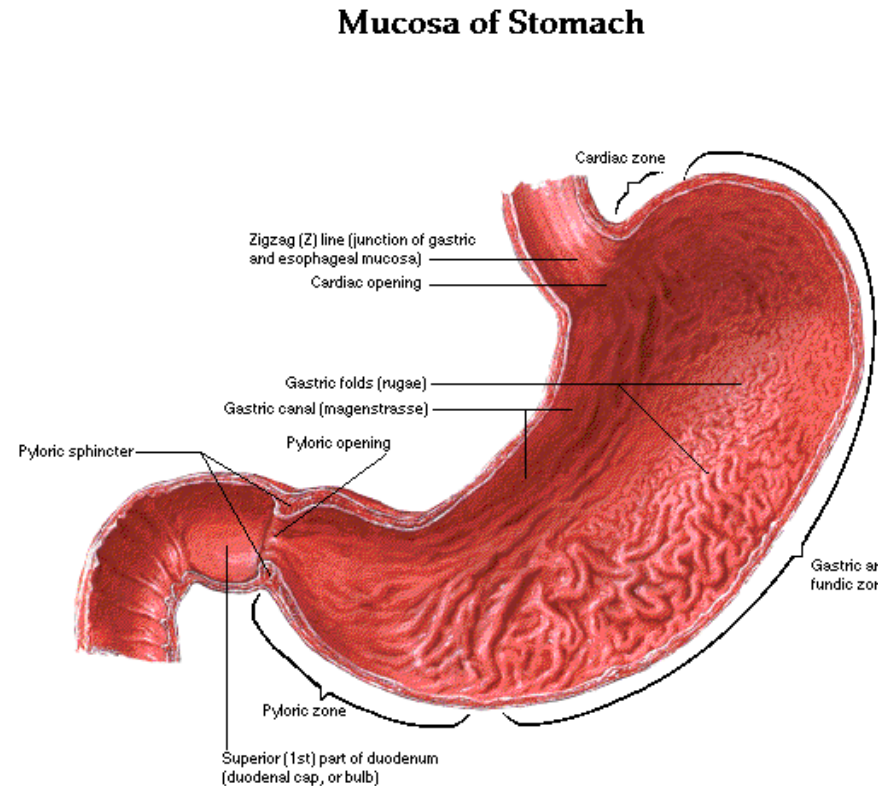
esophageal (cardiac) sphincter found before stomach

- thickened muscular ring
- controls movement of food in & out of stomach



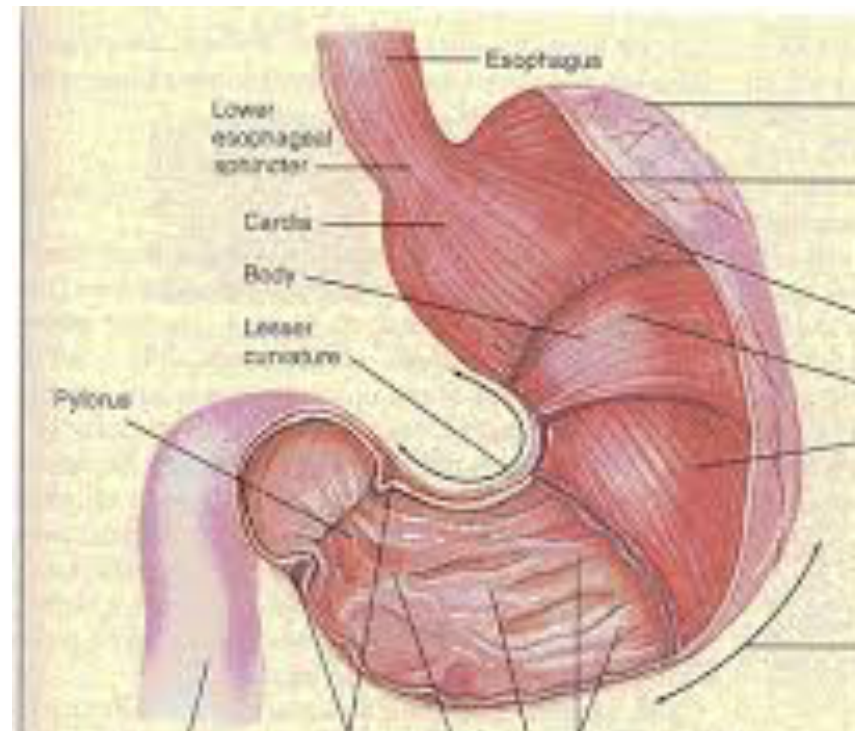
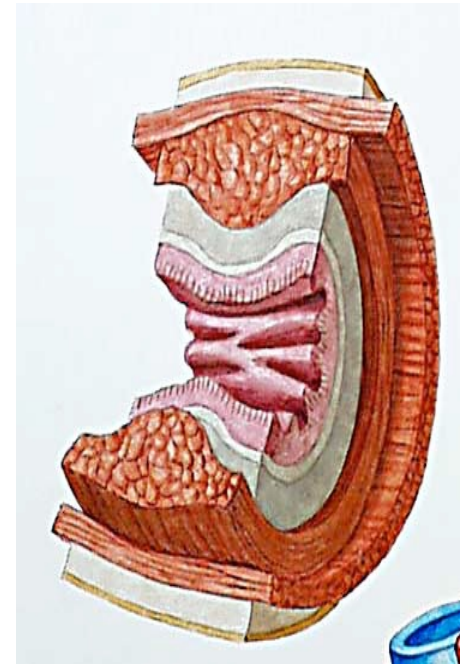
The Stomach

- gastric juices contain mucus, hydrochloric acid, & pepsin
 - **mucus** - protects stomach lining
 - **HCl** - kills harmful bacteria (pH 1-3)
- activates the enzyme pepsin
 - **pepsin** - enzyme that cuts proteins into shorter chains of amino acids



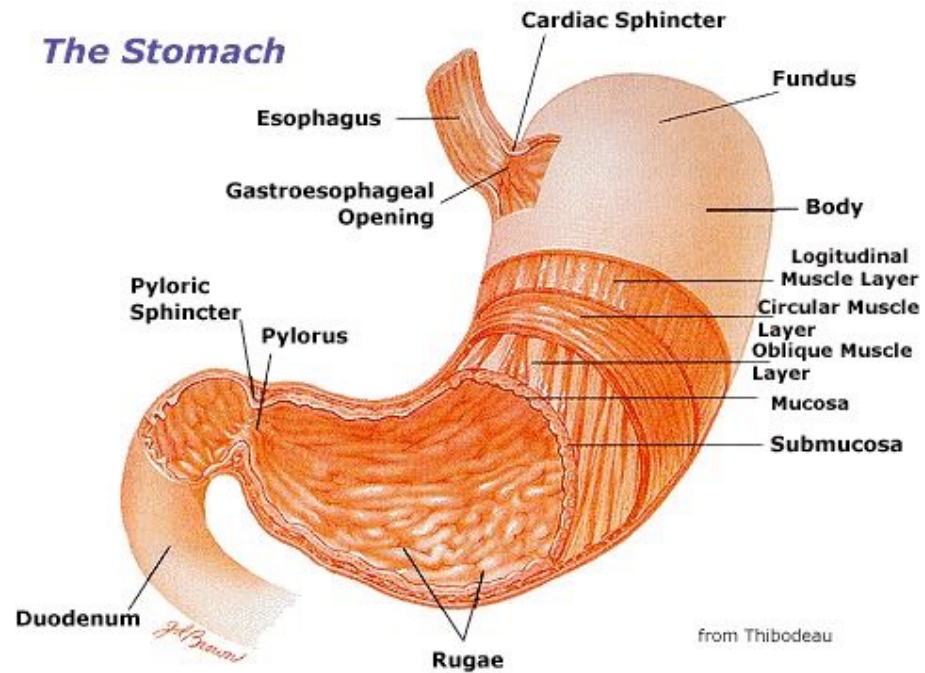
The Stomach

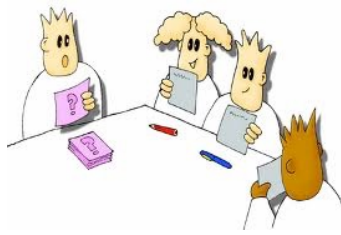
- muscle layers circular and longitudinal smooth muscle---> work to **mechanically** by churning to breakdown food into: **chyme** - thick liquid found in stomach



The Stomach

- **pyloric sphincter** found at end of stomach
- controls movement of food out of stomach into sm intestine





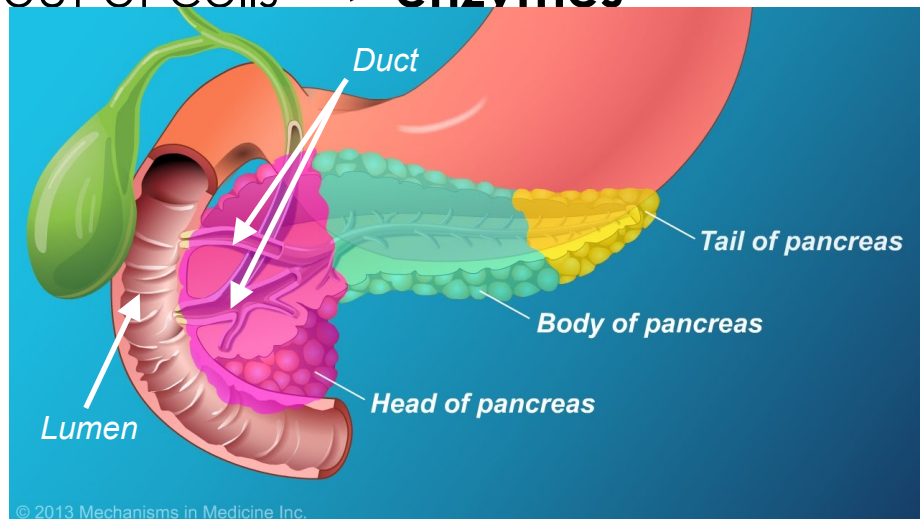
- Describe the structure of a sphincter. What is its function?
- What is/are the function(s) of HCl in the stomach?
- What results if there is a hole in the mucus lining the stomach wall?
- Distinguish between chemical and mechanical digestion.
- What **chemical** digestion has taken place in the mouth and stomach? List any enzyme(s) and the substrate(s) they act on.
- List any and all **mechanical** digestion that takes place in the mouth and stomach.

Digestive (Pancreatic) Juices are Added

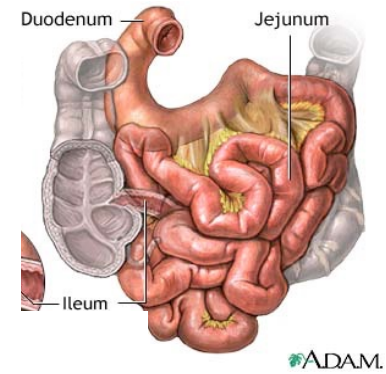
- When food enter the **duodenum** (the begin of the small intestine), it receives **pancreatic juices**- secretions of the pancreas
- most of the pancreas secretes digestive enzymes
- hormones of the stomach mediate the action of the pancreas

pancreatic cells - recall-> ribosomes, rough ER, and Golgi-> make protein products and ship out of cells —> **enzymes**

- amylase - digest starch
- lipase- digest fats into fatty acids
- proteases - digest proteins to amino acids
- sent down a **duct** - into the **lumens** of the **duodenum**

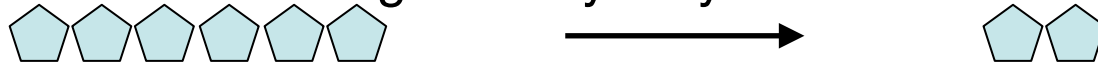


Enzyme Digestion in Small Intestine

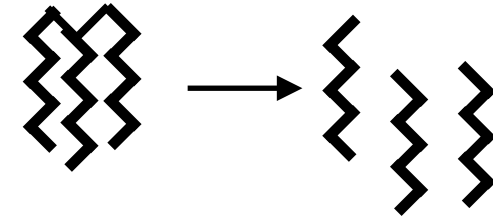


- 6-7 m long
- muscles moves food along (***peristalsis***)
- primary functions: chemically breakdown chyme & absorb nutrients

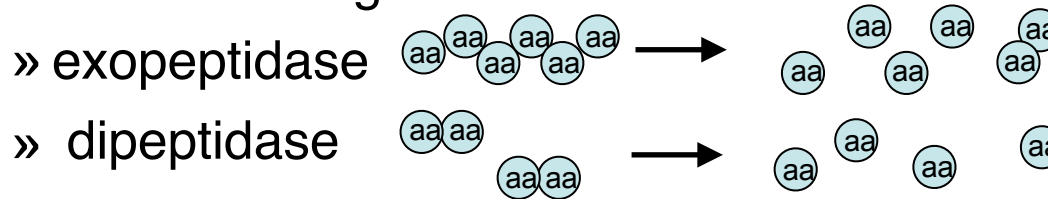
• Starch → digested by amylase → maltose



• Fats (triglycerides) → Lipase → digested to fatty acids

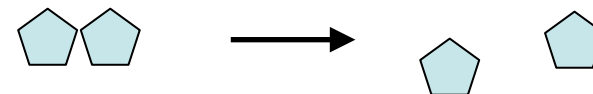


• Proteins → proteases → digested to amino acids



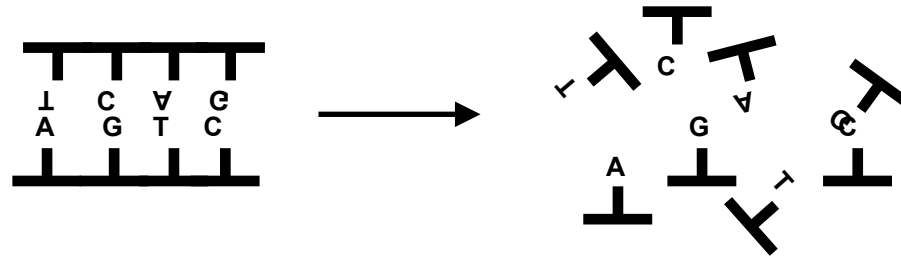
Maltose, lactose/sucrose → lactase and sucrase

→ to simple sugars



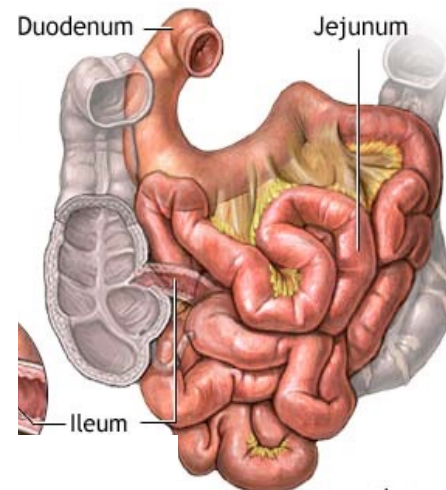
Enzyme Digestion in Small Intestine

DNA and RNA → digested by nucleases → nucleotides



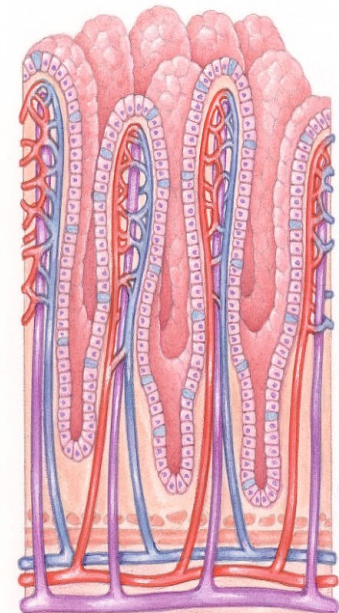
Once these **macromolecules** are broken into these = **monomers** → absorption into blood stream

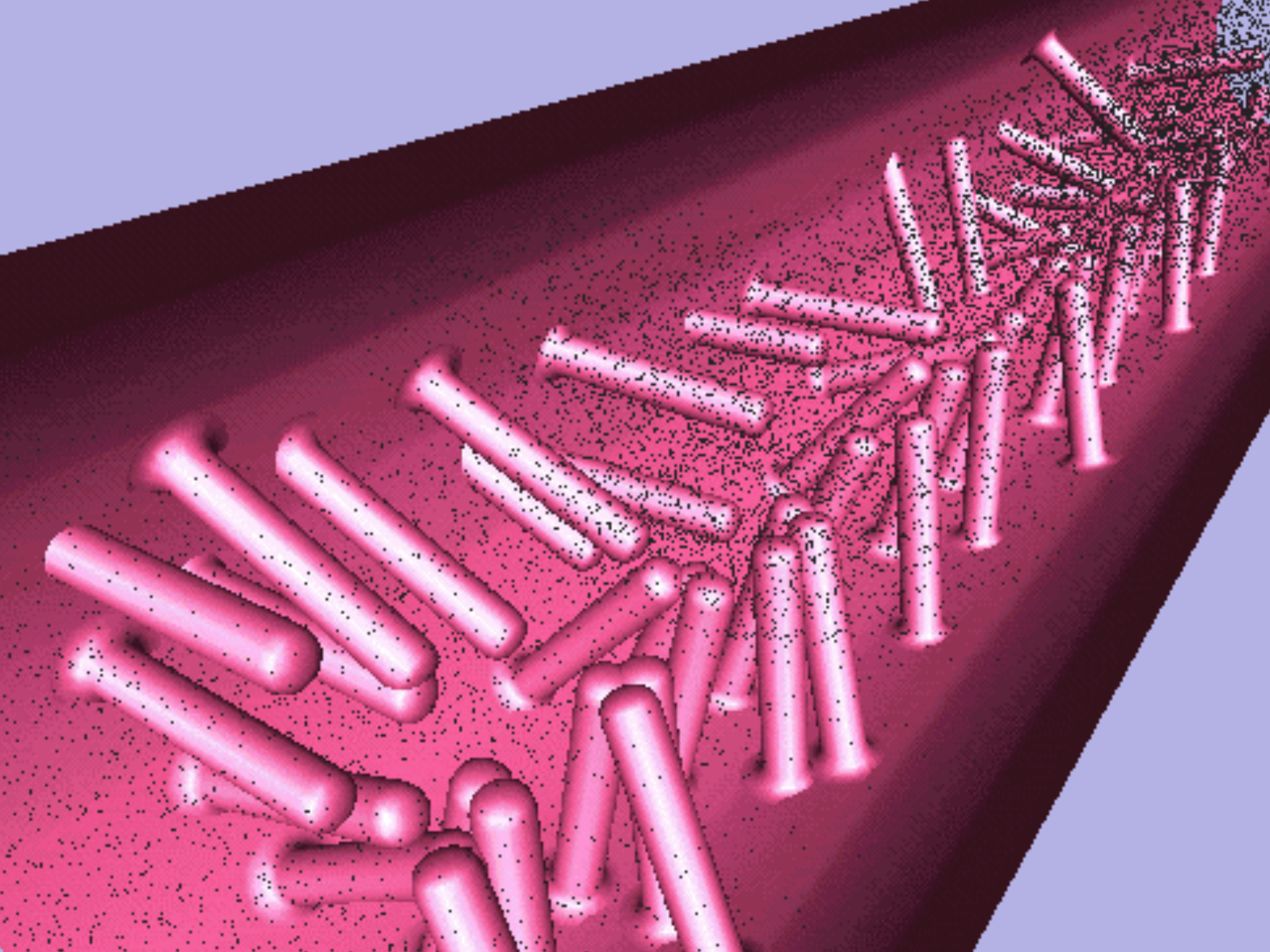
Lots of *surface area* is needed!!!



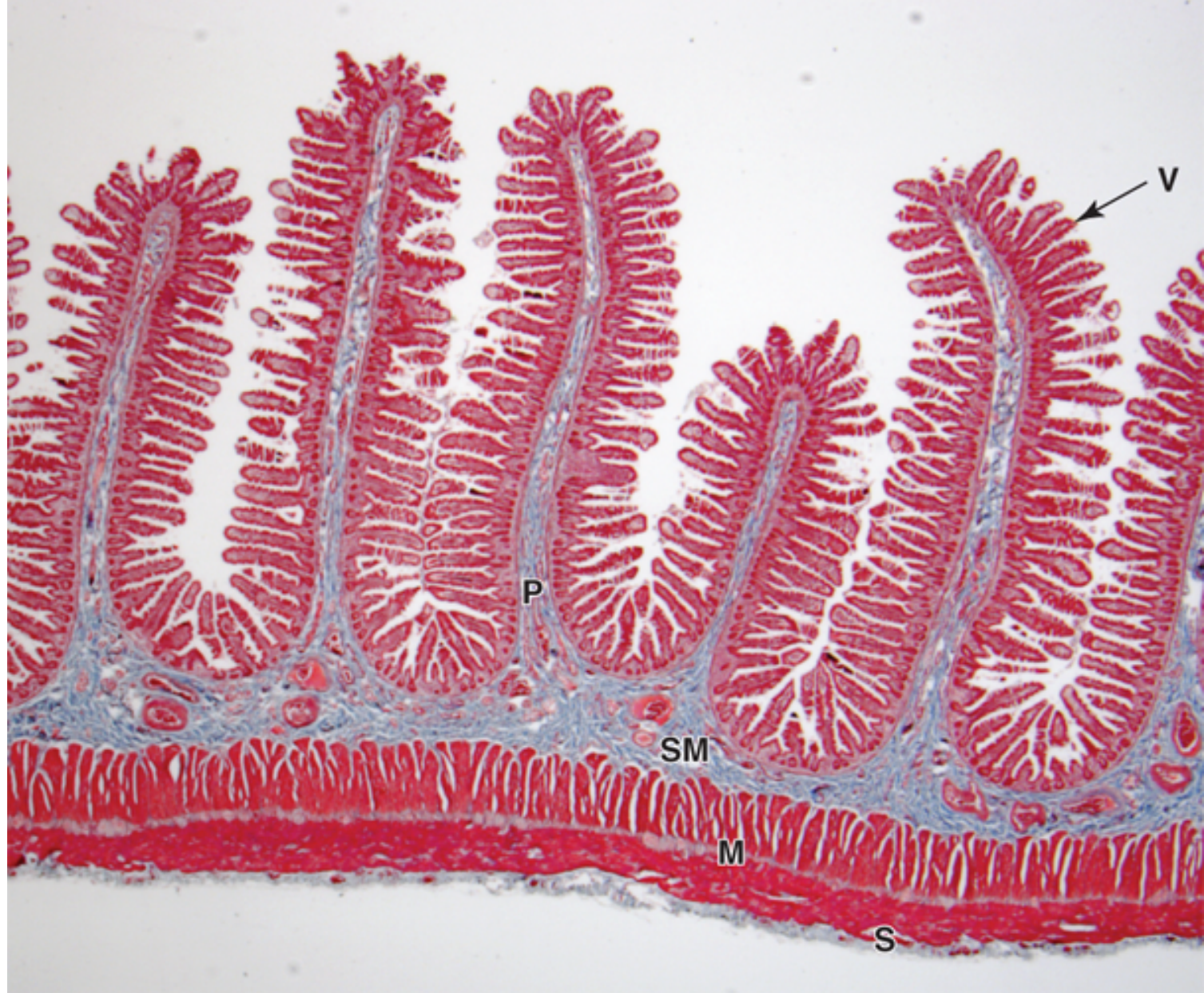
Small Intestine

- how does the intestine increase **surface area** for absorption of nutrients?
 - the **mucosa** has folds or projections called **villi** (finger-like extensions)
 - **microvilli** cover the *columnar epithelial cells* on the **villi**
 - » each .5-1.5mm long and 40/mm²
 - **capillaries** in villi absorb most nutrients directly to the blood stream
 - Lymphatic vessels receive the fatty acids → eventually into blood

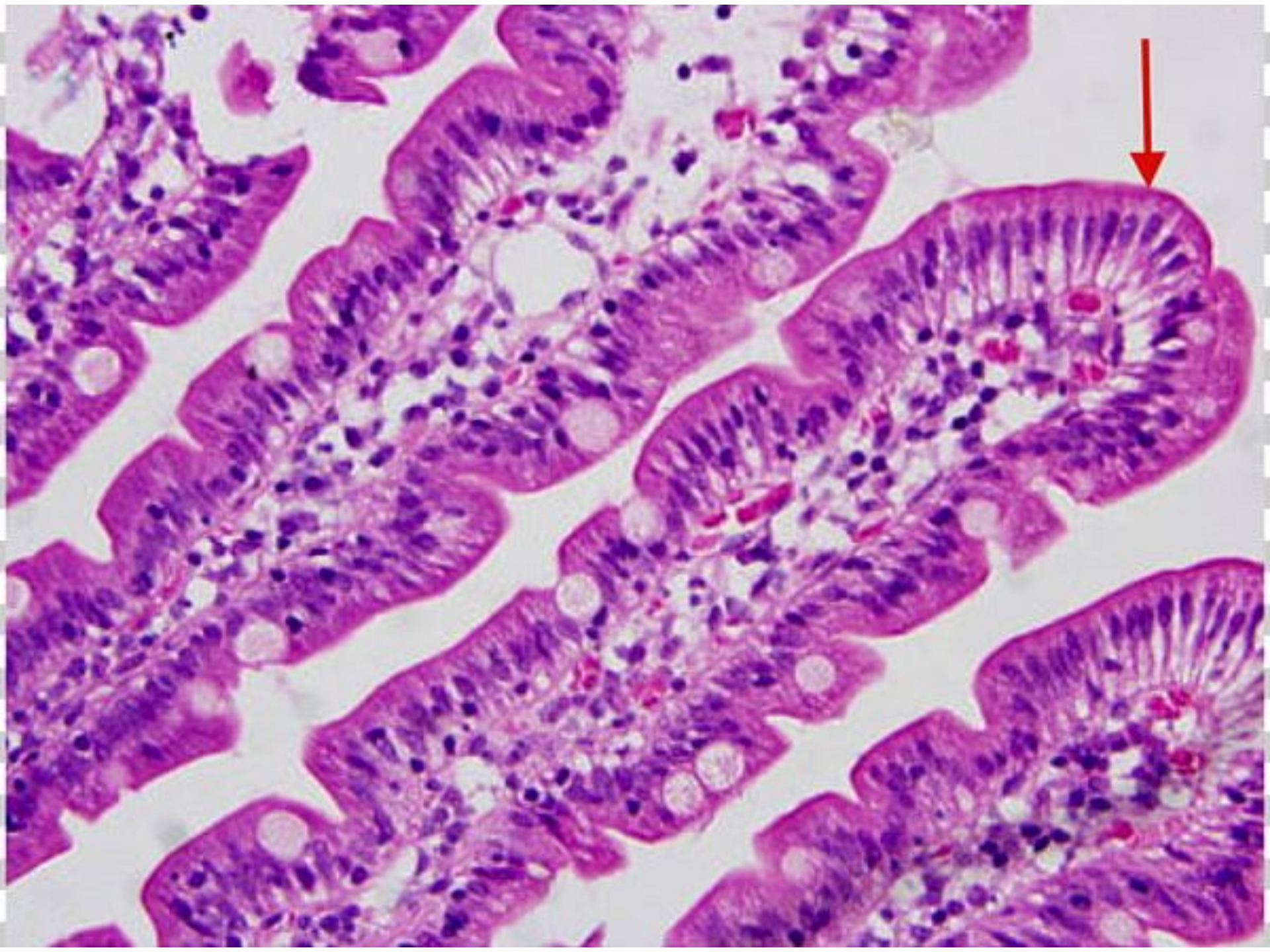


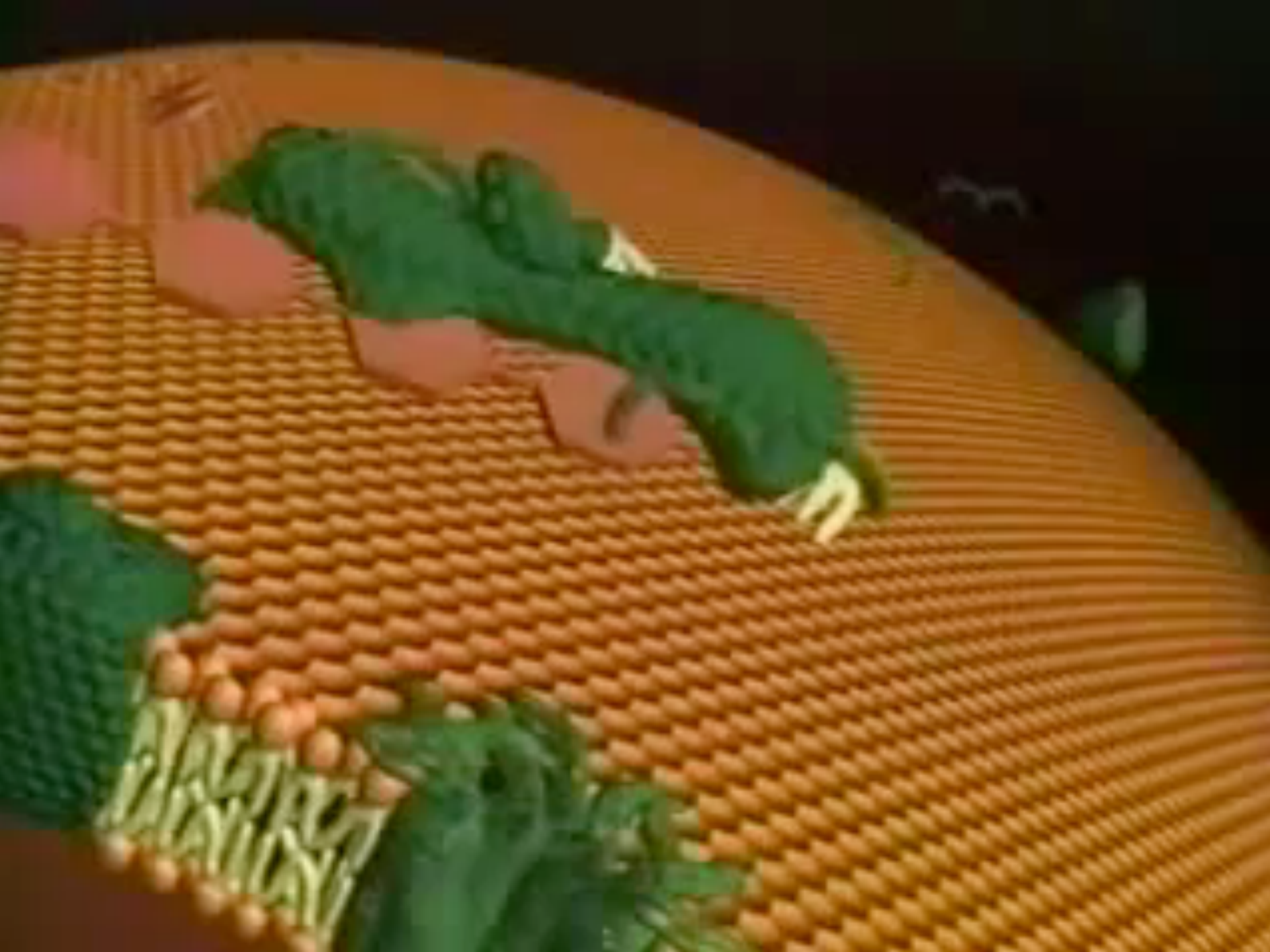






Source: Anthony L. Mescher: Junqueira's Basic Histology, 14th Edition.
www.accessmedicine.com
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3 sections of small intestine:

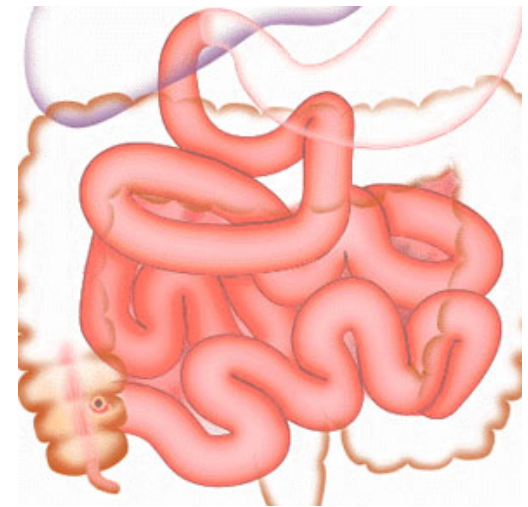
1. duodenum

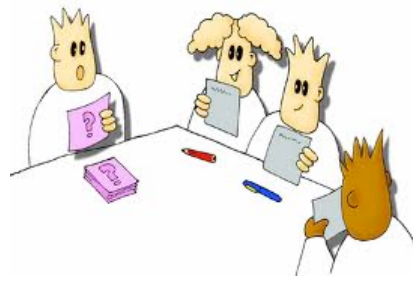
- chemical breakdown is primary
- pancreas & gall bladder empty enzymes to breakdown

2. jejunum - breaks down proteins & carbohydrates

3. ileum - absorbs remaining nutrients

- pushes undigested material along





- How does the SI increase the surface area?
- Why does the SI need to have a high surface area?
- A baby is born with a mutation that results in an unusually smooth small intestine that has far fewer villi than a normal small intestine. Describe one possible consequence of this mutation.
- What would you recommend to be true about the food the child consumes?

