



...Put Lab Notebook in box based on your lab time. Thanks!!

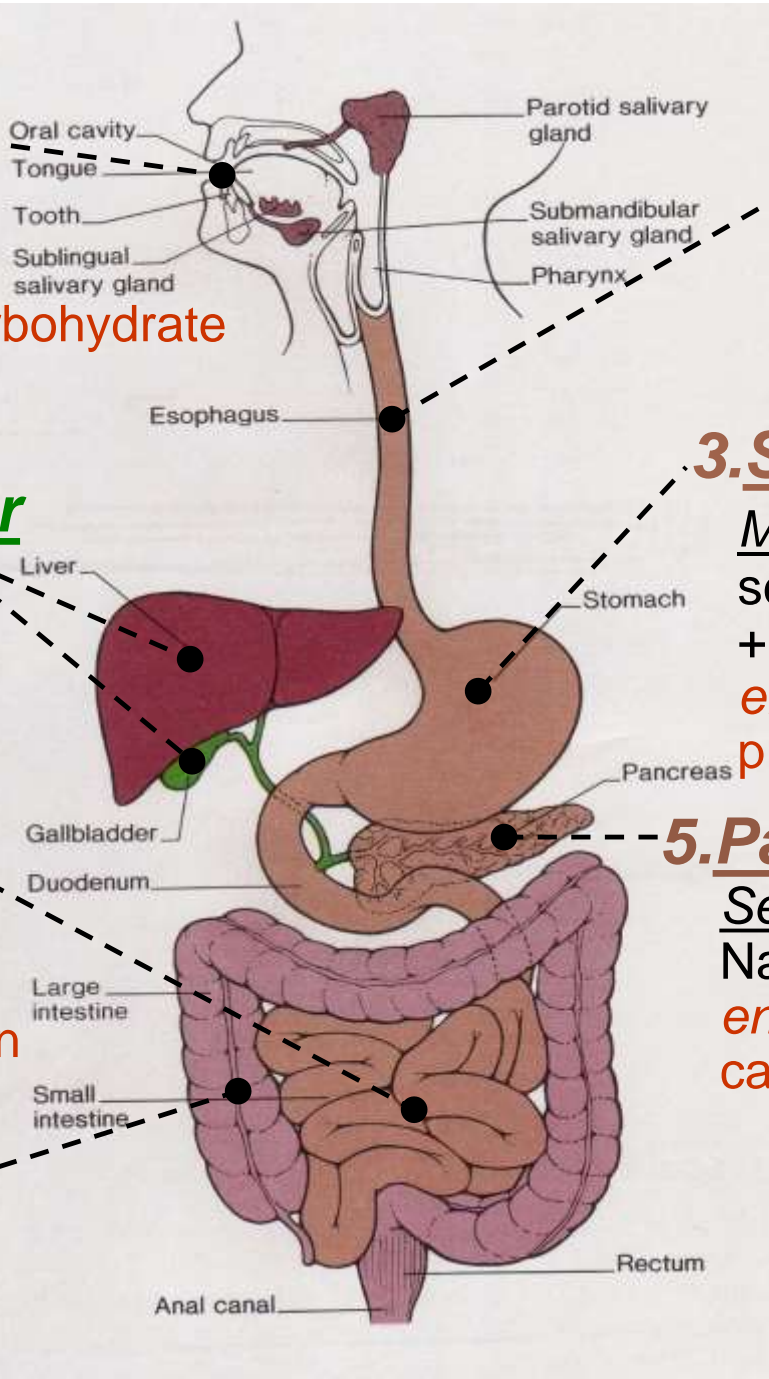


BI 121 Lecture 7

- I. Announcements** Exam I one week from today, Oct 29th!
10 am Lab → 5 KLA, 11 am → 129 HUE, AEC, All others here!
Discussion + Review, Sunday Oct 27th, 6-7:30 pm, here! Q?
- II. Gastrointestinal Physiology** DC Mod 3 pp 17-23, LS ch 15+
 - A. Organ-by-organ review LS tab 15-1 pp 440-1 +...
 - B. Zymogen? = Inactive precursor LS fig 15-9 p 452...
 - C. Accessory organs? Pancreas, Liver, Recycling! pp 457-63
 - D. Small intestine? Ulcers? Energy nutrient digestion LS
Beyond the Basics, fig 15-20,15-22 pp 456, 467-8, Mayo Clinic
 - E. Large intestine? LS fig 15-24 pp 472-4
- III. Cardiovascular System** DC Mod 4, LS ch 9, Torstar, G&H+...
 - A. Circulatory vs. Cardiovascular (CV)? CV vs. Lymphatic
CV Pulmonary & Systemic circuits DC pp23-31+LS p229+
DC fig 4-1 p 24, LS fig 9-2b p 231
 - B. Arteries, capillaries, veins, varicosities? G&H, Torstar, DC
 - C. ♥ layers, box, chambers, valves, inlets, outlets
LS fig 9-4 p 233, fig 9-2a p 231; DC pp 23-6
 - D. Normal vs. abnormal blood flow thru ♥ & CVS LS, Fox+...

1. Mouth

Ingestion entry way
salivary gland secretion
mucus + enzymes
enzymatic digestion: carbohydrate
mastication = chewing
deglutition = swallowing



2. Esophagus

Rapid transit
peristalsis
secretion mucus

3. Stomach

Mixing peristalsis
secretion mucus + HCl
+ enzymes
enzymatic digestion:
protein + butter fat!

5. Pancreas

Secretion mucus +
 NaHCO_3 + enzymes
enzymatic digestion:
carbohydrate, fat, protein

4. Liver-Gall Bladder

Emulsification =
detergent action of bile
+ secretion

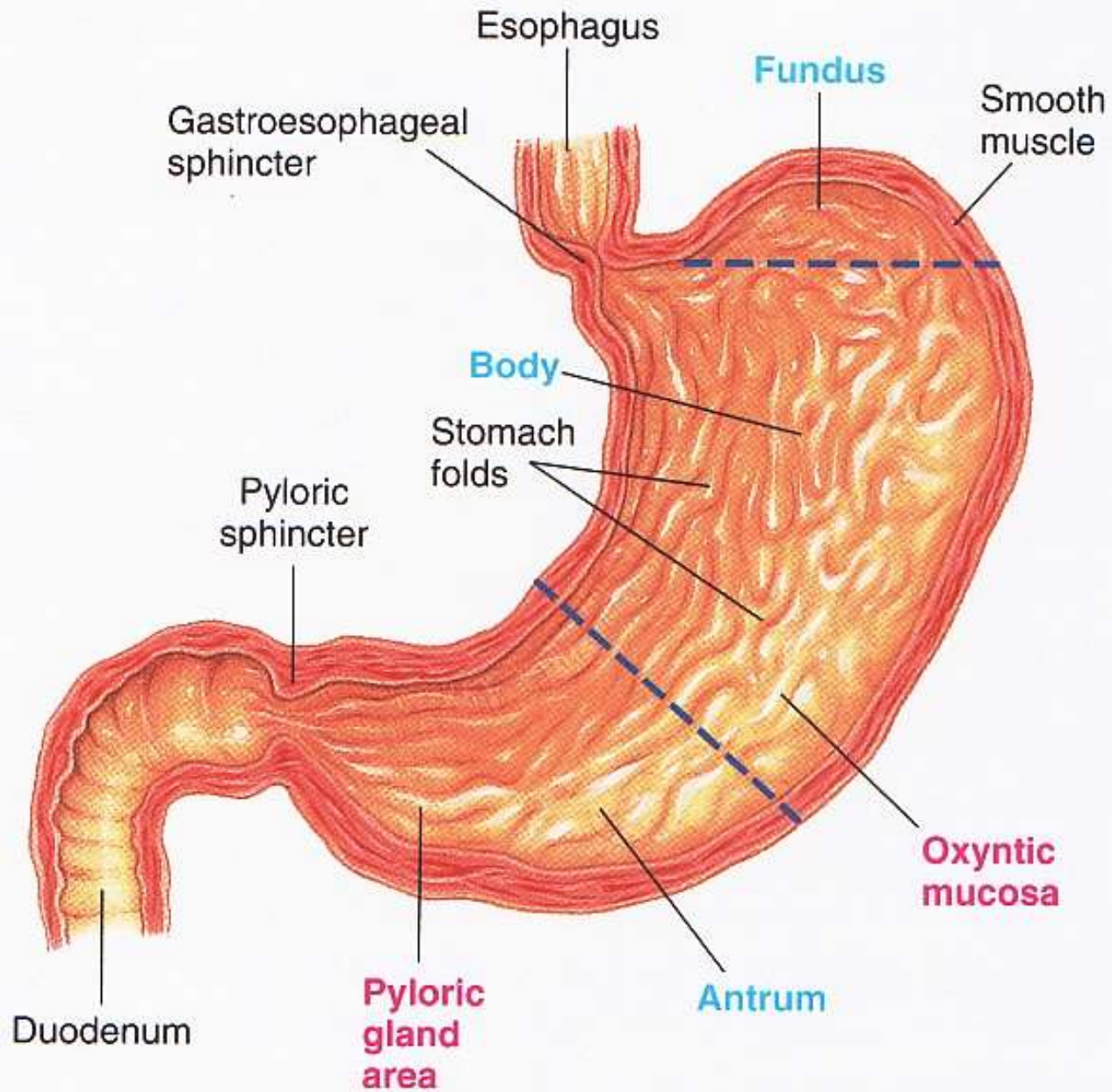
6. Small Intestine

Absorption
Secretion mucus
+ enzymes
enzymatic digestion:
carbohydrate, fat, protein
Peristalsis

7. Large Intestine

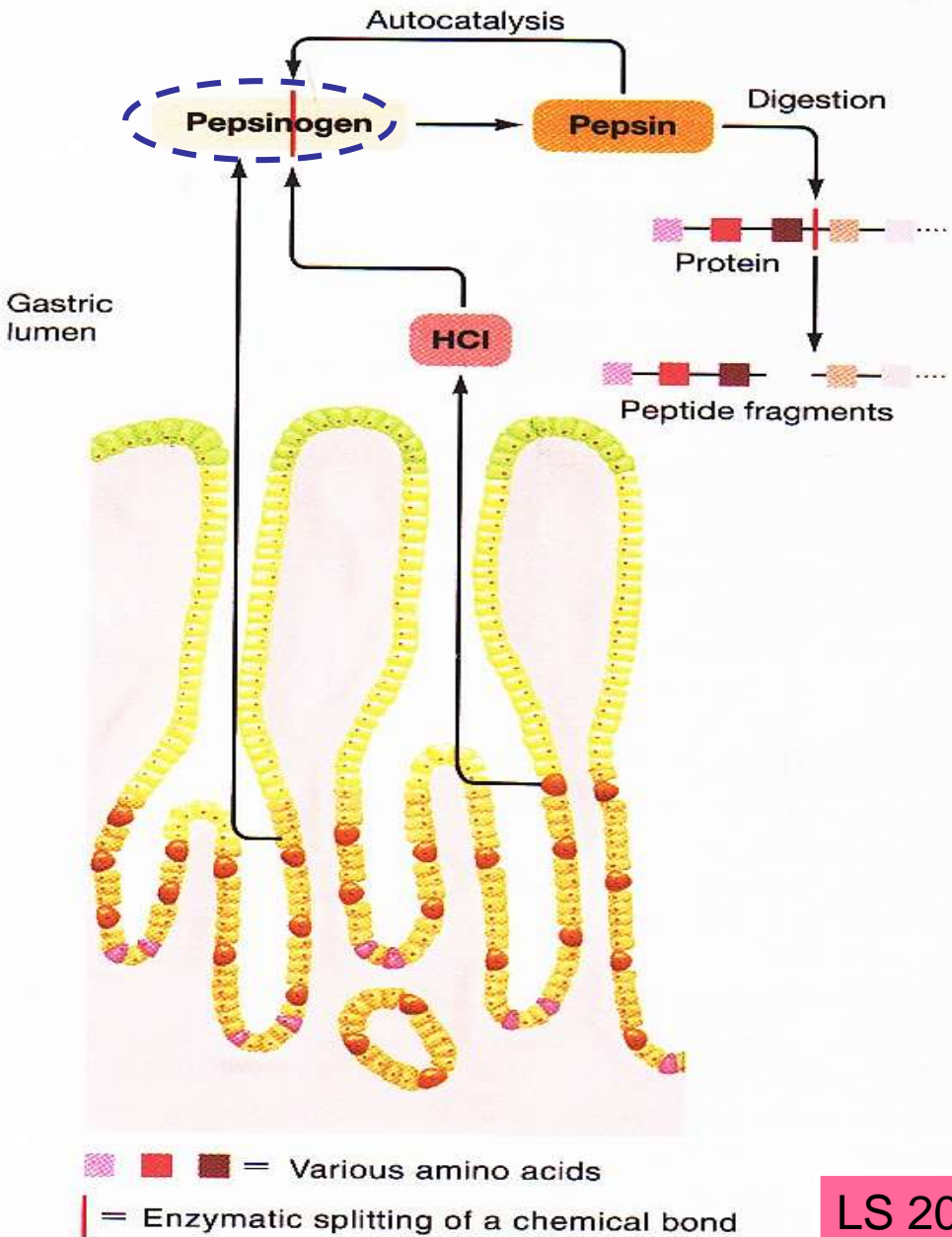
Dehydration
secretion + absorption
storage + peristalsis

Where does
enzymatic
digestion of
protein
begin?

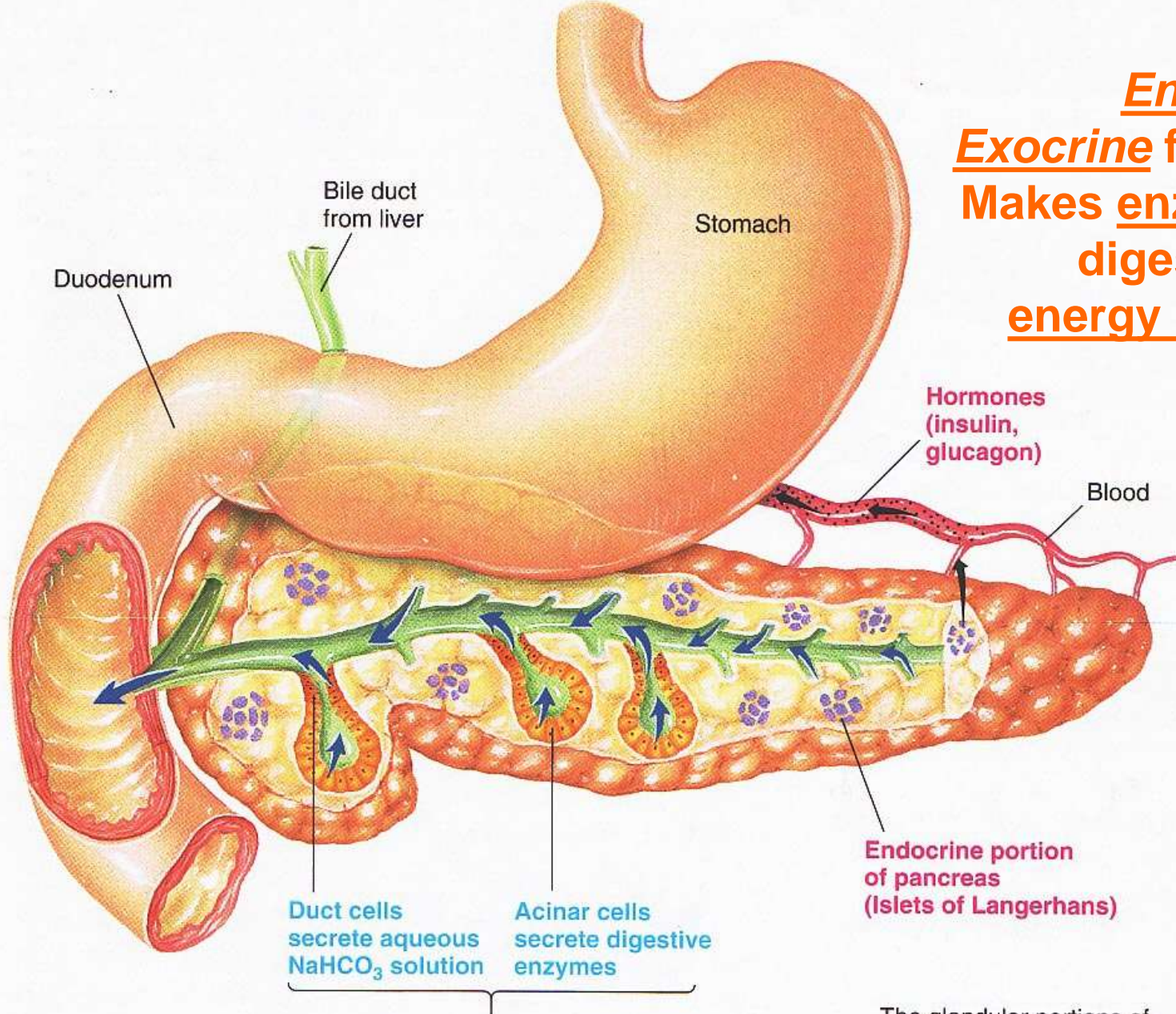


● **FIGURE 15-7**

Zymogen = an inactive precursor



Why is the
pancreas so
unique?



Endocrine + Exocrine functions; Makes enzymes for digesting all 3 energy nutrients!

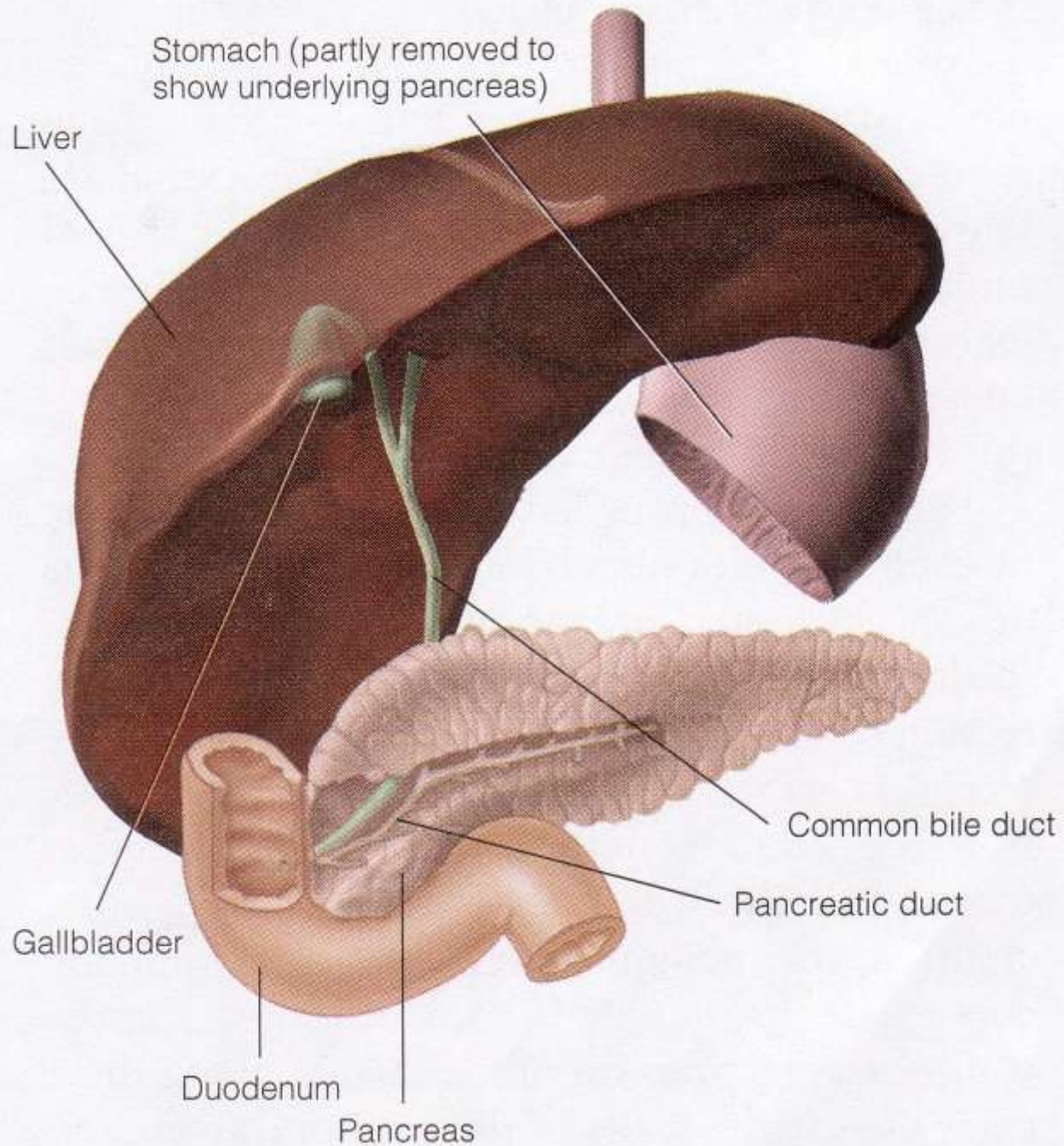
Duct cells secrete aqueous NaHCO_3 solution
 Acinar cells secrete digestive enzymes

Exocrine portion of pancreas (Acinar and duct cells)

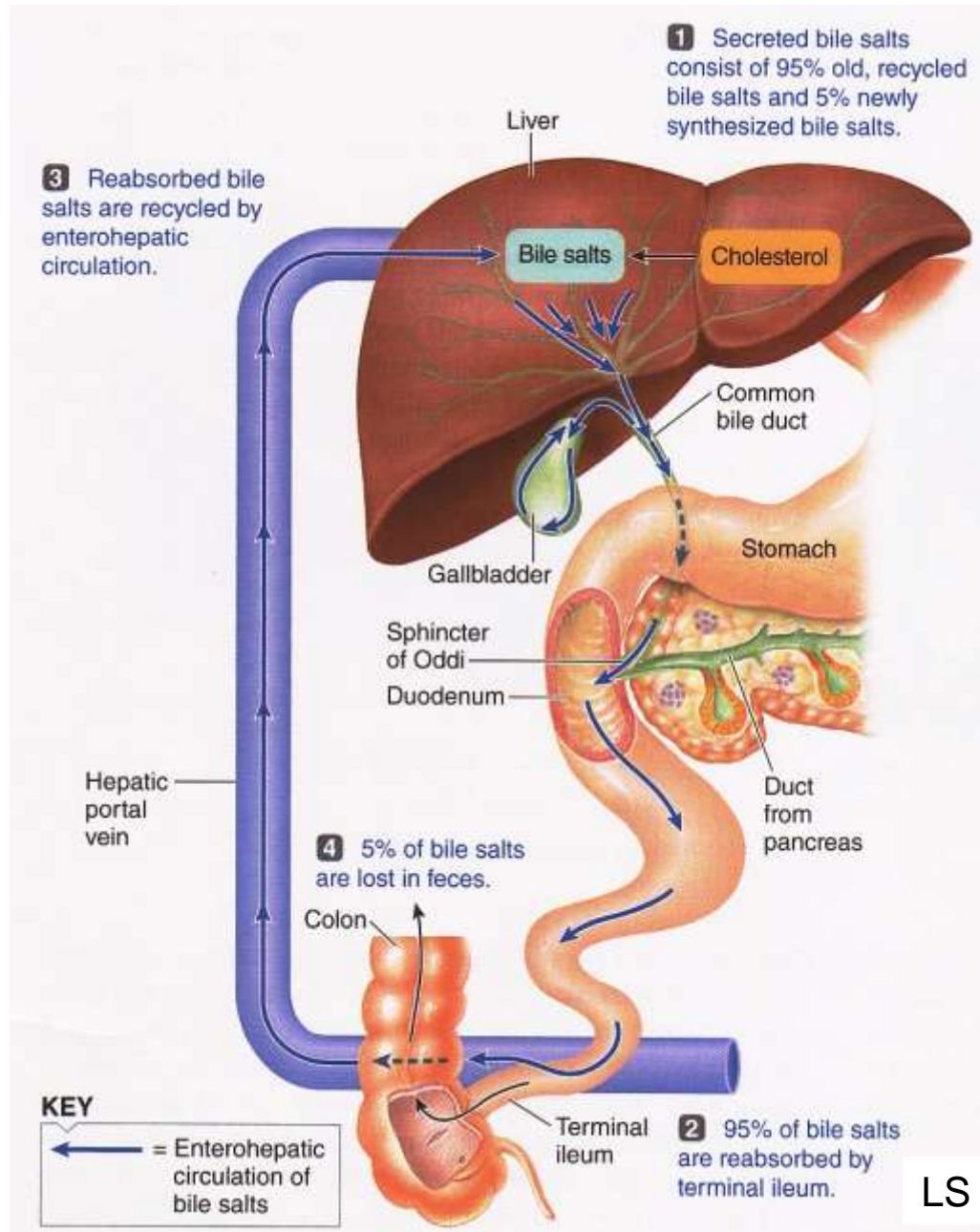
Endocrine portion of pancreas (Islets of Langerhans)

The glandular portions of the pancreas are grossly exaggerated.

**What are other
accessory organs
of digestion, that is,
off-shoots of the
primary tube?**

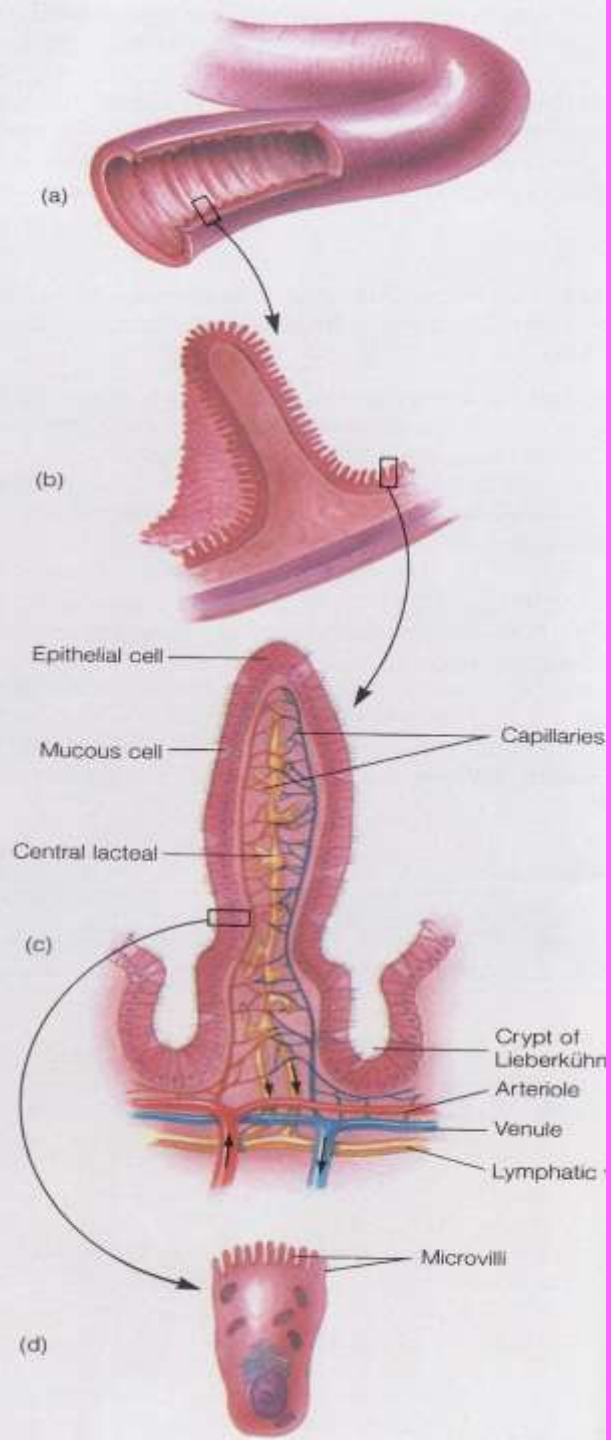


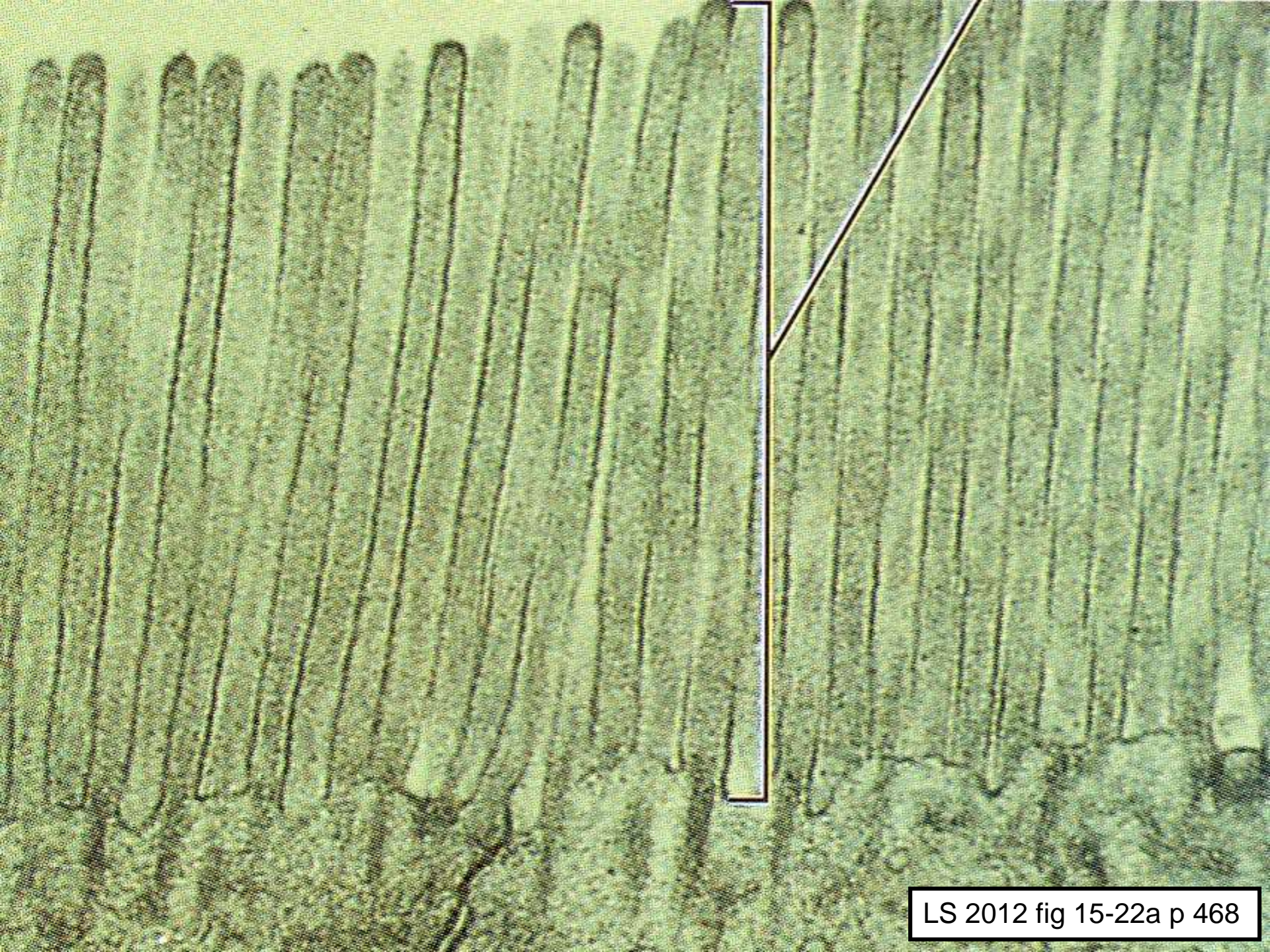
Liver: Amazing Recycling of Bile Salts!



What is the major
function of the
small intestine?

Absorption!!







<https://www.mayoclinic.org/diseases-conditions/peptic-ulcer/symptoms-causes/syc-20354223>



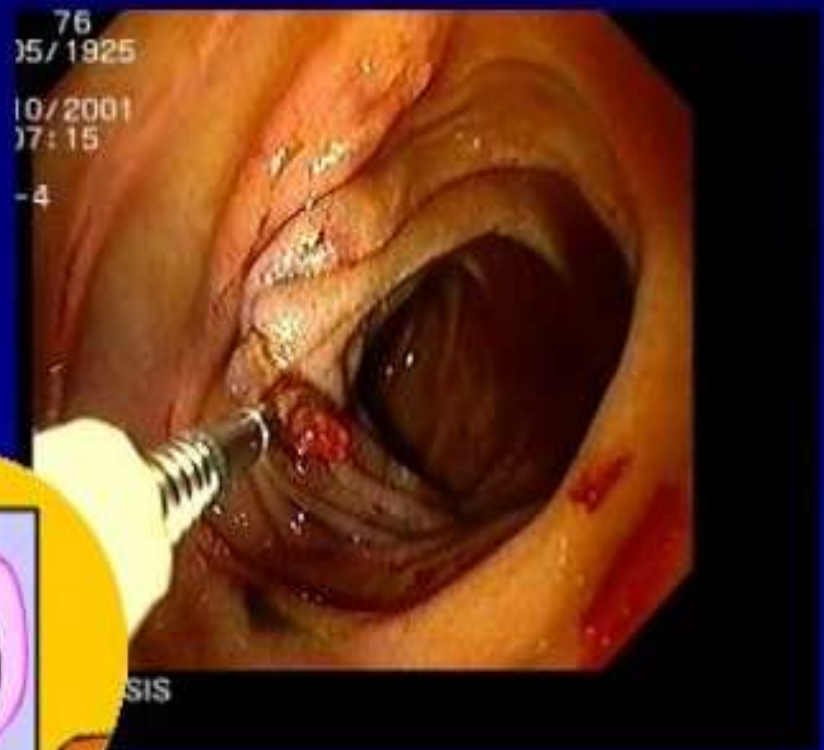
Ulcer Facts

- Most ulcers are caused by an infection, not spicy food, acid or stress.
- The most common ulcer symptom is burning pain in the stomach.
- Your doctor can test you for *H. pylori* infection.
- Antibiotics are the new cure for ulcers.
- Eliminating *H. pylori* infections with antibiotics means that your ulcer can be cured for good.

Clipping a Duodenal Ulcer

Peering through the pylorus into the duodenum, we see some blood and a vessel sticking out of the wall, just at the front edge of a small but deep ulcer.

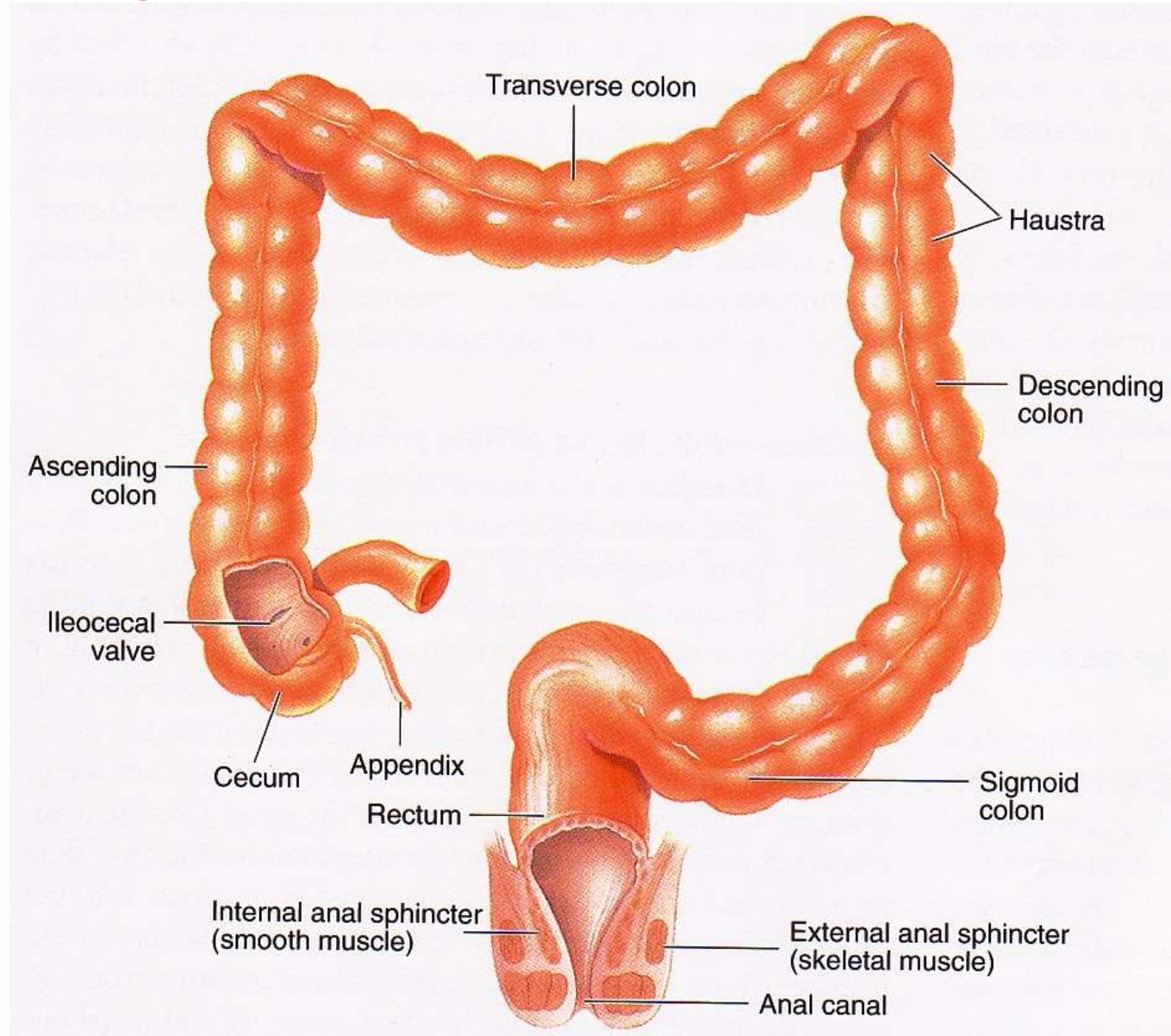
In the second photograph, a disposable metal clip is applied to the ulcer. The patient remained well and left hospital three days later.



▲ **Table 15-5 Digestive Processes for the Three Major Categories of Nutrients**

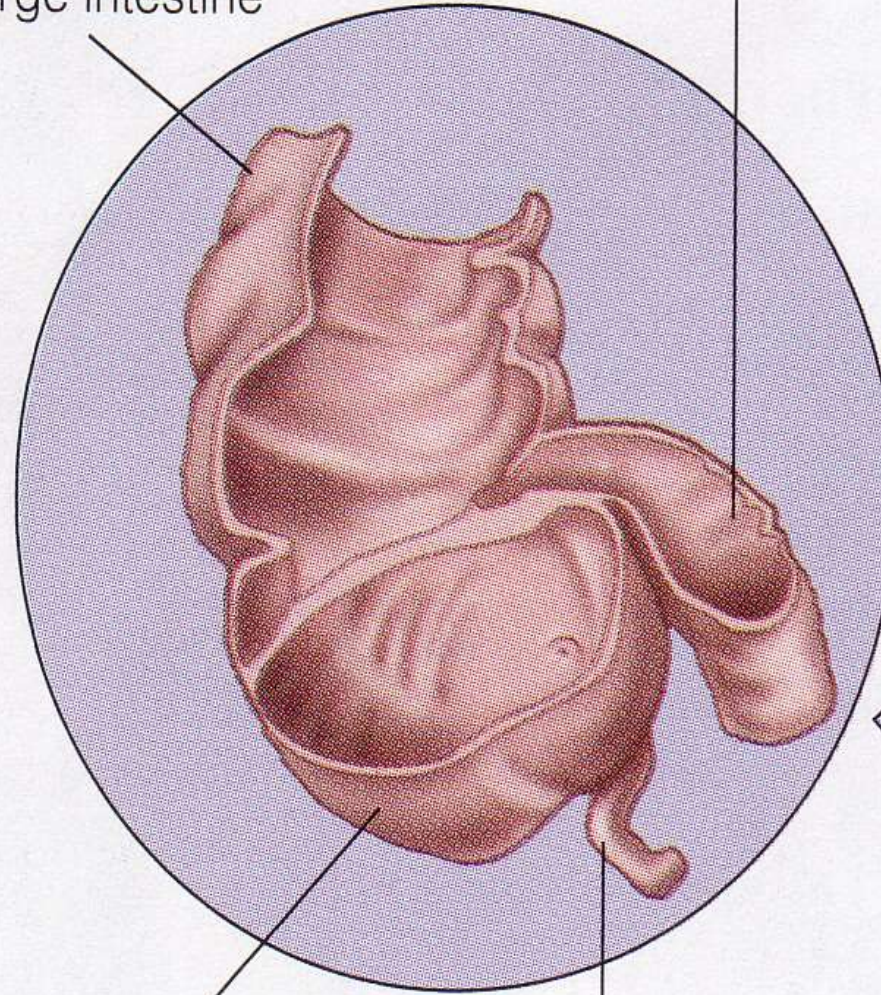
Nutrients	Enzymes for Digesting the Nutrients	Source of Enzymes	Site of Action of Enzymes	Action of Enzymes	Absorbable Units of the Nutrients
Carbohydrates	Amylase	Salivary glands	Mouth and (mostly) body of stomach	Hydrolyzes polysaccharides to disaccharides (maltose)	
		Exocrine pancreas	Small-intestine lumen		
	Disaccharidases (maltase, sucrase, lactase)	Small-intestine epithelial cells	Small-intestine brush border	Hydrolyze disaccharides to monosaccharides	Monosaccharides, especially glucose
Proteins	Pepsin	Stomach chief cells	Stomach antrum	Hydrolyzes protein to peptide fragments	
	Trypsin, chymotrypsin, carboxypeptidase	Exocrine pancreas	Small-intestine lumen	Attack different peptide fragments	
	Aminopeptidases	Small-intestine epithelial cells	Small-intestine brush border	Hydrolyze peptide fragments to amino acids	Amino acids
Fats	Lipase	Exocrine pancreas	Small-intestine lumen	Hydrolyzes triglycerides to fatty acids and monoglycerides	Fatty acids and monoglycerides
	Bile salts (not an enzyme)	Liver	Small-intestine lumen	Emulsify large fat globules for attack by pancreatic lipase	

Large Intestine Structure & Function



Ascending
portion of
large intestine

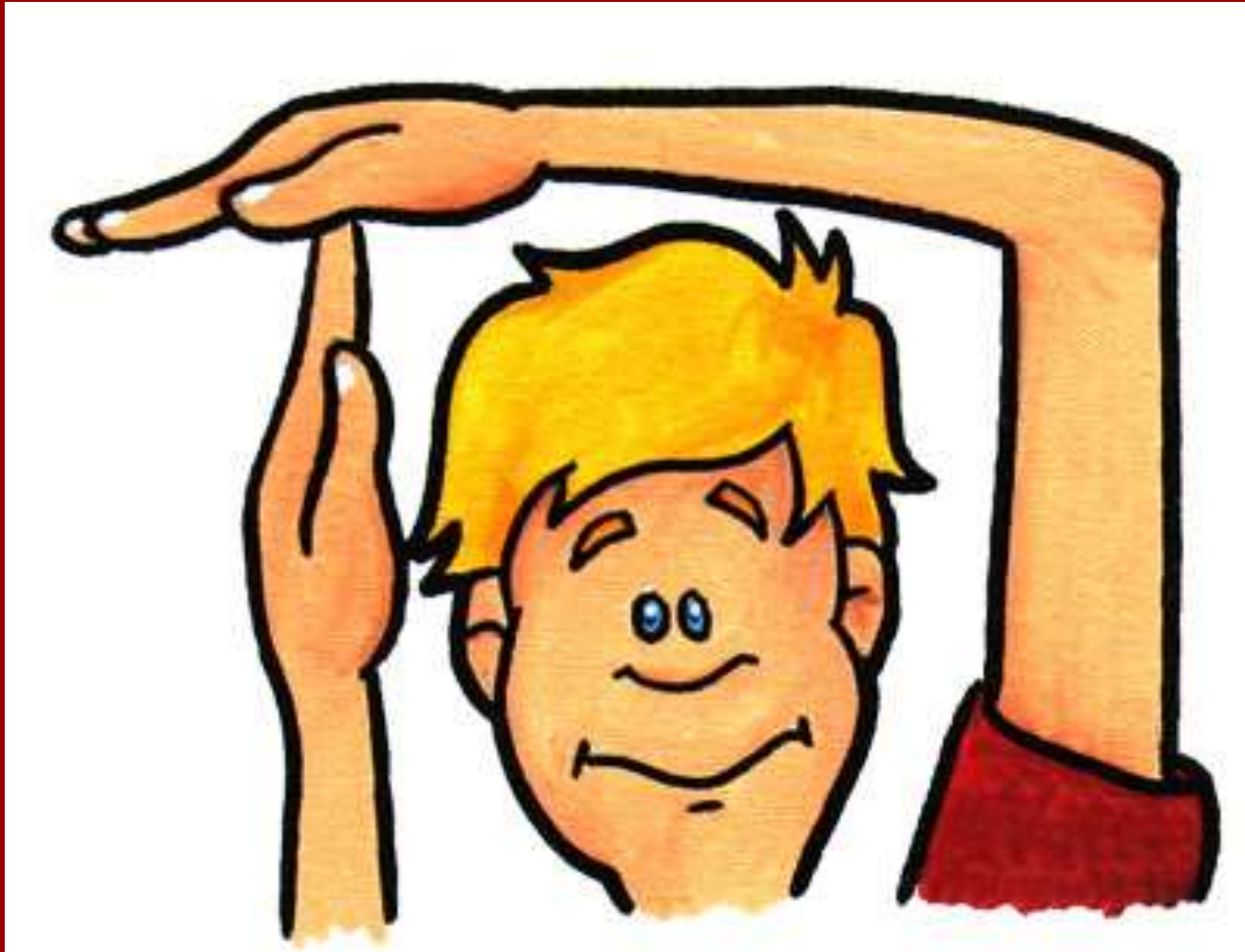
Ileum
of small
intestine



Cecum

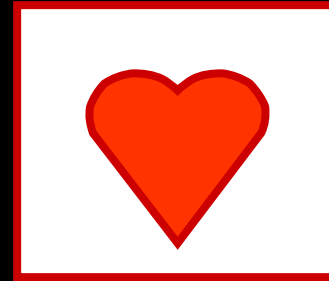
Appendix

Time-out for Questions!

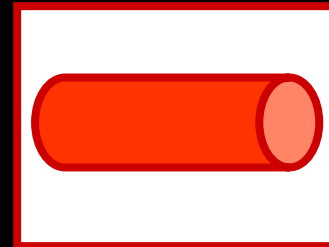


+ Brief Break!

Cardiovascular (CV) = Heart + Vessels + Blood!



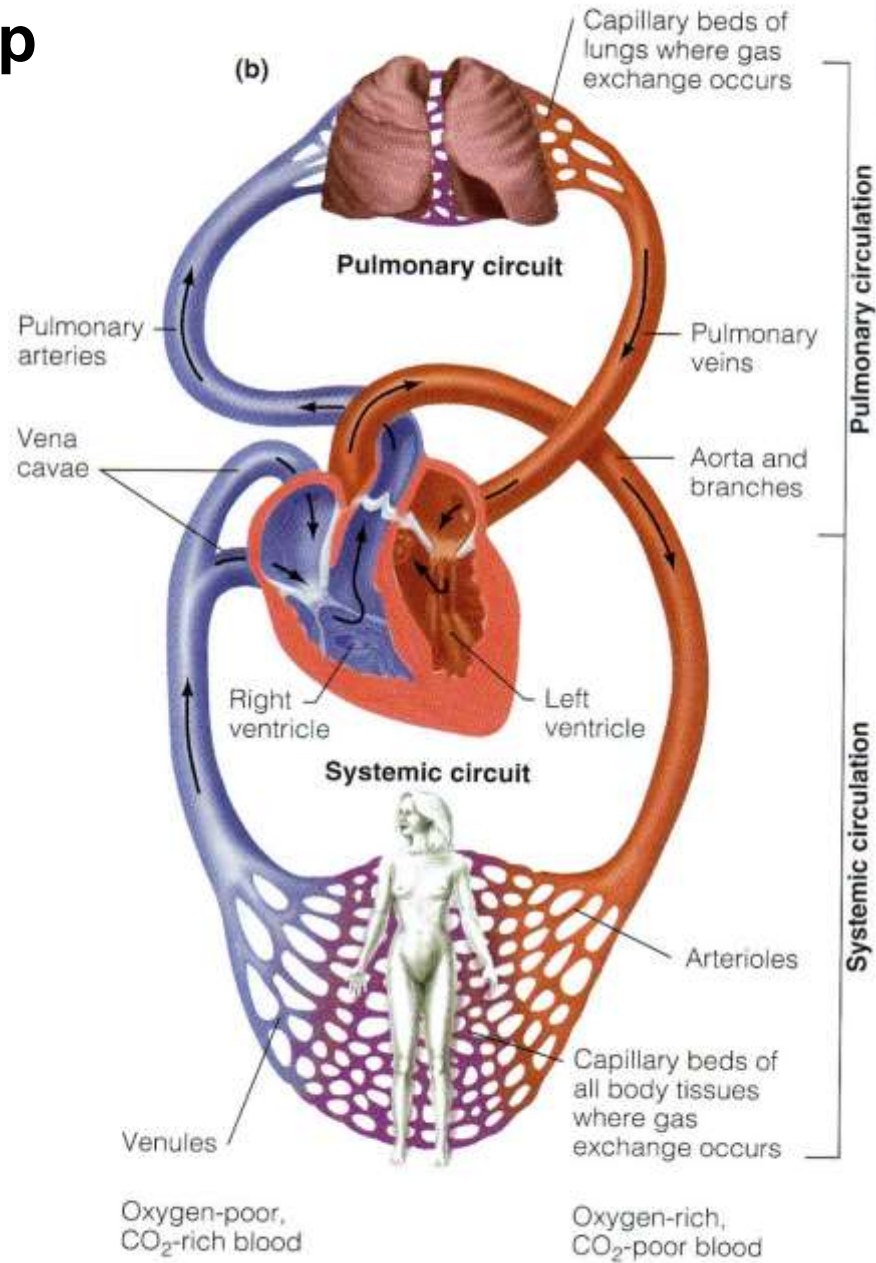
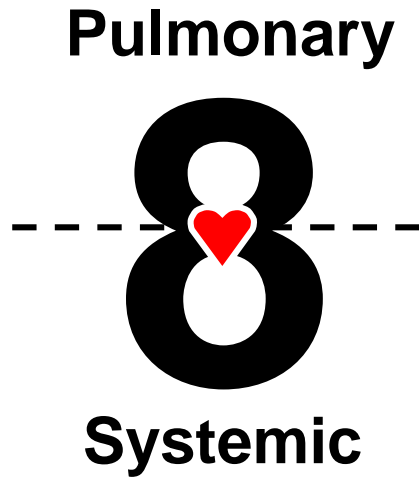
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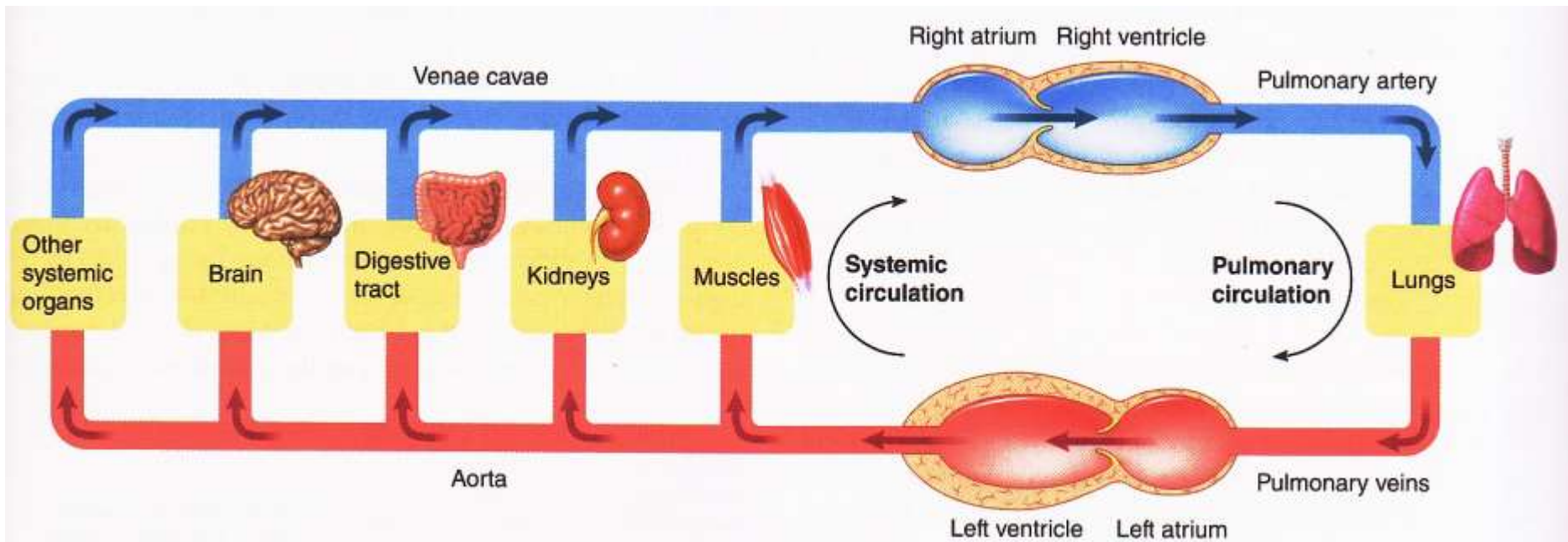
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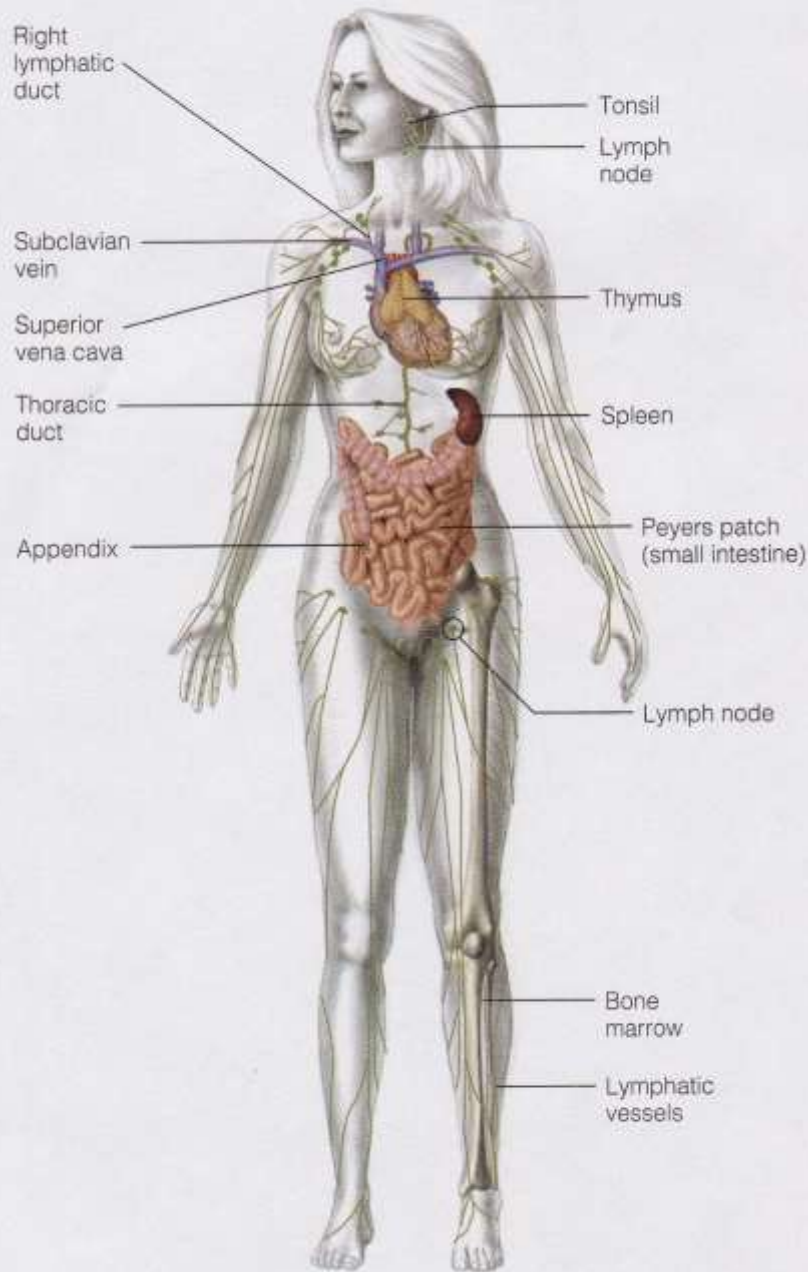


NB: Figure-8 loop



Dual Pump Action & Parallel Circulation



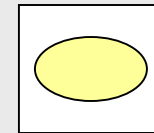


Lymphatic System

1. Lymph Nodes

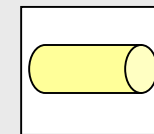
2. Vessels

3. Lymph

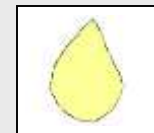


No pump!

+



+



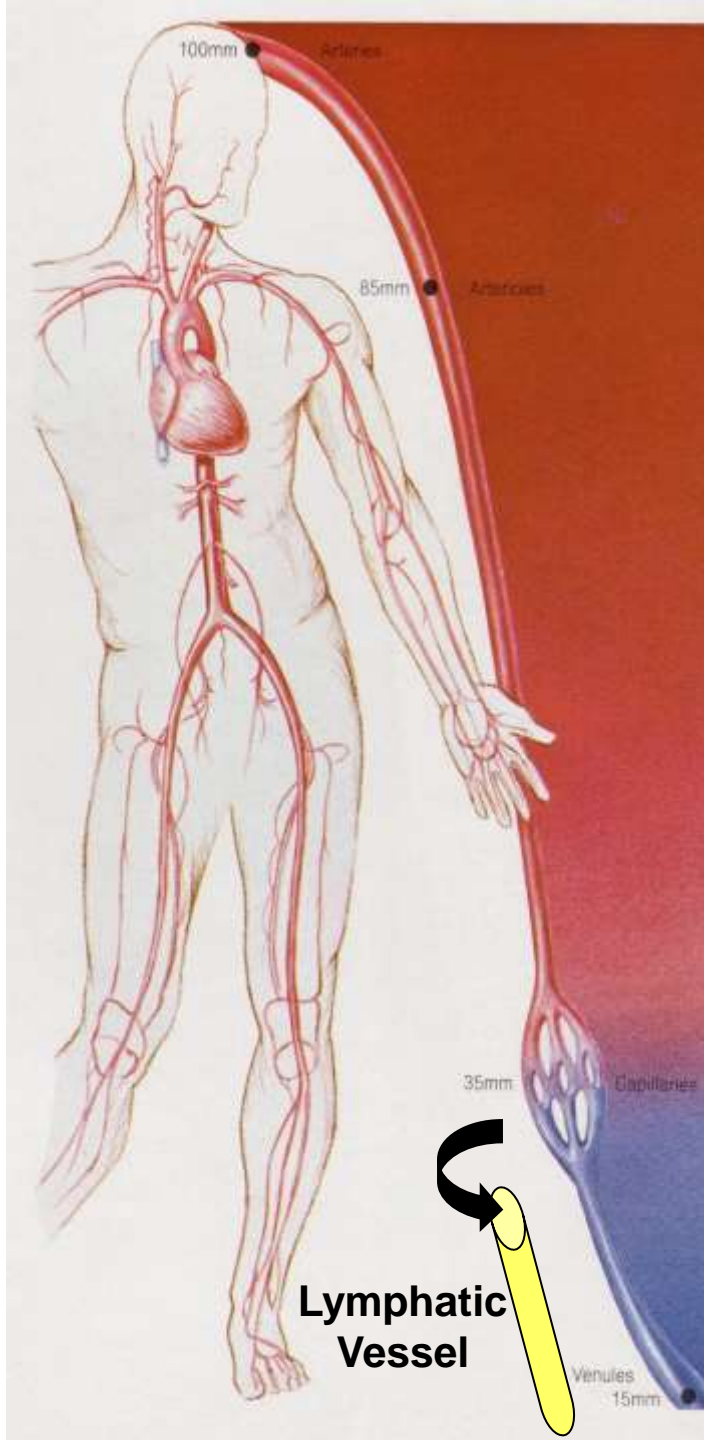
Lymphatic System

**Alternative System of
Circulation
or
Drainage System**

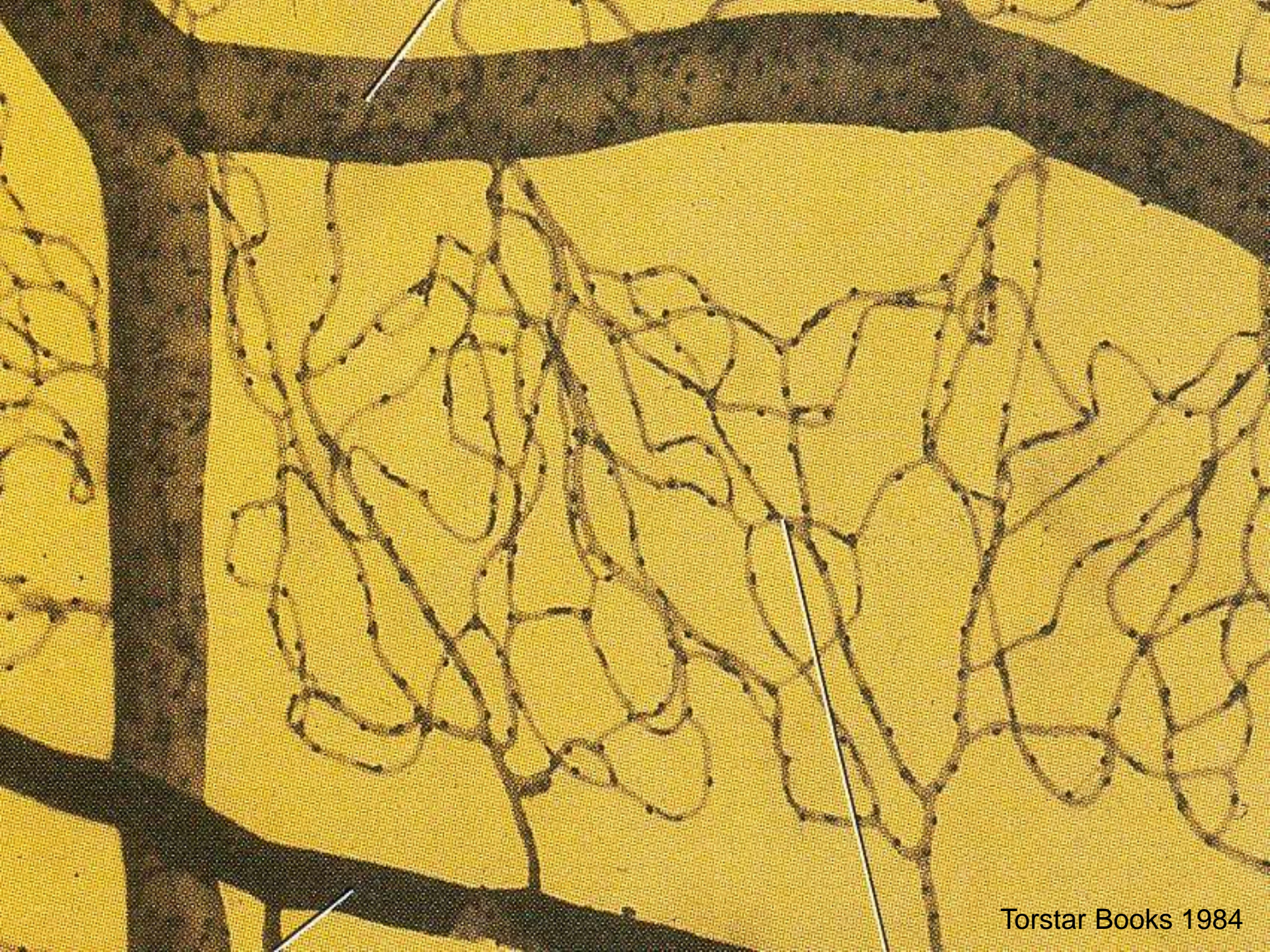
Lymph Vessels || Veins

Lymphatic System Blockage in Elephantiasis from Mosquito-borne Parasitic Filaria Worm

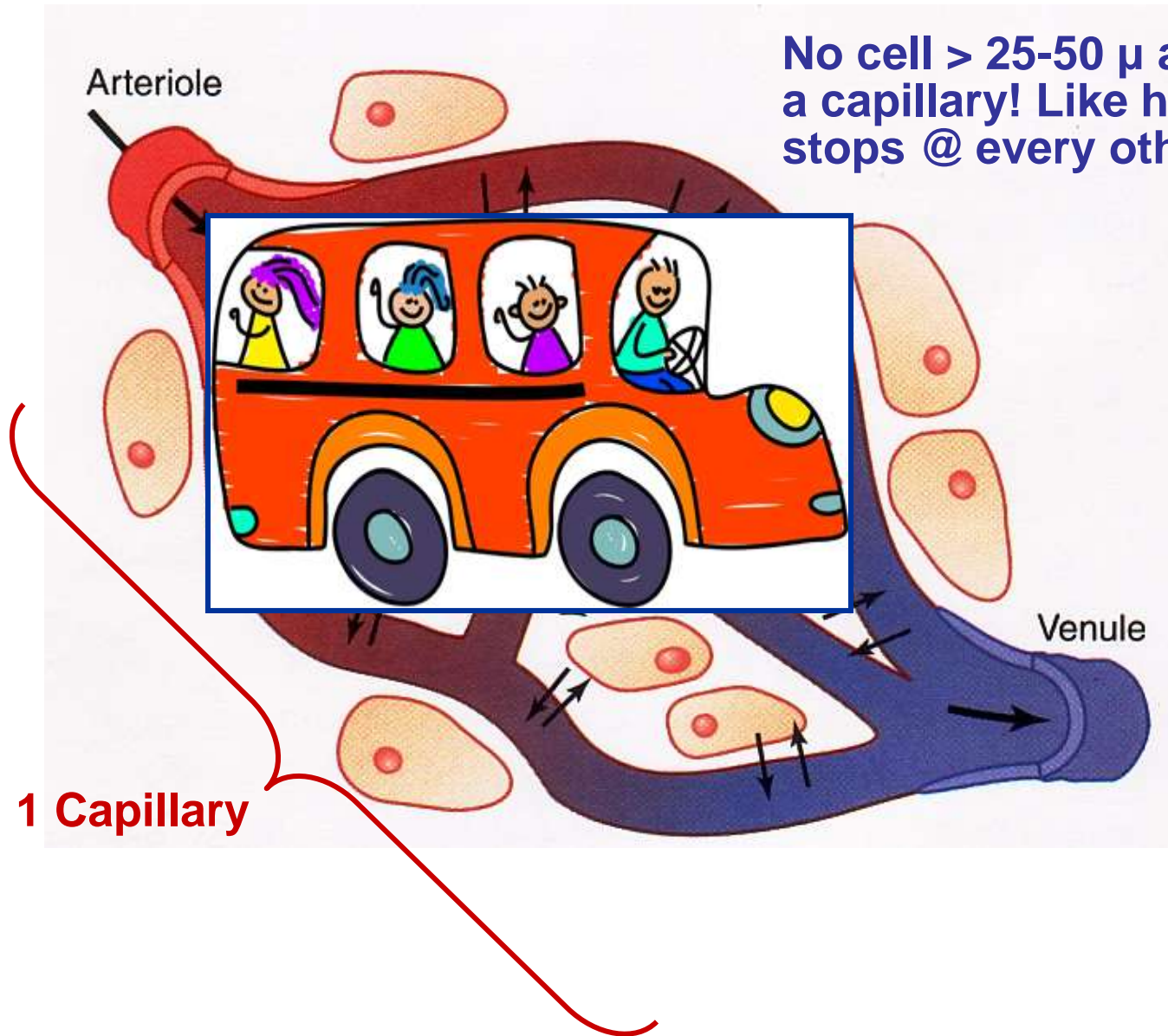




Lymphatics collect run-off & are parallel to venules/small veins!

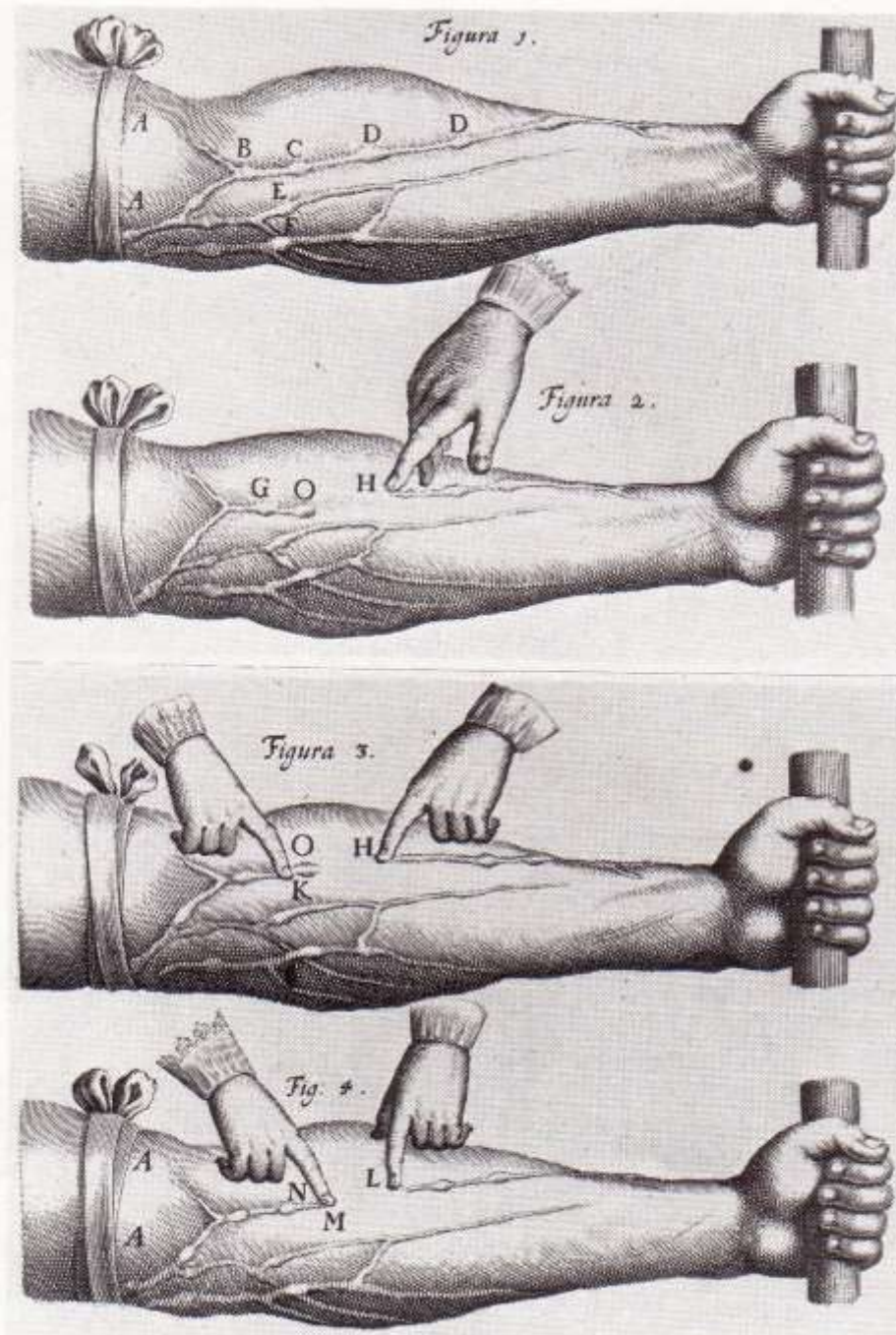


Microcirculation Exchange: 10 Billion Capillaries!

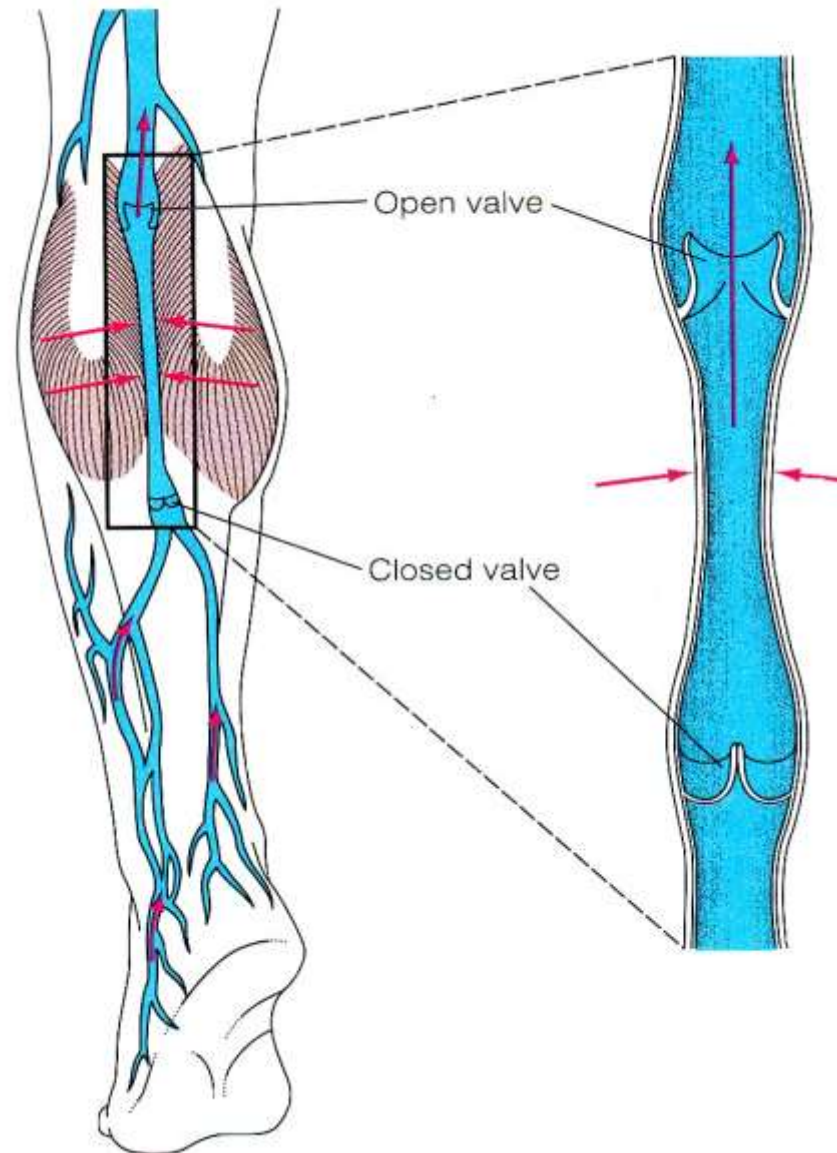


No cell > 25-50 μ away from a capillary! Like having bus stops @ every other block!

**Harvey
Experiments:
1-way system
of venous
valves!**

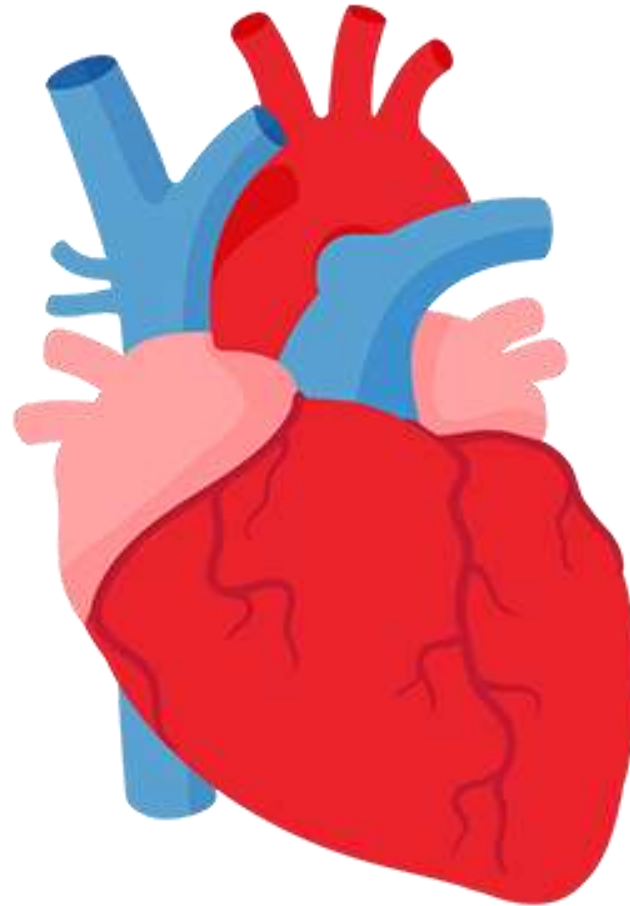


Skeletal Muscle Pump

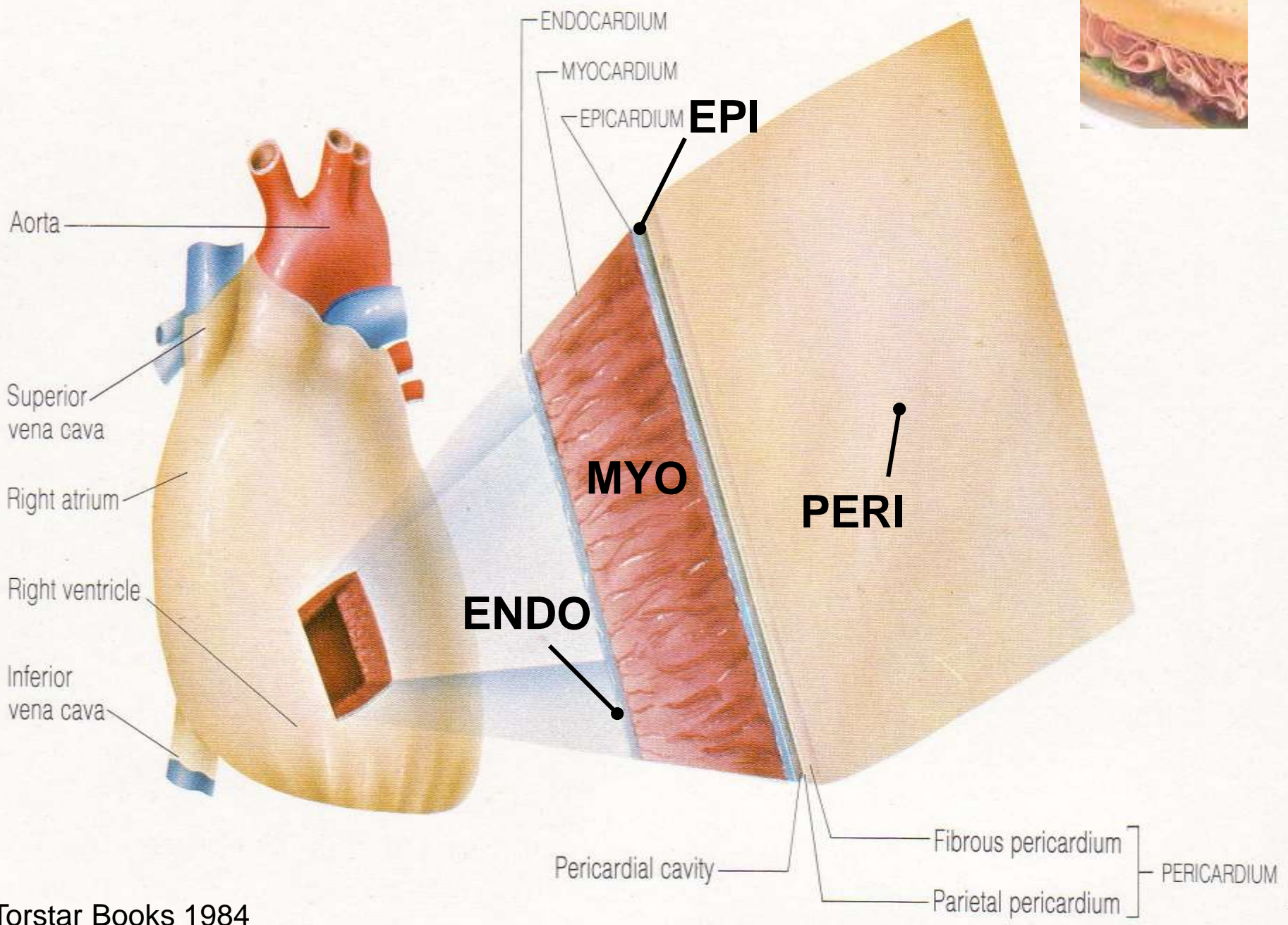




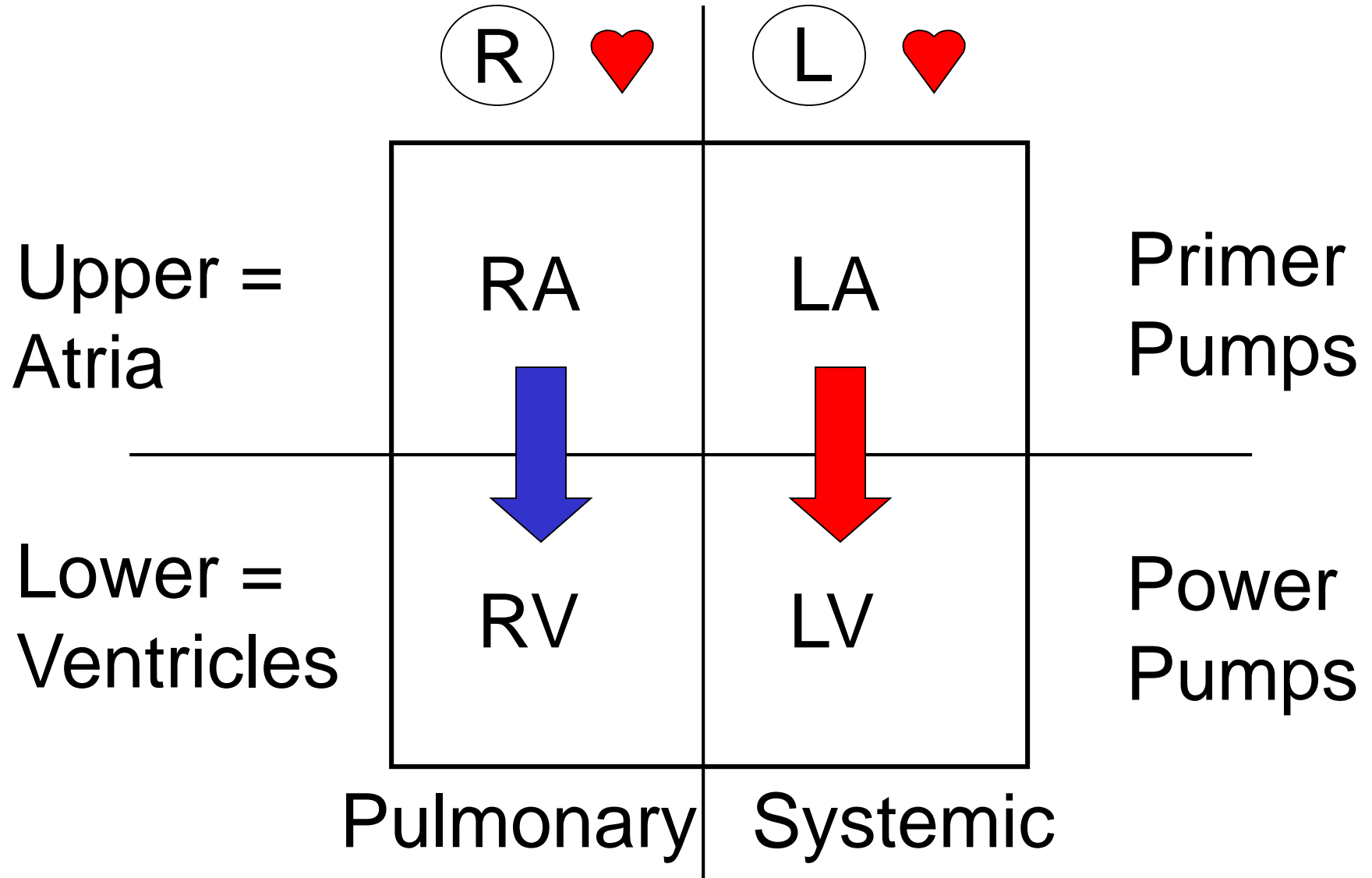
The Heart: The Living Pump

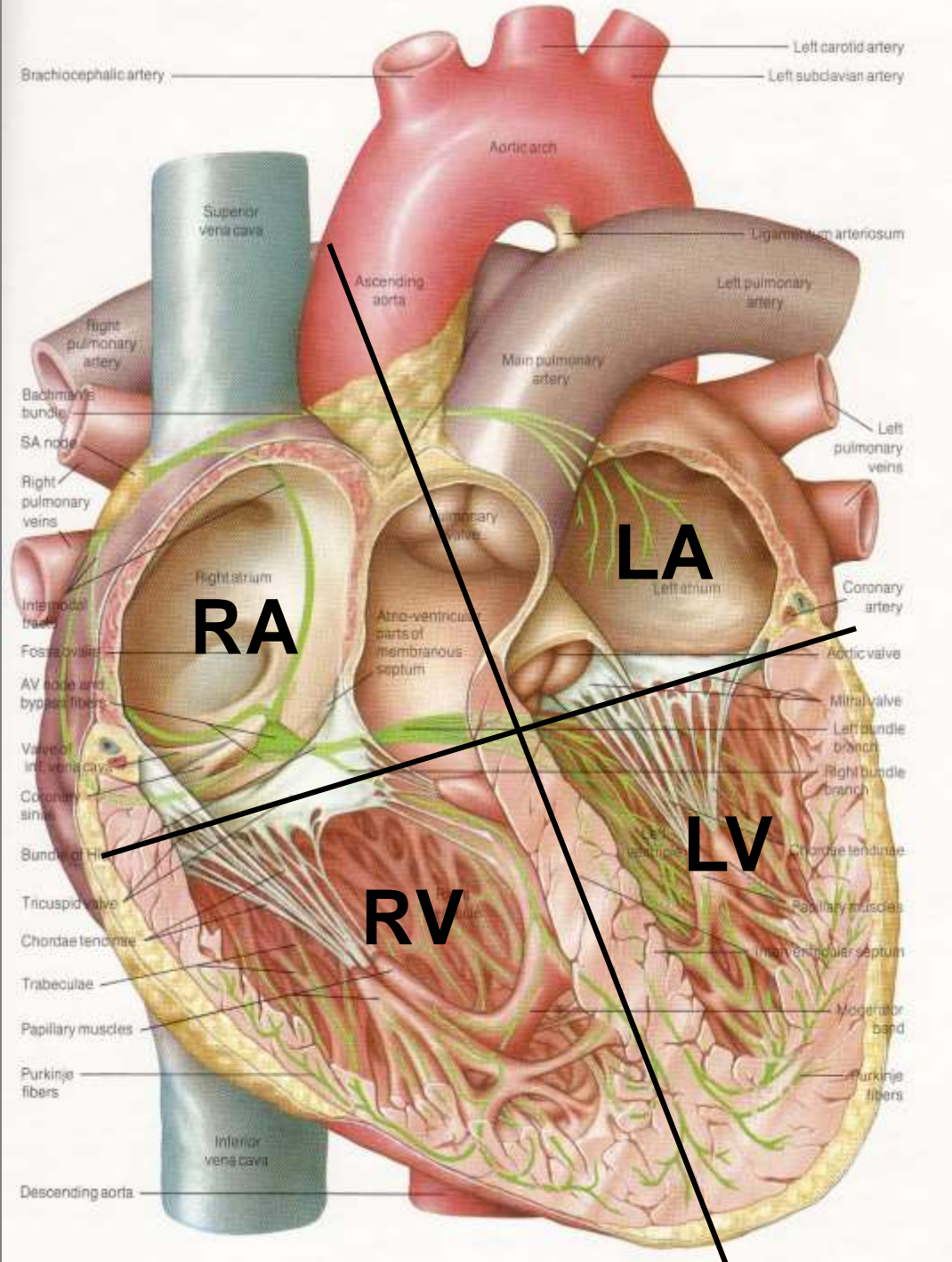


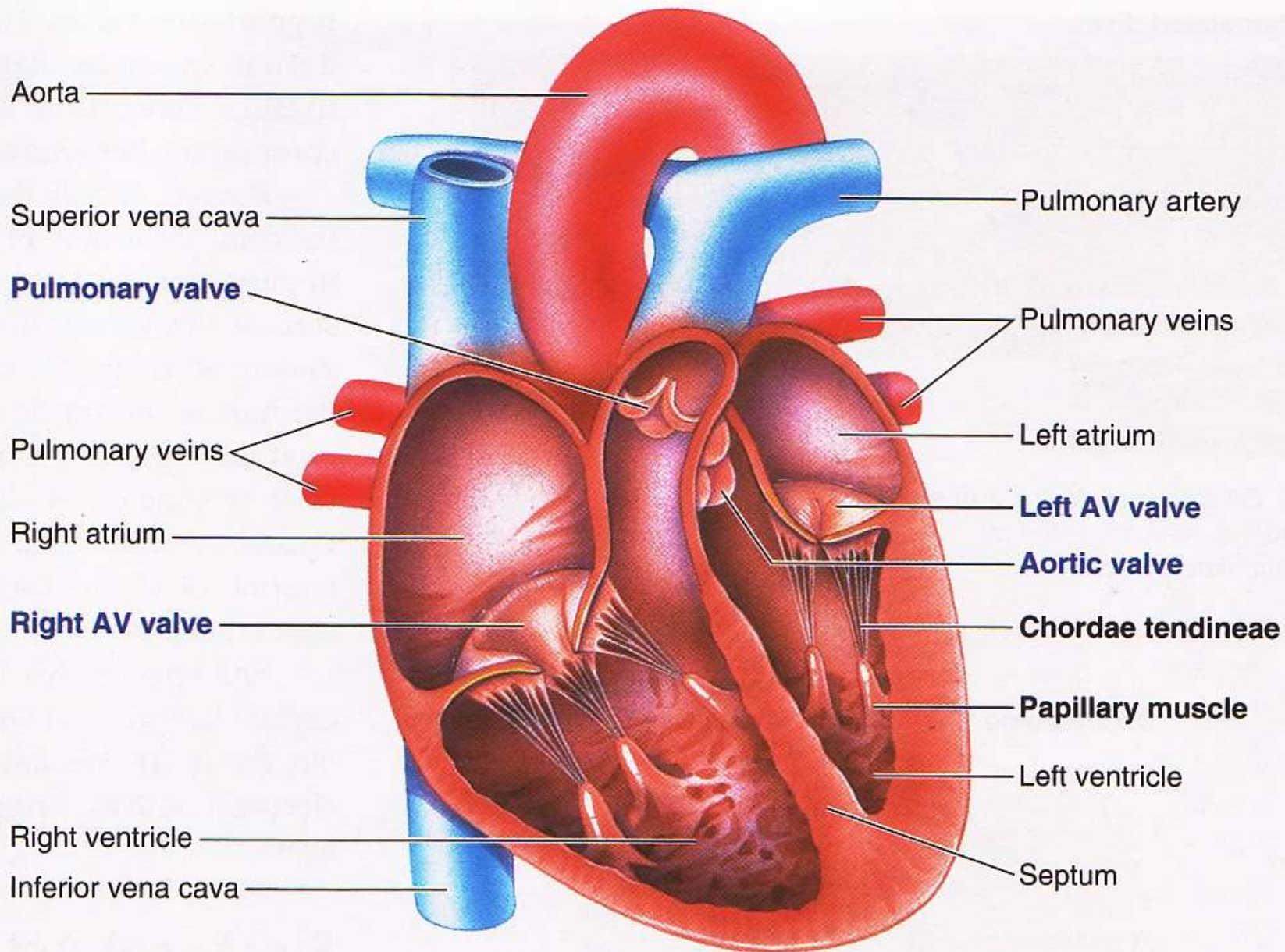
<https://ed.ted.com/lessons/how-the-heart-actually-pumps-blood-edmond-hui#review>



Human  = 4-chambered box?
2 separate pumps?







(a) Location of the heart valves in a longitudinal section of the heart

Heart Valves Ensure Unidirectional Blood Flow!



Right AV valve



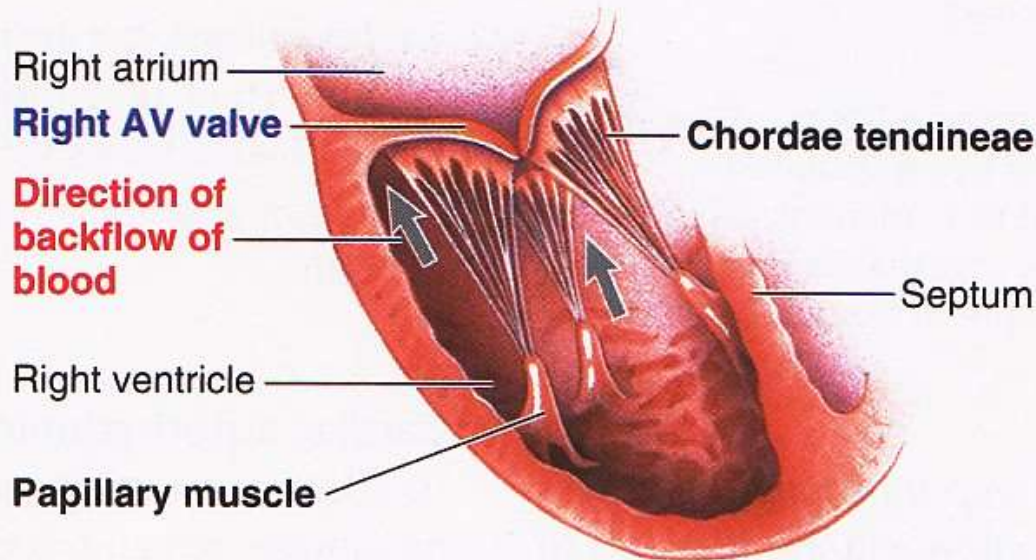
Left AV valve

Mom's
valve!



Aortic or pulmonary valve

(b) Heart valves in closed position, viewed from above



(c) Prevention of eversion of AV valves

● **FIGURE 9-4** Heart valves.

Valves must
be normal &
healthy to
work well!



Human ♥ = 4 unique valves?
2 valve sets?

Semilunar = Half-moon shaped

More
rigid

1. Pulmonic/Pulmonary
2. Aortic



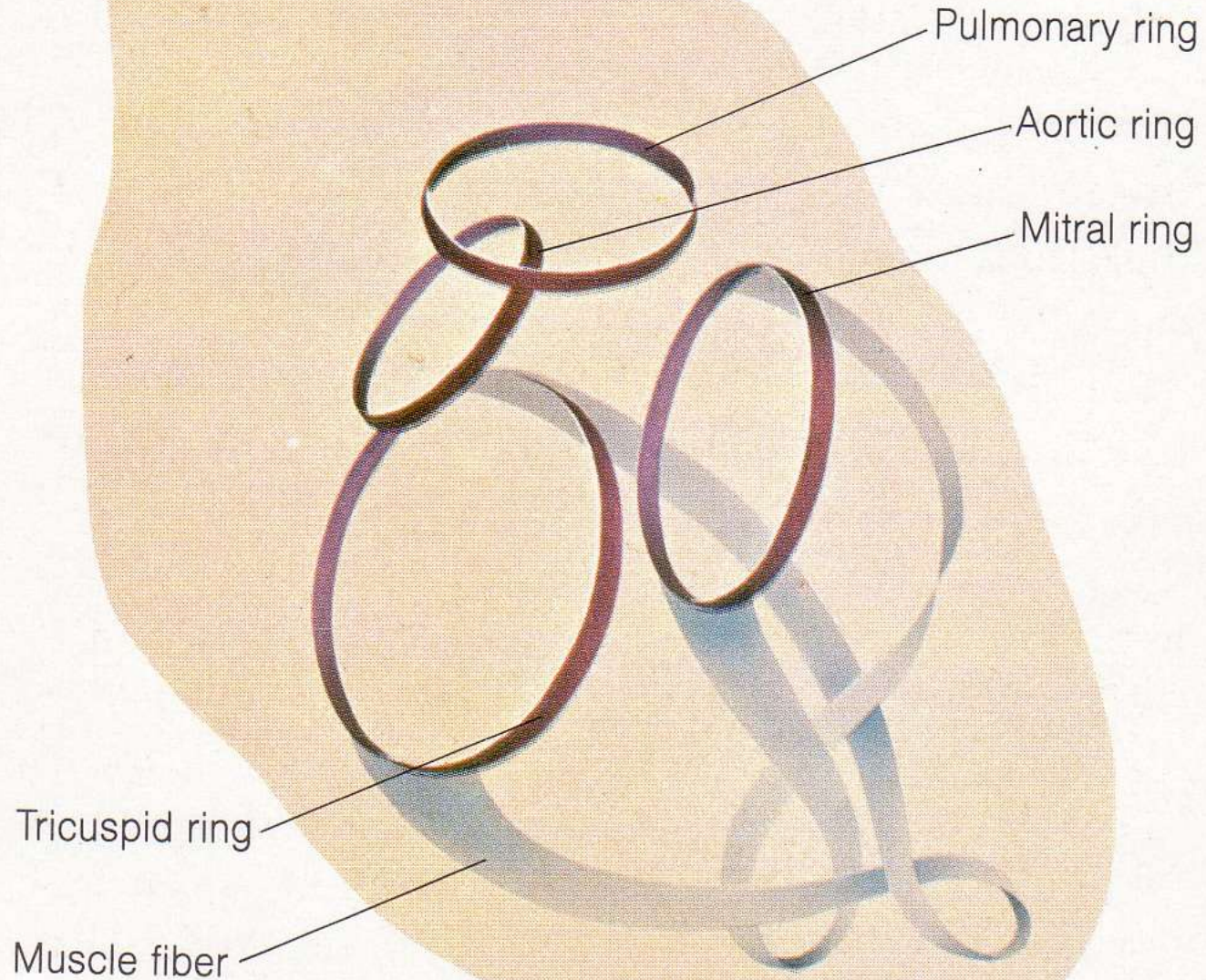
AV = Atrioventricular

More
flimsy

3. (R) AV = Tricuspid
4. (L) AV = Mitral/Bicuspid



Heart Valve Orientation & Scaffolding



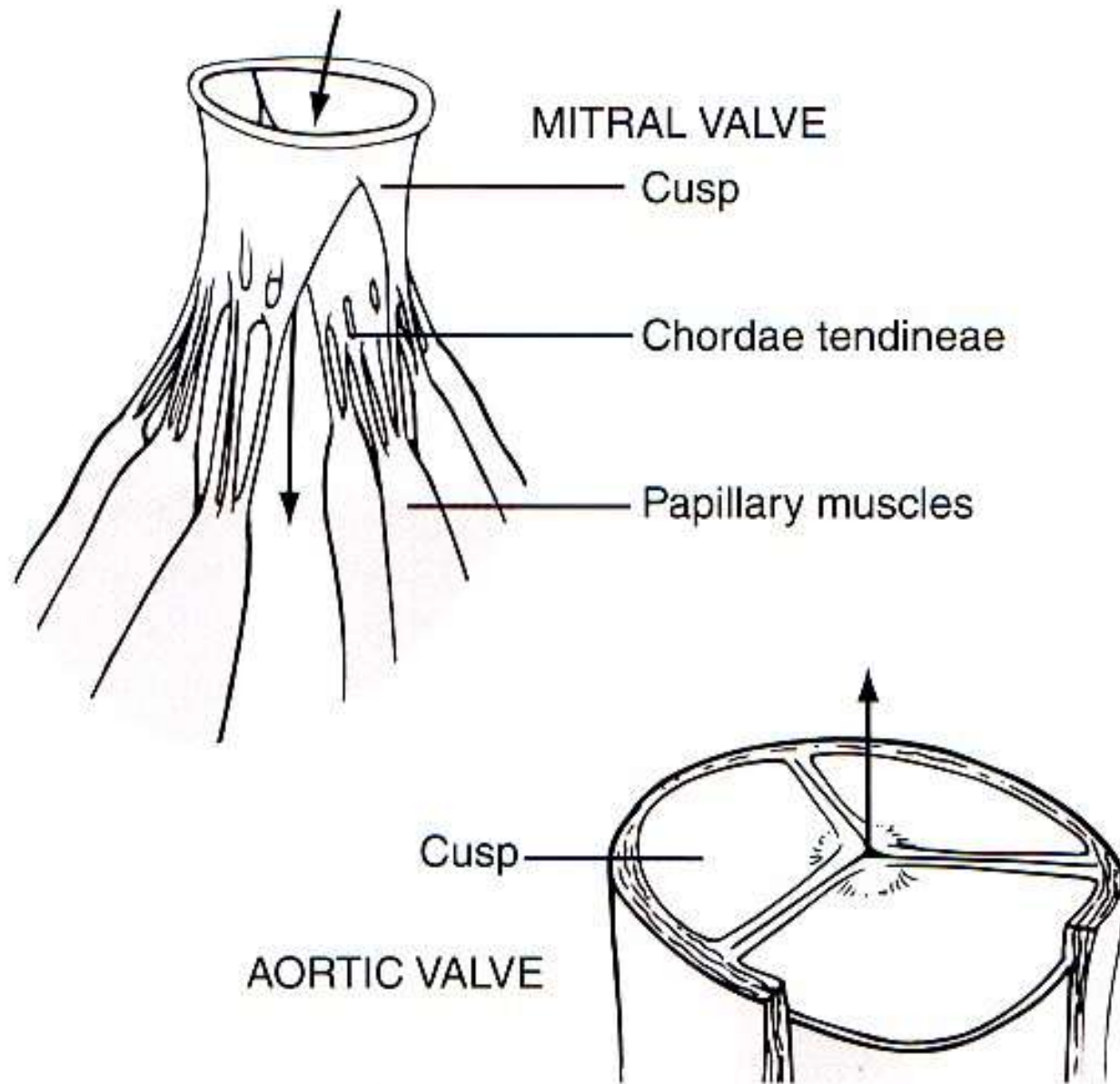
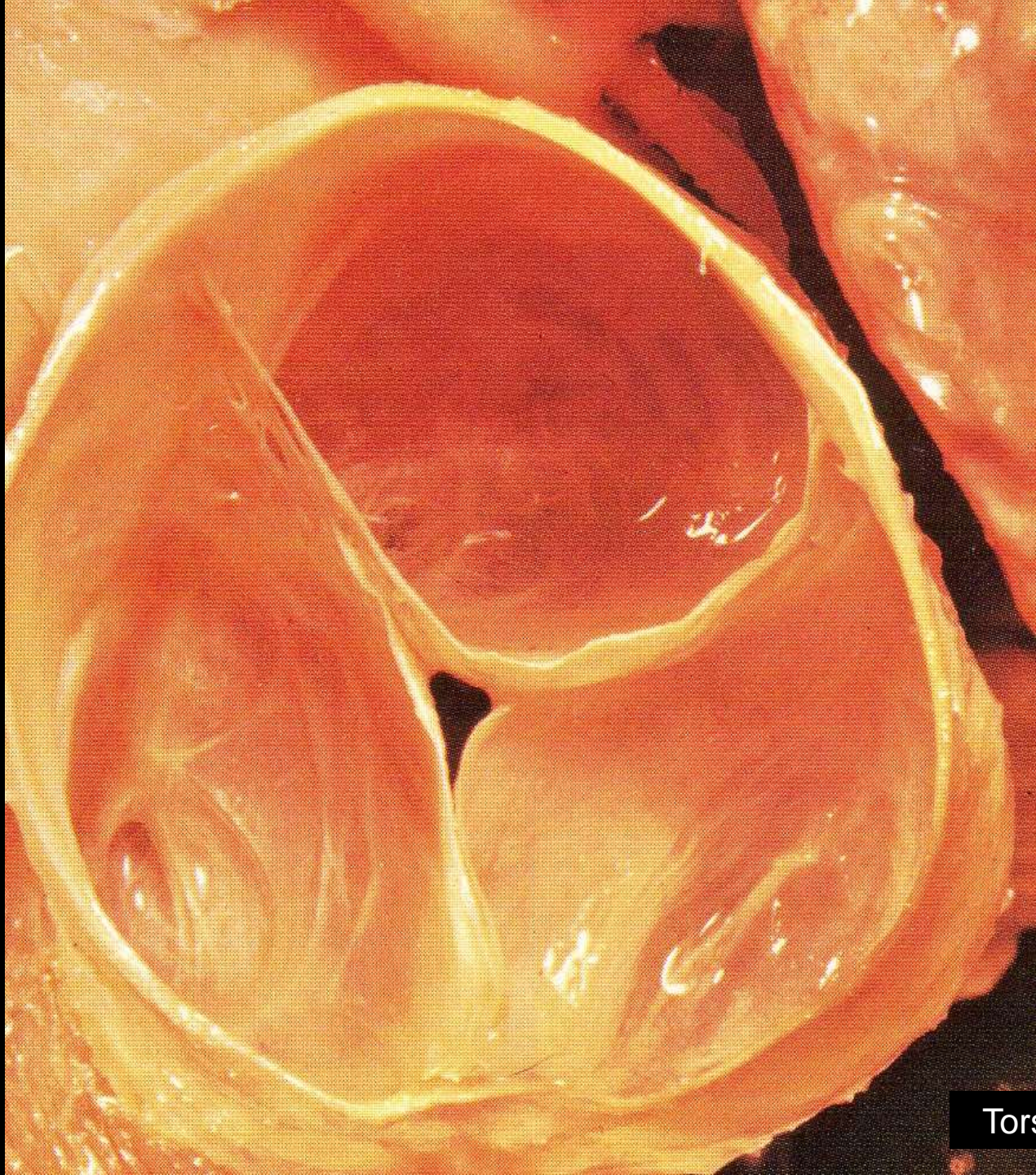


FIGURE 9-6

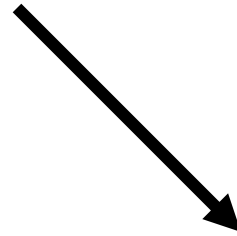
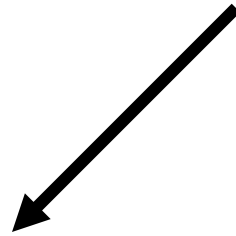
Mitral and aortic valves.







Cardiac Cycle

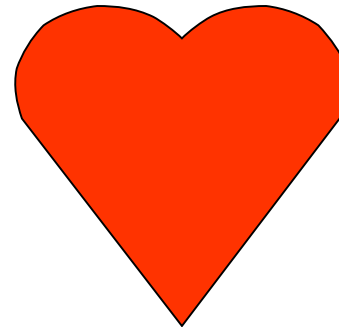
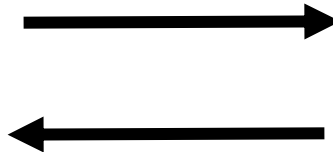
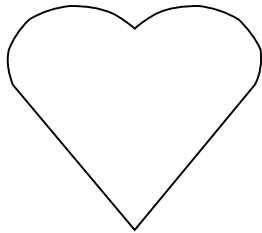


Systole

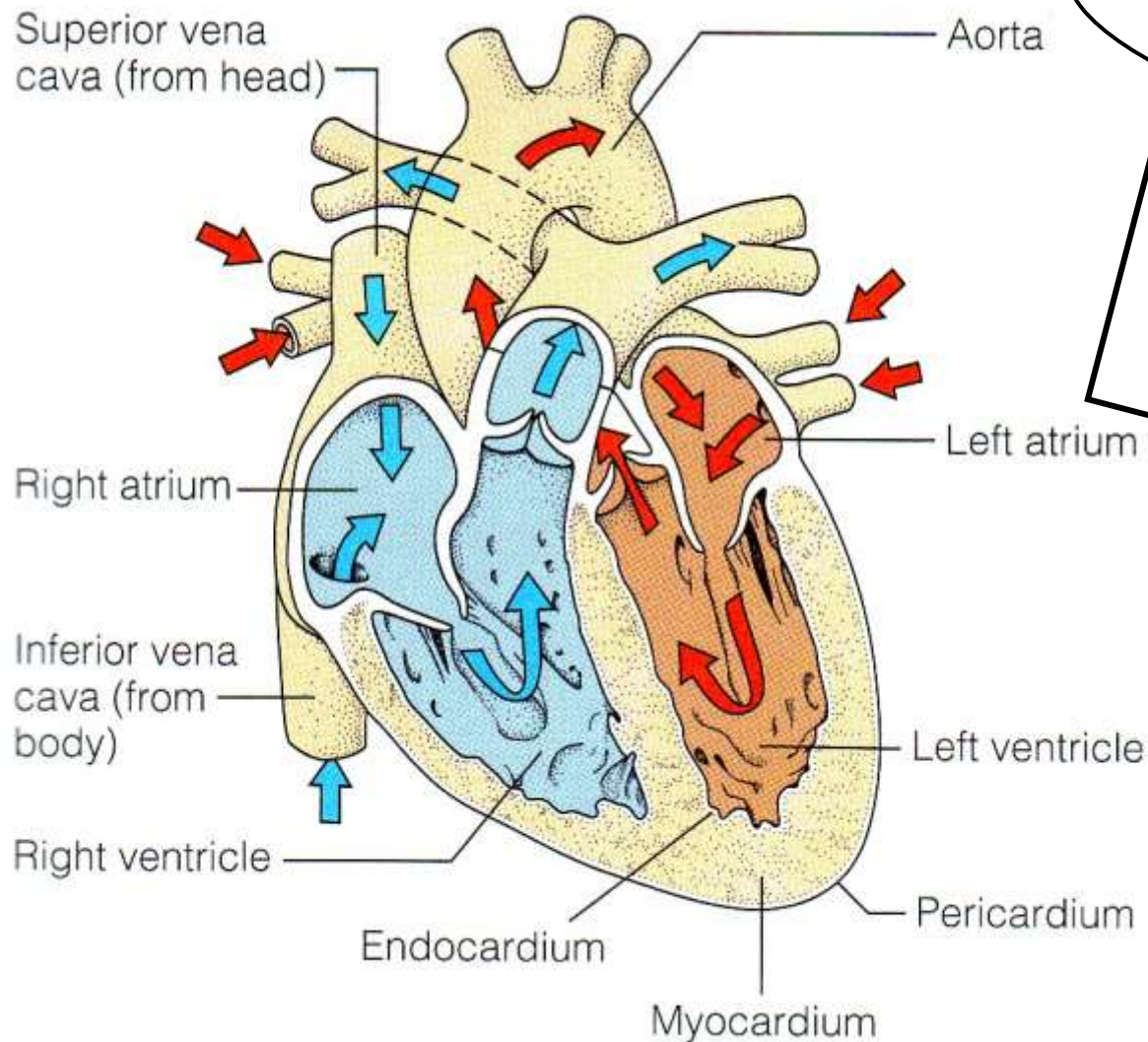
Contract
& Empty

Diastole

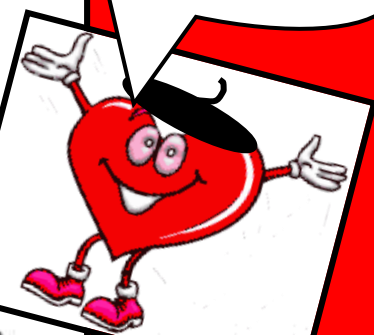
Relax
& Fill



Veins → Atria → Ventricles → Arteries



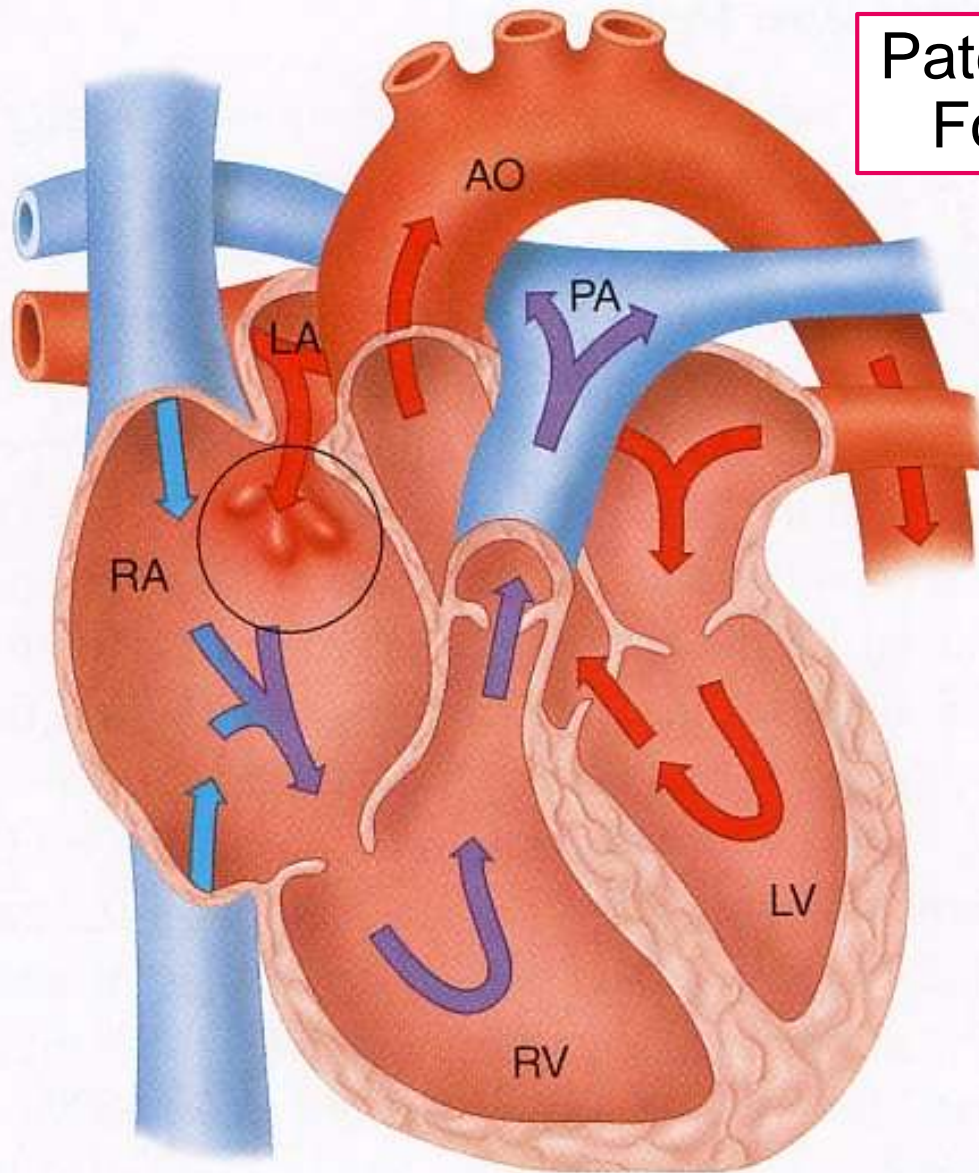
VAVA!



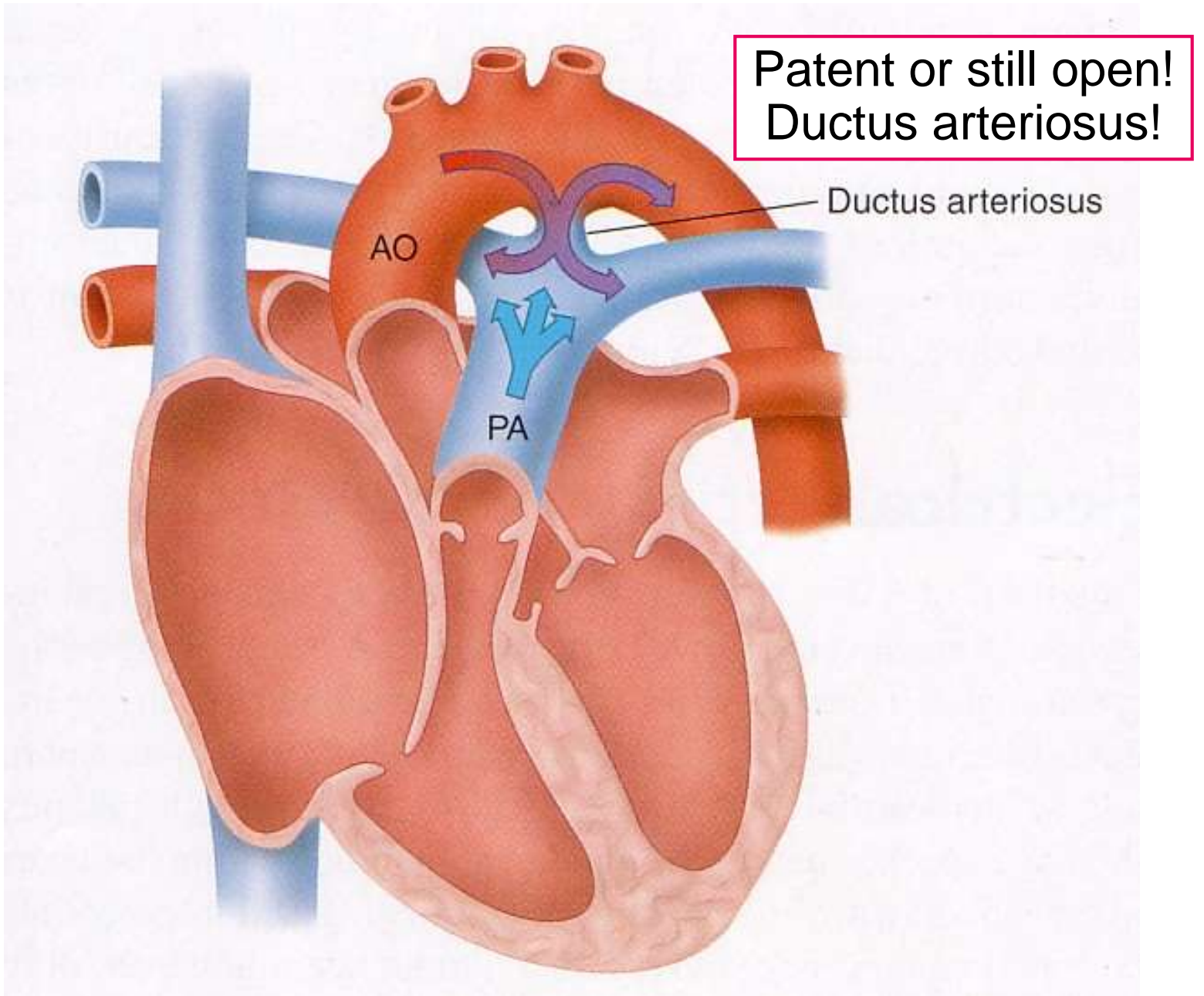
LS2007

<https://www.nhlbi.nih.gov/health-topics/how-heart-works>
<https://www.youtube.com/watch?v=zJXAIh9VDDU>

Patent or still open!
Foramen ovale!



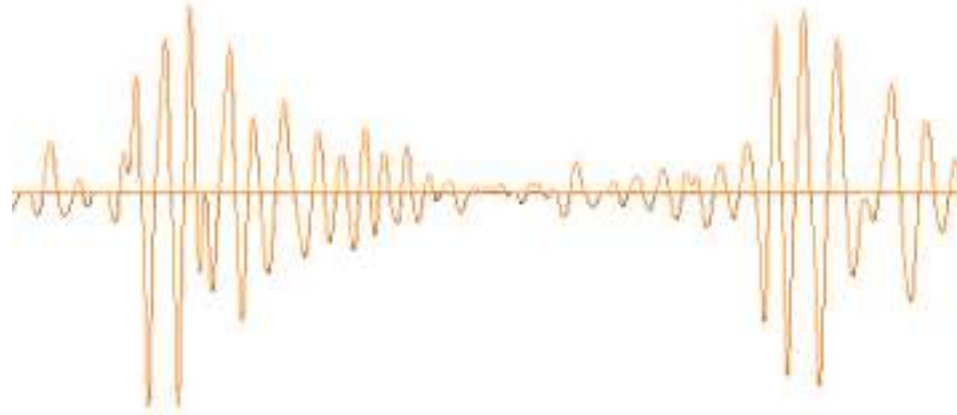
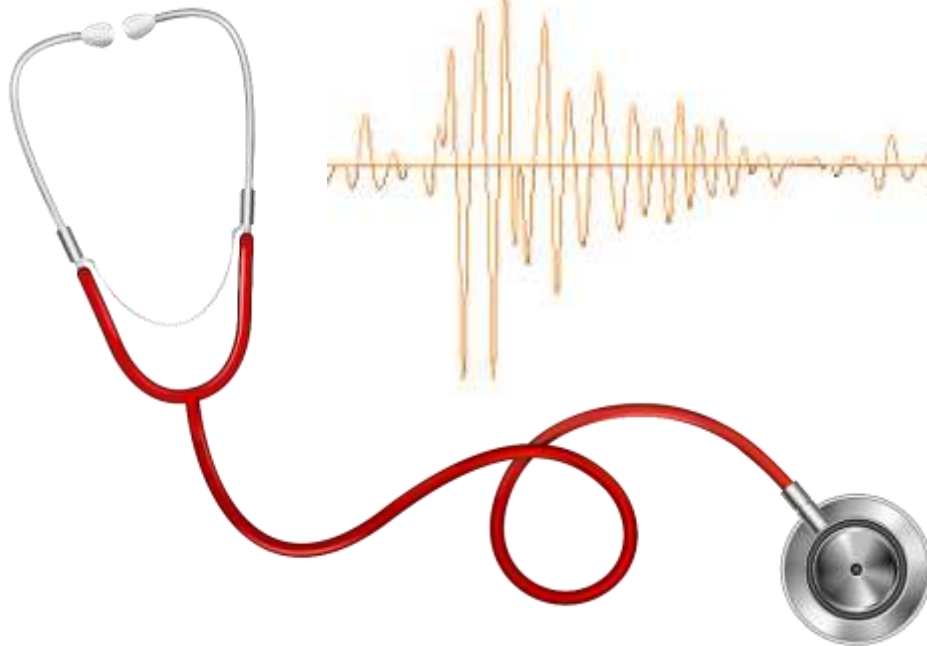
Septal defect
in atria



***Heart Murmurs? An unusual or extra heart sound
lub-dup, lub-dup vs lub-gurgle-dup, lub-swish-dup...***

S1 = lub

S2 = dup



<https://www.thinklabs.com/heart-sounds>