Food Digestion

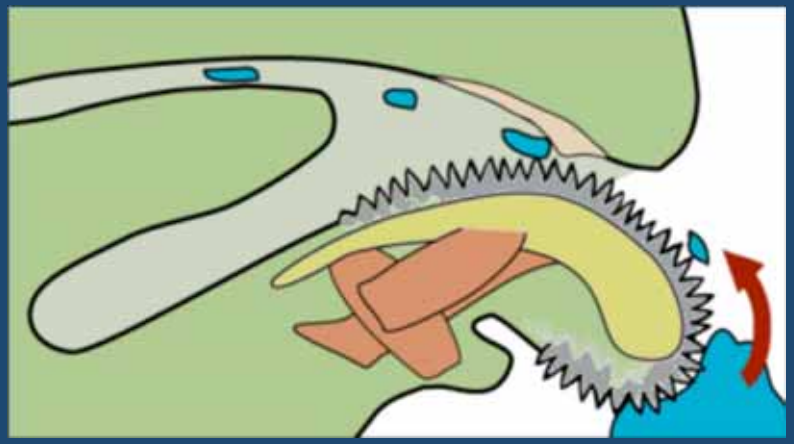
CH. 43

Molecules

Mass Feeder

http://www.youtube.com/watch?v=mLVDwlrSq5U

The Radula



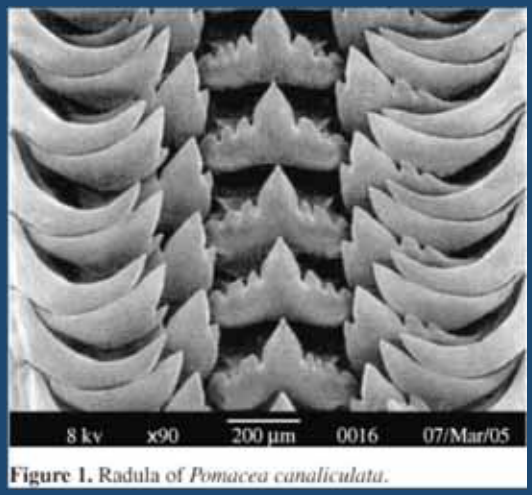


Figure 1. Radula of *Pomacea canaliculata*.

http://en.wikipedia.org/wiki/File:Snail_radula_working.png

http://www.midnightsunschool.com/Katchemak_Bay/mollusks.html

http://www.scielo.br/scielo.php?pid=S1519-69842007000400019&script=sci_arttext

http://shells.tricity.wsu.edu/ArcherdShellCollection/Illustrations/Radula.html

Question

What happens to the food after it's eaten?

Molecules of interest

Carbohydrates	Lipids	Proteins

- Carbs and Lipids more common
- Lipids carry the most energy (9 kcal vs. 4 kcal)

- What do you want on your toast?
  - Butter, Jam/Jelly, Peanut Butter

The complete gut advantage

- Some advantages of a complete gut:
  - Long tube moving food in one direction
    - can fit more food in gut (compare to incomplete gut)
  - Specialization of the gut
    - Physical / chemical processes can be separated
- Let's follow the three macromolecules through the 'gut'

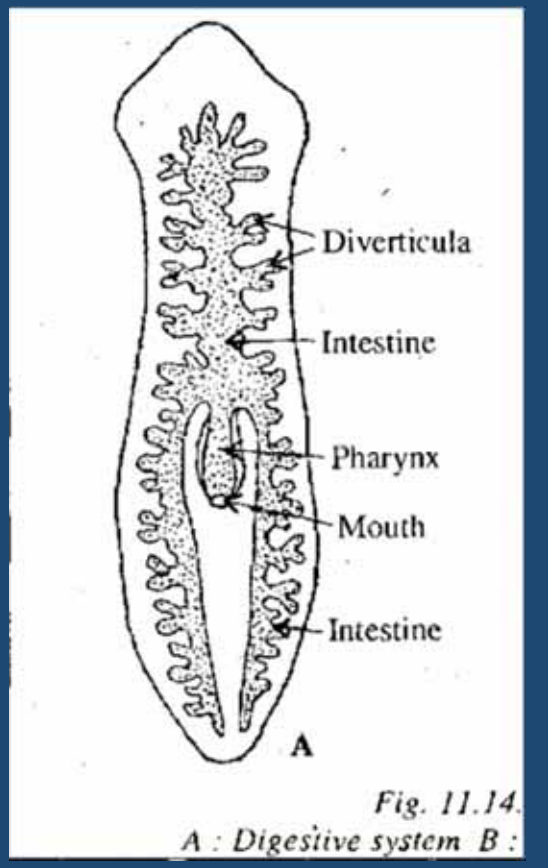
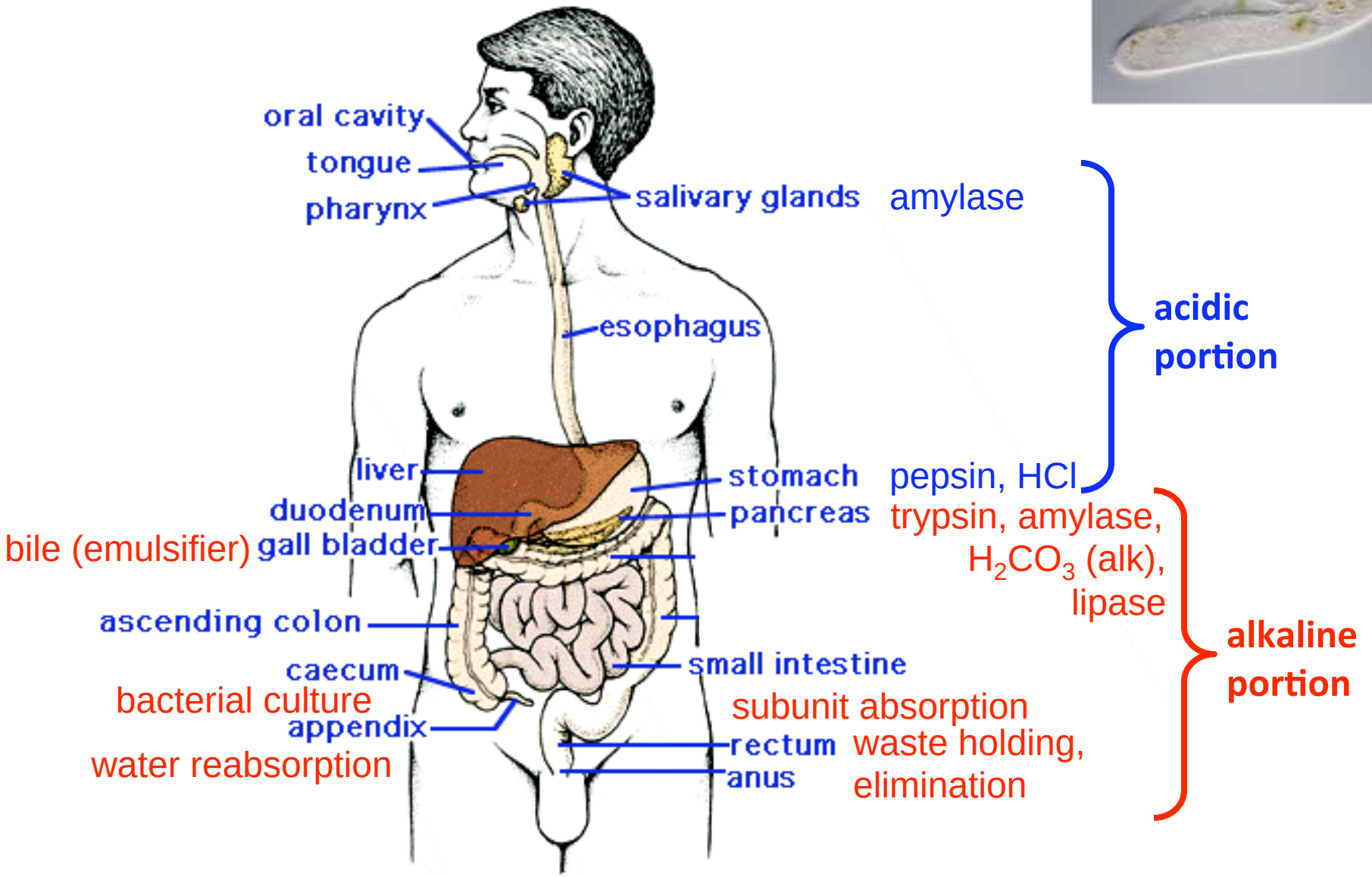


Fig. 11.14.
A : Digestive system B :

http://www.tutornext.com/phylum-platyhelminthes/7091

The human digestive system preview:



http://www.sciencephoto.com/media/149302/enlarge

The mouth

- Salivary glands produce amylase to breakdown carbohydrates (starch)
- The tongue secretes lipase enzymes which begin to breakdown lipids

http://www.3dscience.com/3D_Images/Human_Anatomy/Digestive/Open_Mouth.php

Stomach

- Highly muscular organ
  - Some mixing
  - Creates a uniform consistency
- Releases Hydrochloric acid (HCl)
- Partial digestion of proteins

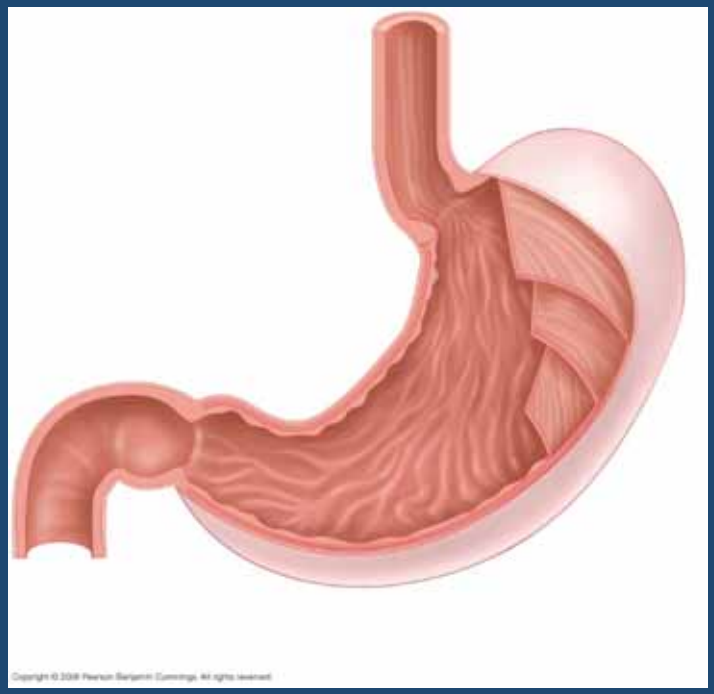


Fig. 43.8 pg 966

Stomach

- Digestion (denaturing) of proteins by acid
  - 2-3 pH
  - Unfolding proteins (loss of 2^o and 3^o structure)
  - Pepsin = enzyme denatures proteins
  - Why doesn't pepsin dissolve our own cells?
    - Stored in cells and released into lumen as pepsinogen
    - Pepsinogen becomes pepsin in presence of acid

Stomach

How does the acid get into the stomach?

$H_20 + CO_2 \rightarrow H_2CO_3 \rightarrow H^+ + HCO_3$

Carbonic acid bicarbonate

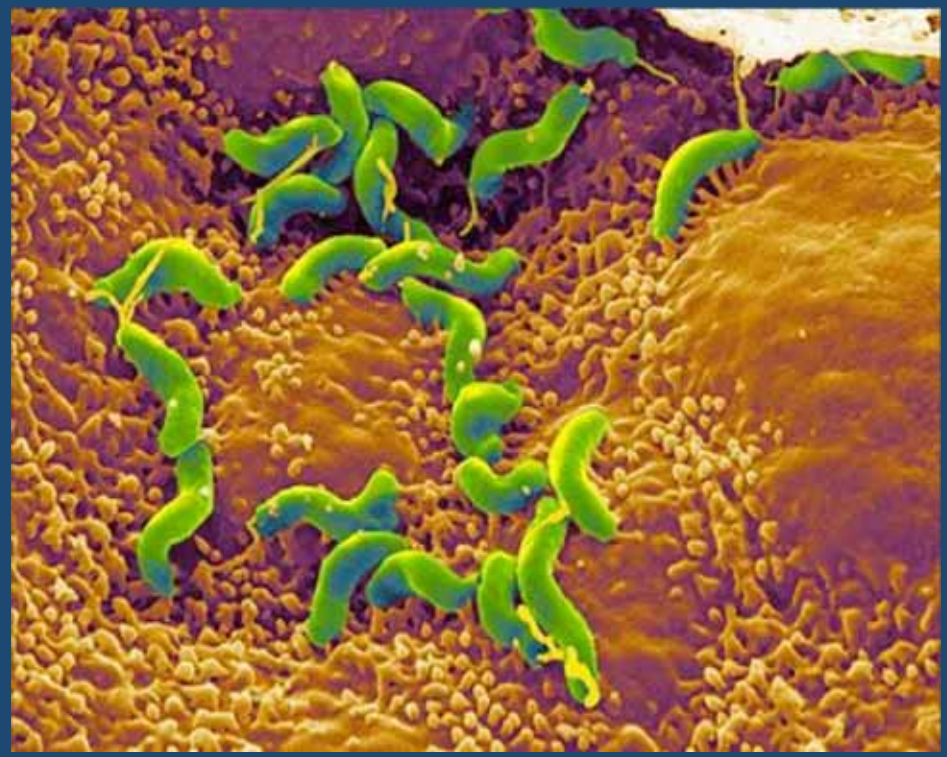
H^+ actively pumped into lumen by ATPase (requires energy)

Concentration gradient ~3 mill to 1

Stomach acid

Why aren't we digesting ourselves?

- Stomach lining safe because of mucous
- Stomach acids do not cause most ulcers
- *Helicobacter pylori* (published 1983, Nobel Prize 2005)
- Self inflicted research!
- Who wants yogurt?



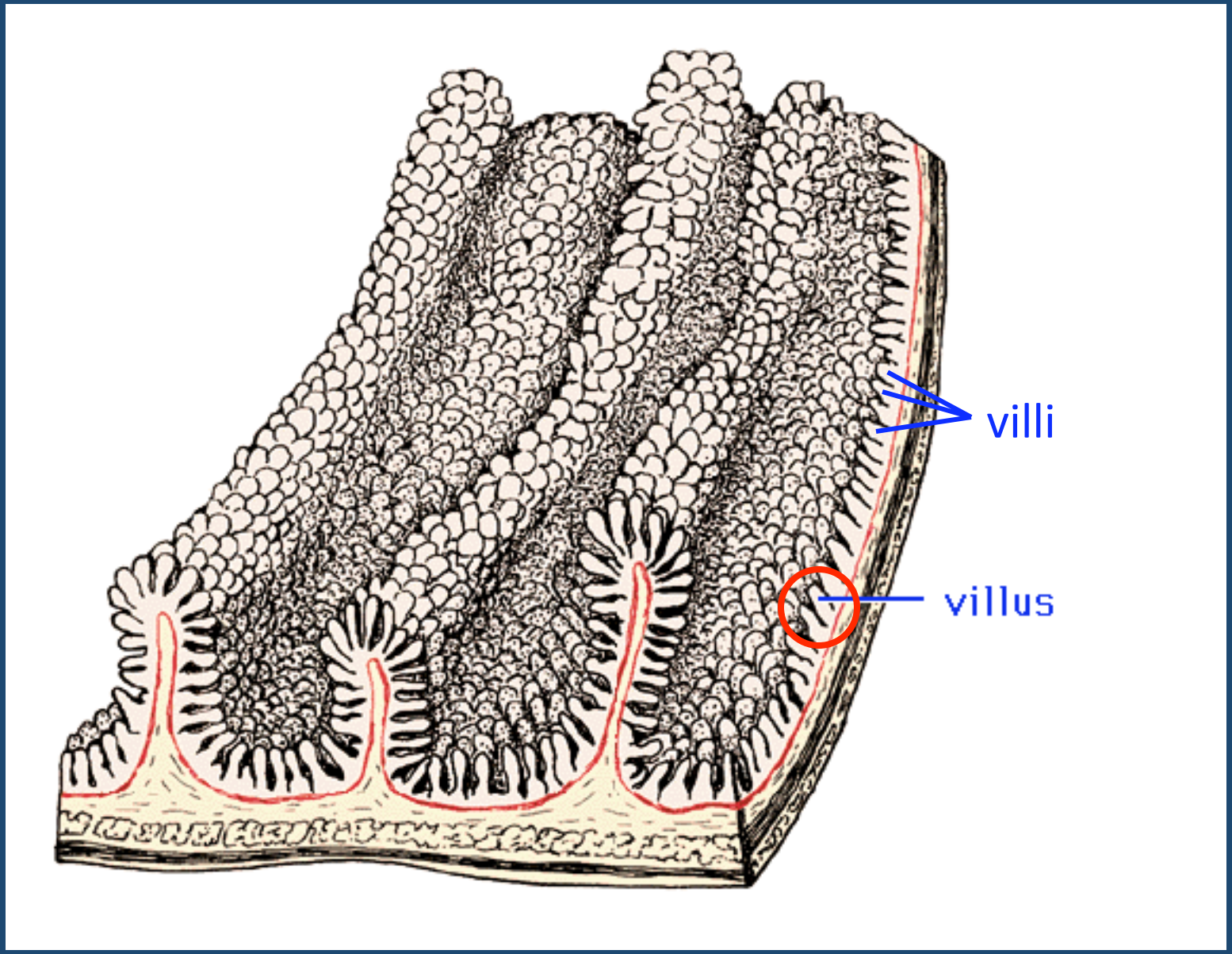
http://www.humenhealth.com/helicobacter-pylori-2

Small Intestine

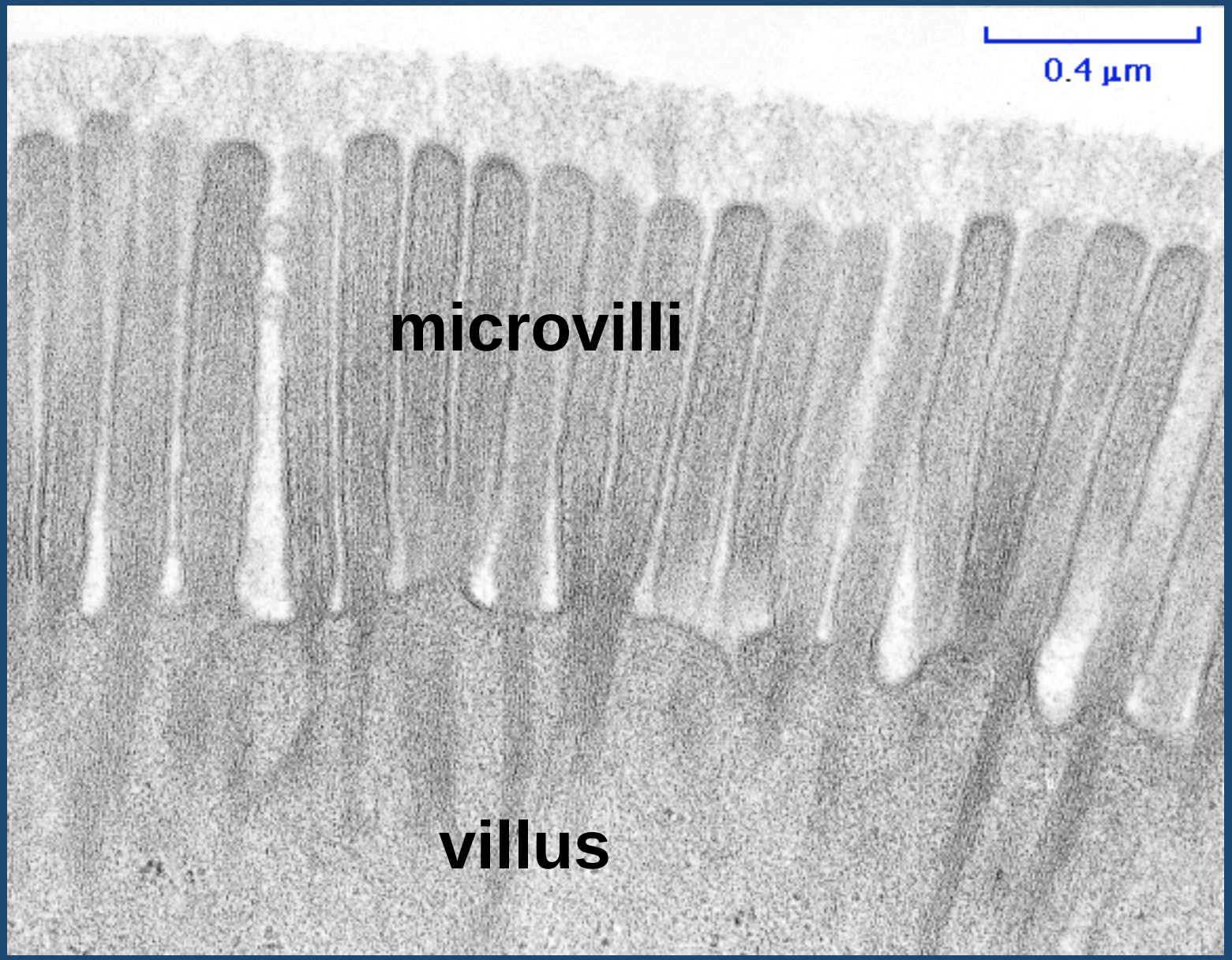
- Enzymes added to the slurry (chyme)
  - Enzymes provided by the pancreas and liver
- Nutrients absorbed selectively and actively
- Keyword for small intestine: surface area!

An intestinal cross section reveals the increased surface area:

Villi line the folds to increase the surface area of the absorptive regions of the intestine.



Here you can see the microvilli from a single villus



Surface area

~20 m long + Folds + Villi + Microvilli =

2 million cm^2 =Tennis court!

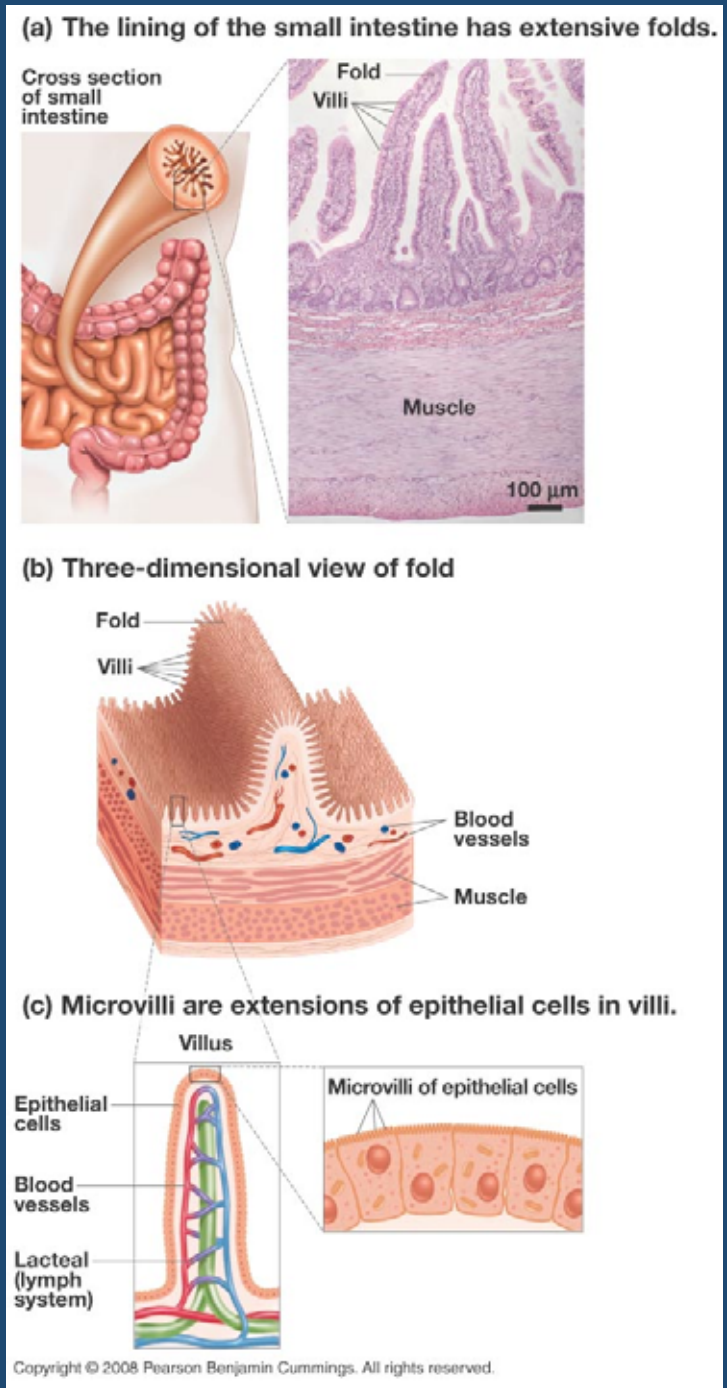


Fig 43.11 pg 969

Small Intestine
Protein digestion

- Protein digestion completed via proteases
  - Inactive proteases abundant in pancreas, SI
  - Trypsinogen changed to trypsin (by protein, not H^+)
  - Trypsin activates many other proteases

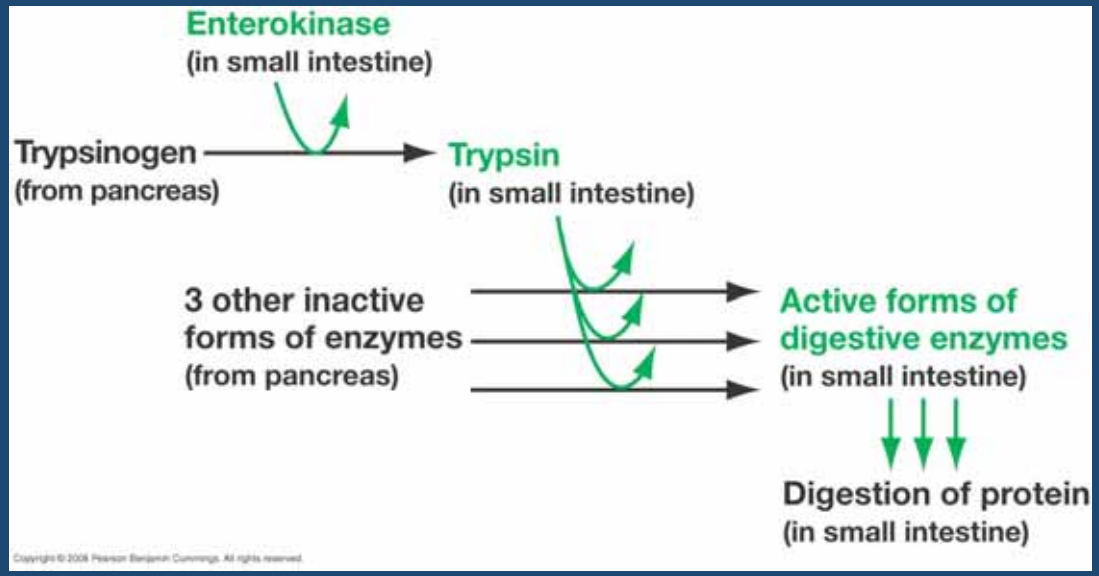


Fig 43.12 pg 970