Small Intestine

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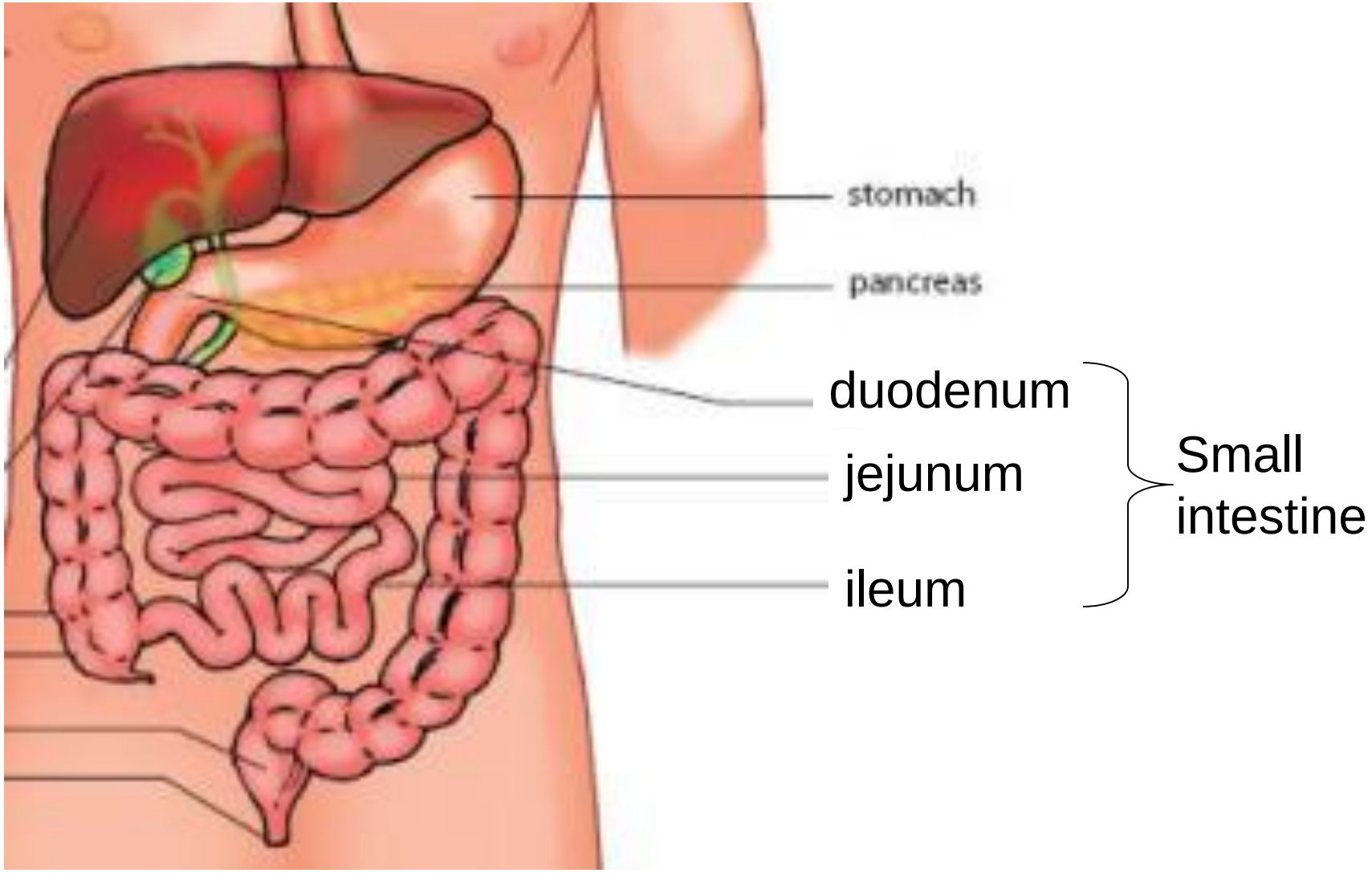
Small Intestine (SI)

- Long tubular structure

- Has 3 parts
  - duodenum
    - contains the common openings of the bile & pancreatic ducts
  - jejunum
    - very vascular
  - ileum
    - distal 60%of the small intestine

Small Intestine



Objectives

1. Describe the main motility patterns of the small intestine

2. List the intestinal secretions and briefly describe their functions

3. Outlines the digestive and absorptive functions of the small intestine

Functions of the small intestine

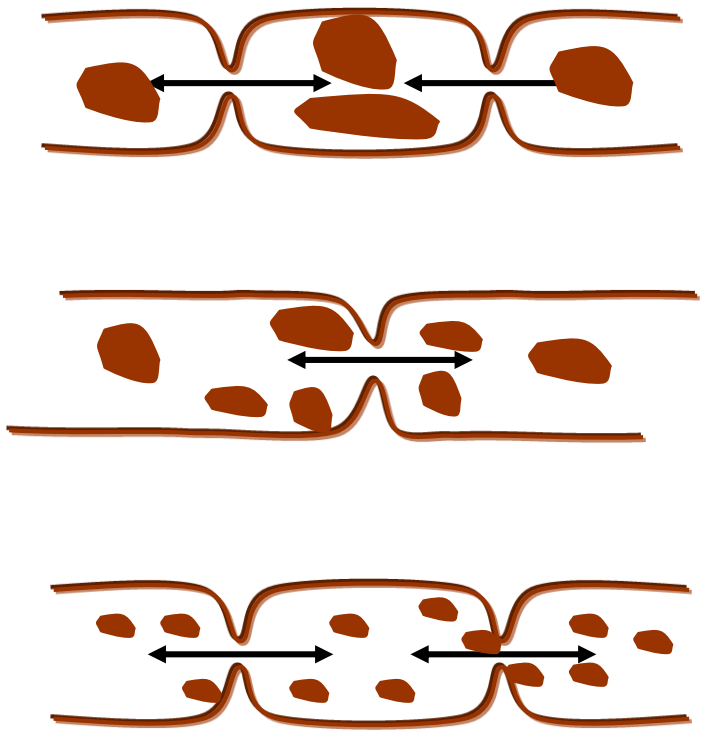
1. Digestion
   - final parts of CHO & protein digestion
   - fat digestion
2. Absorption of water, electrolytes, minerals, vitamins and products of CHO, fat & protein digestion
3. Transport function - transports chyme towards the large intestine
4. Endocrine function - e.g. secretion of CCK, secretin, motilin
5. Immunological function - contains numerous lymphocytes in the mucosa

Movements of the intestine

1. Segmentation
2. Peristalsis
3. Tonic contractions
4. Migrating motor complexes (MMCs)- occur during the interdigestive (fasting) period

1. Segmentation-

- Main motility pattern in SI
- Multiple short annular constrictions in the circular muscle layer
- Causes to-and-fro movement of the intestinal contents
- Helps in brake down food into smaller particles, digestion and absorption
- Frequency depends on the regional basic electrical rhythm

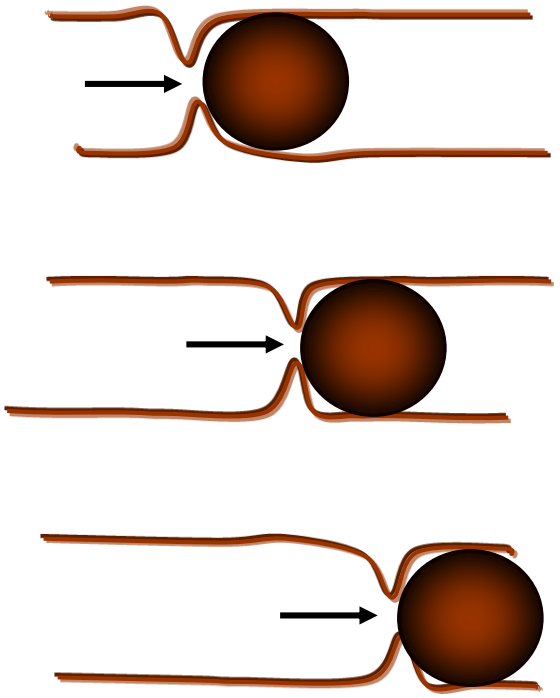


http://www.youtube.com/watch?v=PfnKvErPwY4

Video

2. Peristalsis-

- Less frequent
- Waves travel relatively short distances
- Move intestinal contents towards the colon
- Stimulated by distension of the intestinal wall by luminal contents
- Very intense peristaltic waves (peristaltic rushes) are seen in intestinal obstruction

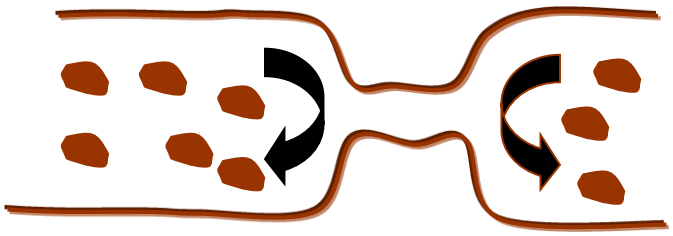


https://www.youtube.com/watch?v=IBMZBvuGPVg

Video

3. Tonic contractions-

- Relatively prolonged contractions
- Isolate one segment of the intestine from the other

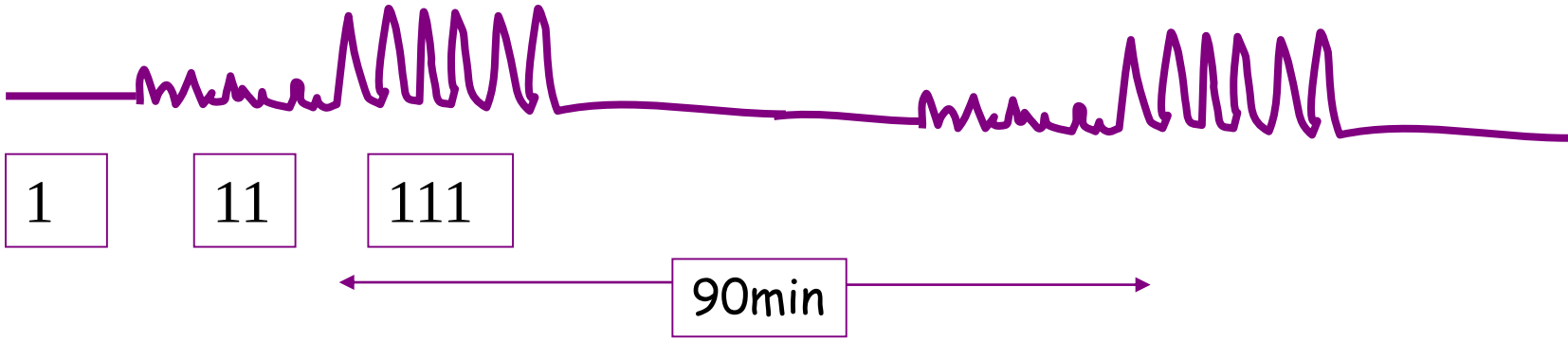


Segmental and tonic contractions slow transit in the intestine

They permits longer contact of the chyme with the enterocytes

4. Migrating motor complexes (MMCs)

- cyclic motor activity migrating from stomach to distal ileum at regular intervals in the fasting state (once in every 90 minutes)
- each cycle consists of 3 phases
  - phase1 : quiescent period
  - phase 11 : period of irregular electrical and mechanical activity
  - phase 111 : short phase of regular activity



MMCs are believed to have a ‘housekeeping’ function

- clears the stomach and small intestine of luminal contents in the fasting state
- prevents bacterial overgrowth

- Motilin and somatostatin may be involved in the initiation of MMCs
- Orderly propagation of MMCs along the digestive tract is dependant on the enteric nervous system

https://www.youtube.com/watch?v=qBwEDtvJtu8

Video

Regulation of SI motility

Stimulated by

- CCK
- bombesin
- opioid peptides
- substance P
- acetyl choline

Inhibited by

- sympathetic discharge
- NO
- VIP
- glucagon

Intestinal secretions

Mucus - secreted by goblet cells and Brunner's glands in the duodenum

- Functions
  - covers and protects the mucosa
  - Lubrication
  - holds immunoglobulins in place - can bind intestinal pathogens
- ↑ by chemical / physical irritation and cholinergic stimulation

intestinal secretions cont….

Isotonic fluid (about 2L/day)

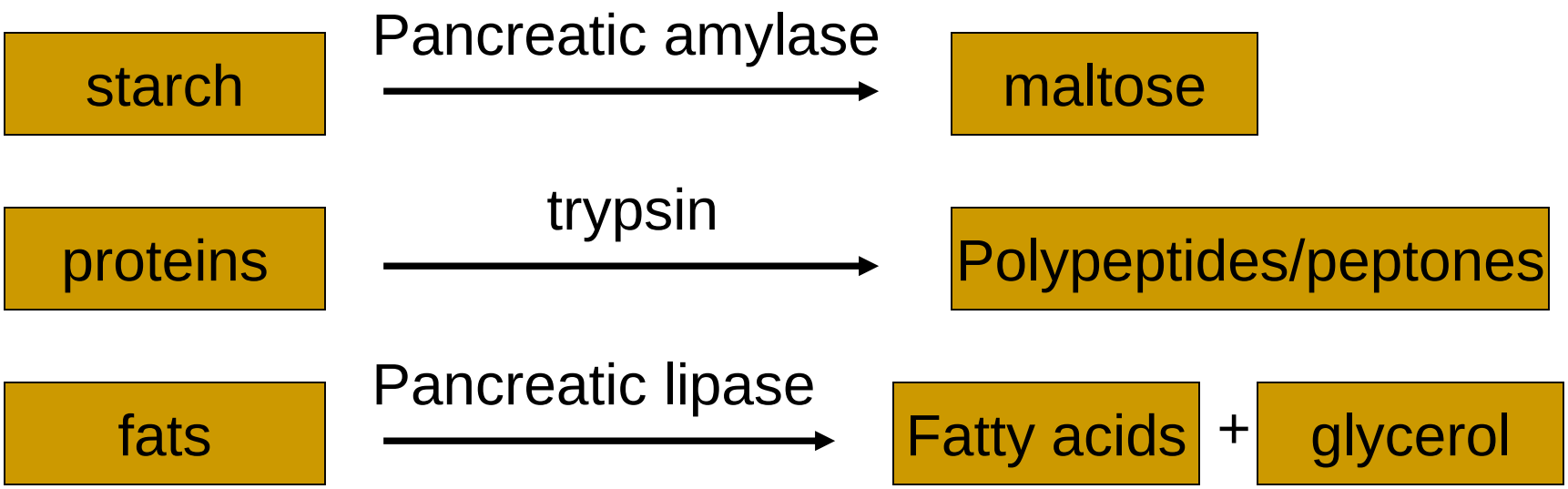
Intestinal secretions

- have very little enzymes
- release of fluid by intestinal glands (crypts) is primarily under control of local factors (e.g.intestinal distension)
- stimulated by VIP (vasoactive intestinal polypeptide)

Vagal stimulation has no significant effect on intestinal fluid secretion

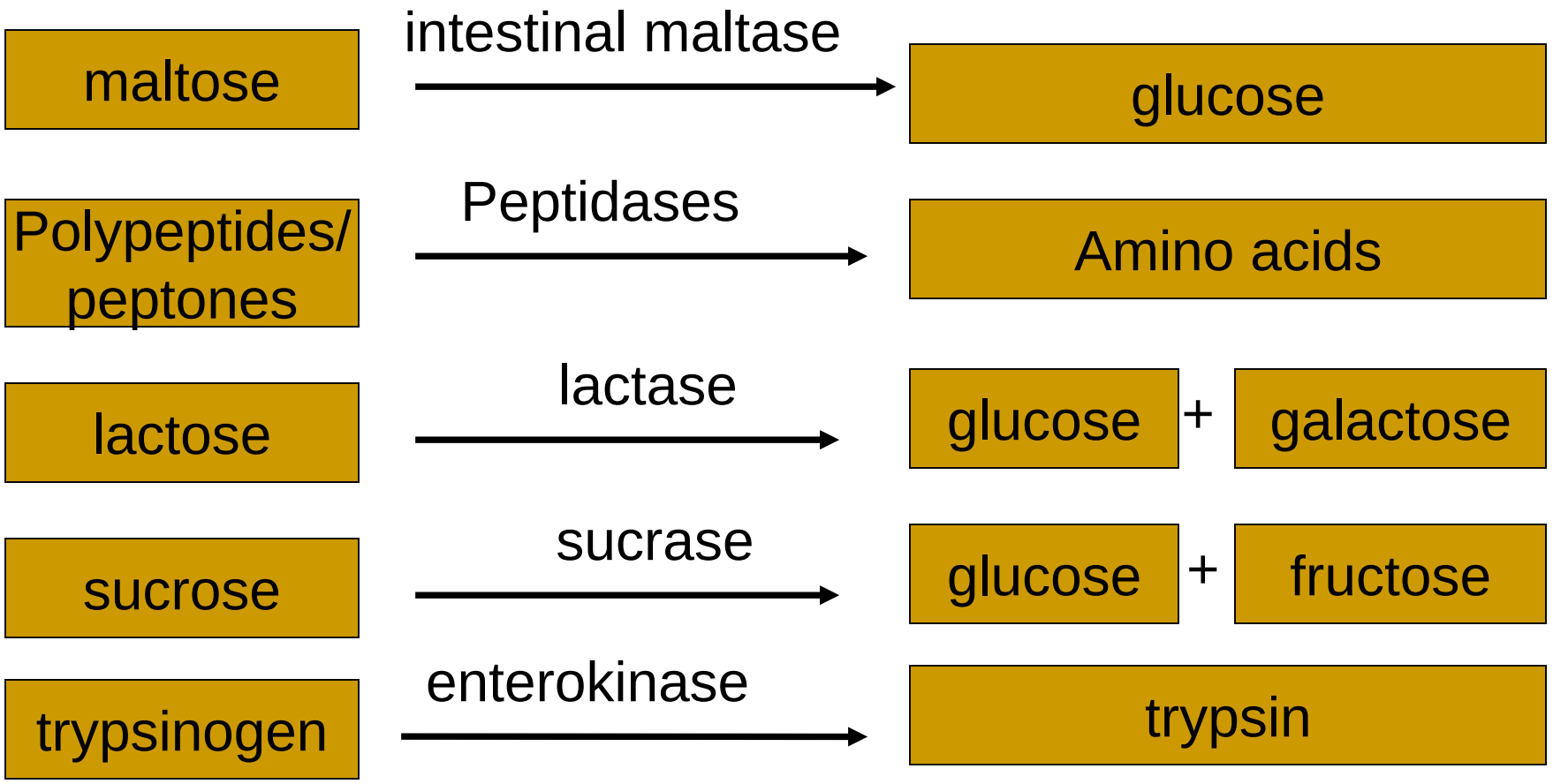
Digestive functions of small intestine

In pancreatic juice,



Small intestine

In intestinal brush border,

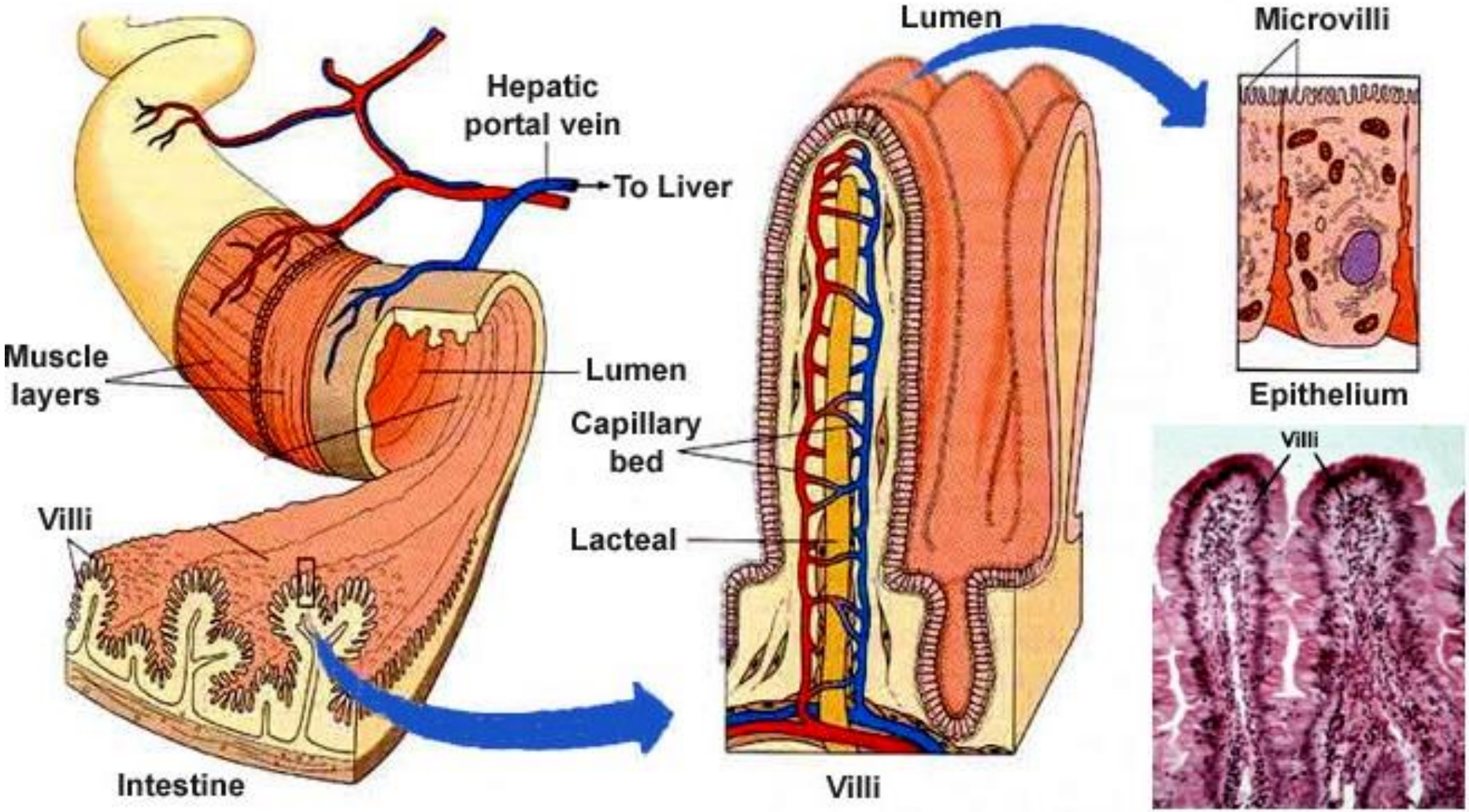


Absorption

- Absorption is the process of transferring the end products of digestion (amino acids, monosaccharides, and fatty acids) into the circulatory system and lymph vessels in the lining of the small intestine

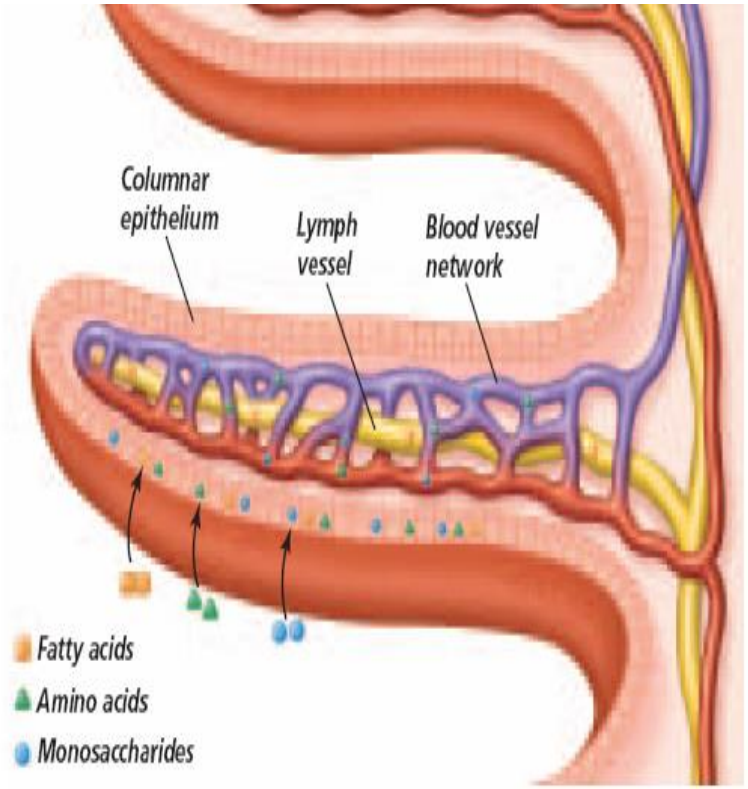
- The highly folded lining of the small intestine is covered with million of fingerlike projections called villi.

Structure of small intestine



Absorption through villi

- Nutrients are absorbed through this surface by means of diffusion and active transport
  - Fatty acids and glycerol enter the lymph vessels & are eventually transferred to the bloodstream
  - Amino acids and monosaccharides enter the capillaries in the villi and are carried to the liver



- Details of digestion and absorption will be discussed later…..

- Ref.
- http://en.wikipedia.org/wiki/Gastrointestinal_physiology