

BI 121 Lecture 8



...We're back & rarin' to go for last 2 weeks!

I. Announcements HR & BP Lab 4 tomorrow + Required Notebook Check. Include Nutrition Analyses. Q? Exam I?
Please read Blood Chemistry Lab 5 twice < Thurs. Thanks!

II. Cardiovascular System LS 2012 ch 9, Torstar Books 1984, DC 2013 Module 4, Guyton & Hall (G&H) 2011 +...

A. Circulatory vs Cardiovascular (CV)? cf + parts

CV vs Lymphatic LS pp 229; DC pp 23, 31

B. CV Pulmonary & Systemic circuits

DC fig 4-1 p 24, LS fig 9-2b p 231

C. Arteries, capillaries, veins G&H +Torstar

D. Varicose veins? Phlebitis? DC

E. ♥ layers, box, chambers, valves, inlets, outlets

LS fig 9-4 p 233, fig 9-2a p 231; DC pp 23-6

F. Normal vs abnormal blood flow thru ♥ & CV system

Billy has a hole in his ♥ SI Fox 2009 fig 13.16, 13.17

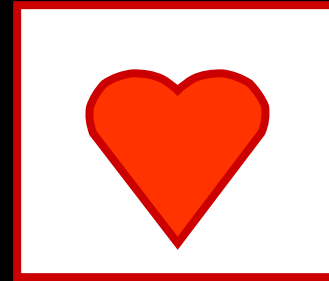
G. Cardiac cycle & heart murmurs?



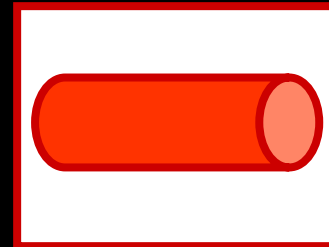
III. Aerobic Exercise: Heart & Blood Vessels. Strength? ACSM

IV. Cardiovascular Diseases Intro LS ch 9 pp 252-7; DC pp 29-30

Cardiovascular (CV) = Heart + Vessels + Blood!



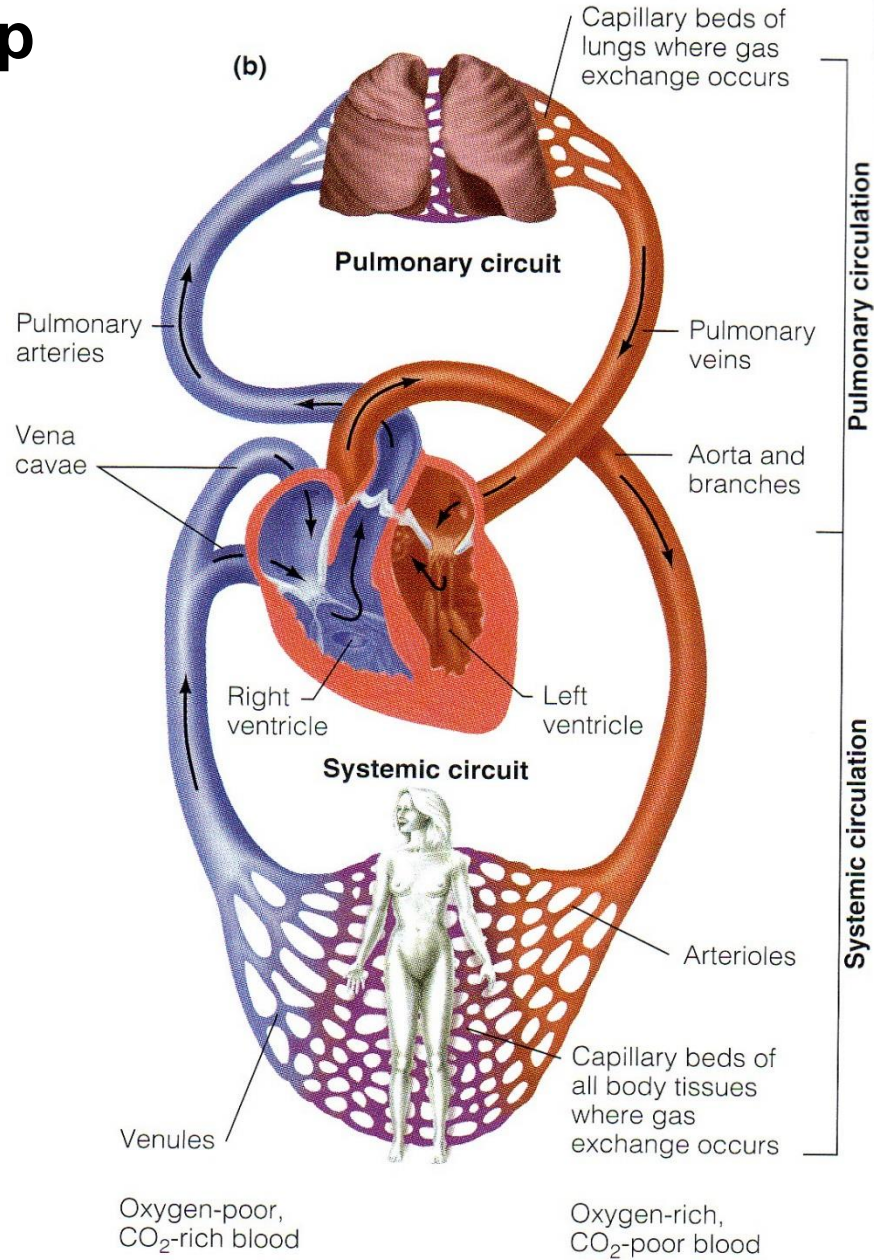
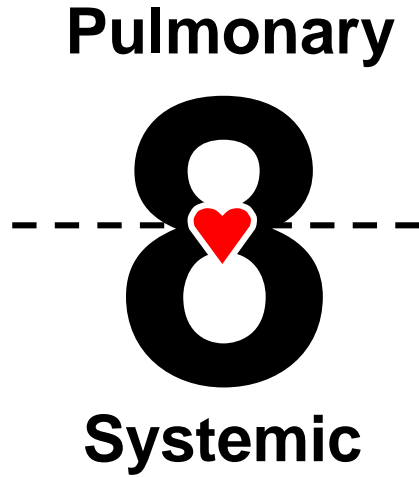
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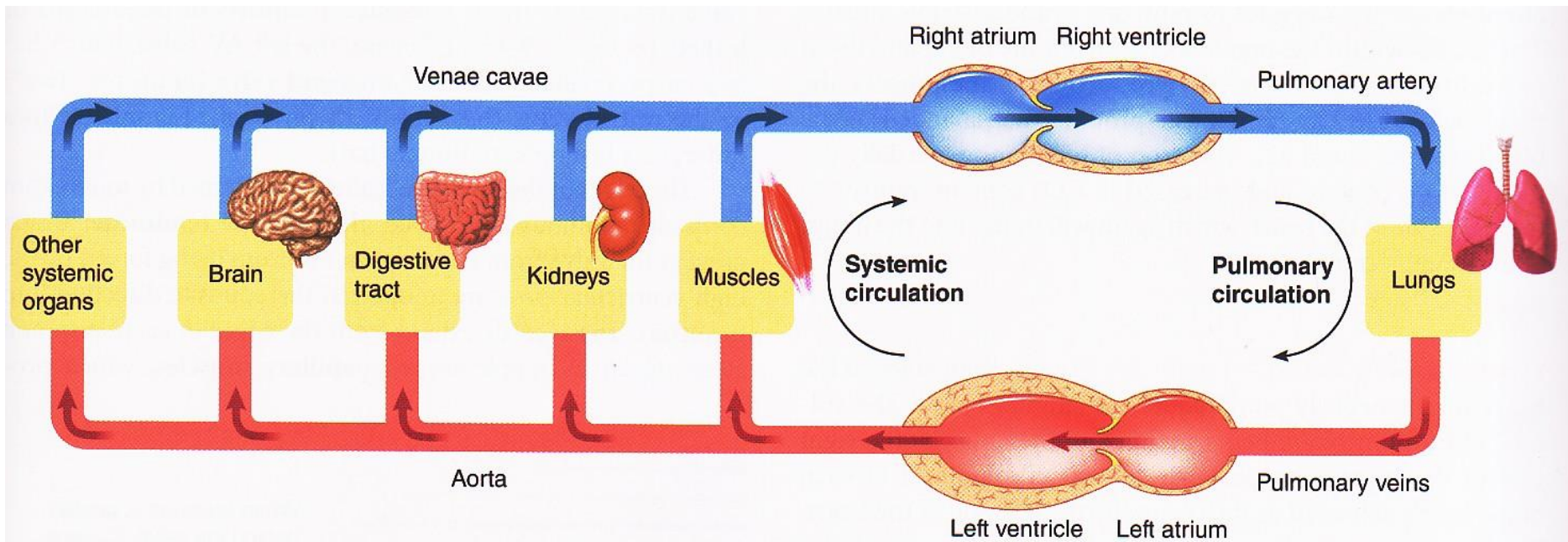
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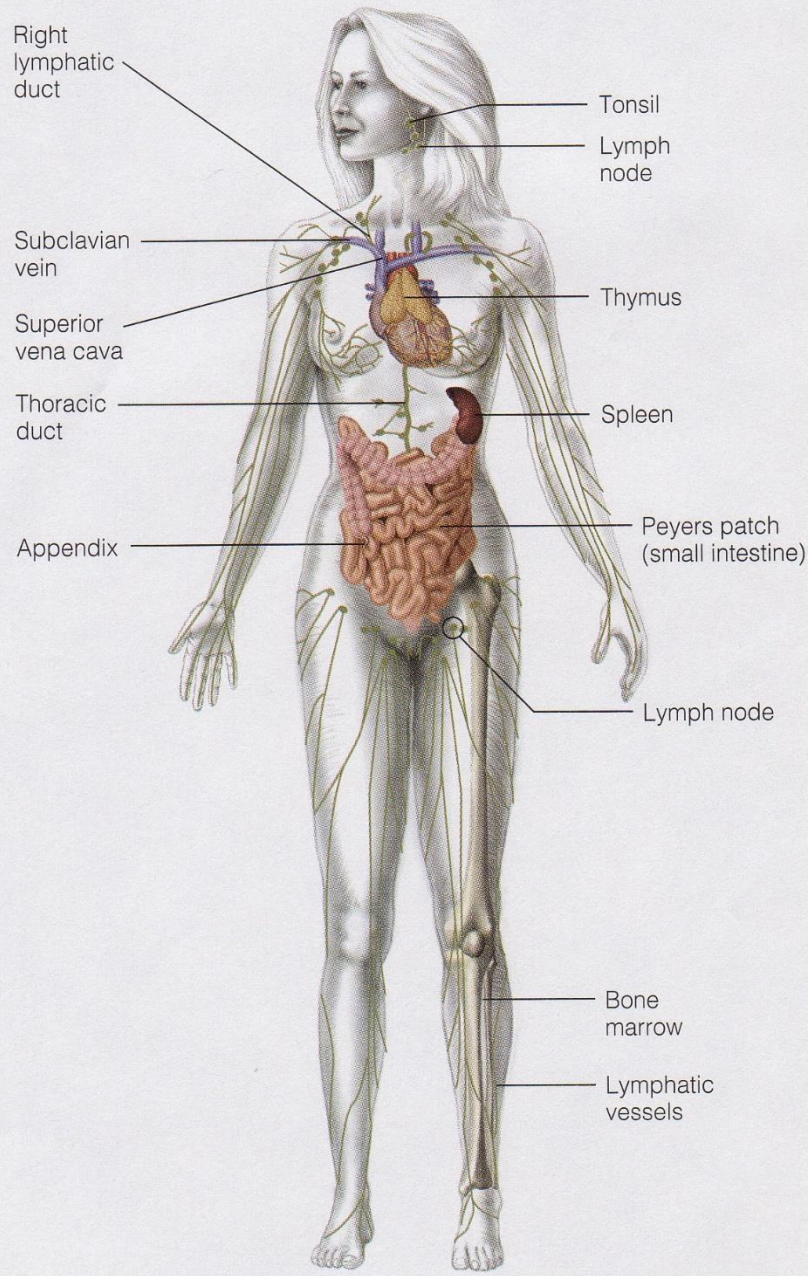


NB: Figure-8 loop



Dual Pump Action & Parallel Circulation



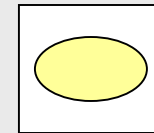


Lymphatic System

1. Lymph Nodes

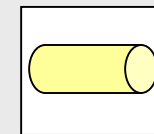
2. Vessels

3. Lymph

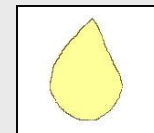


No pump!

+



+



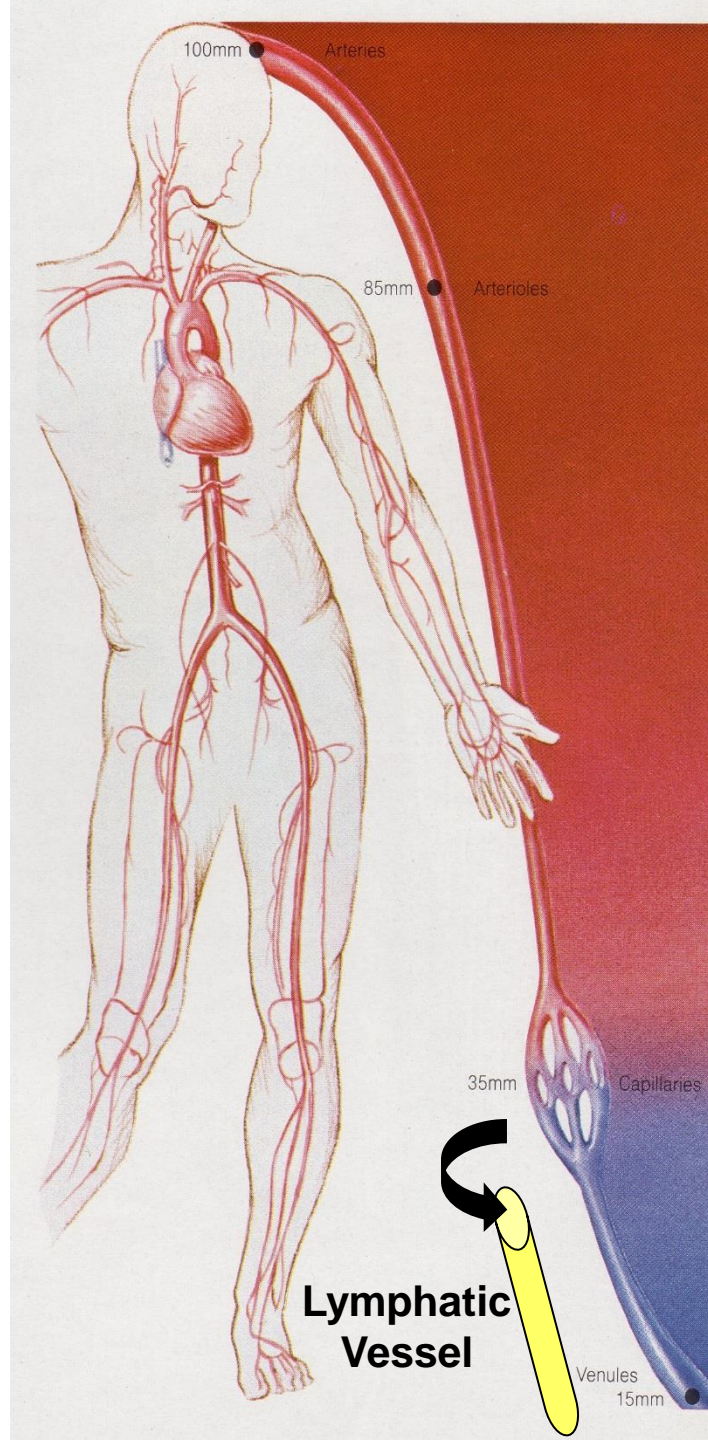
Lymphatic System

**Alternative System of
Circulation
or
Drainage System**

Lymph Vessels || Veins

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

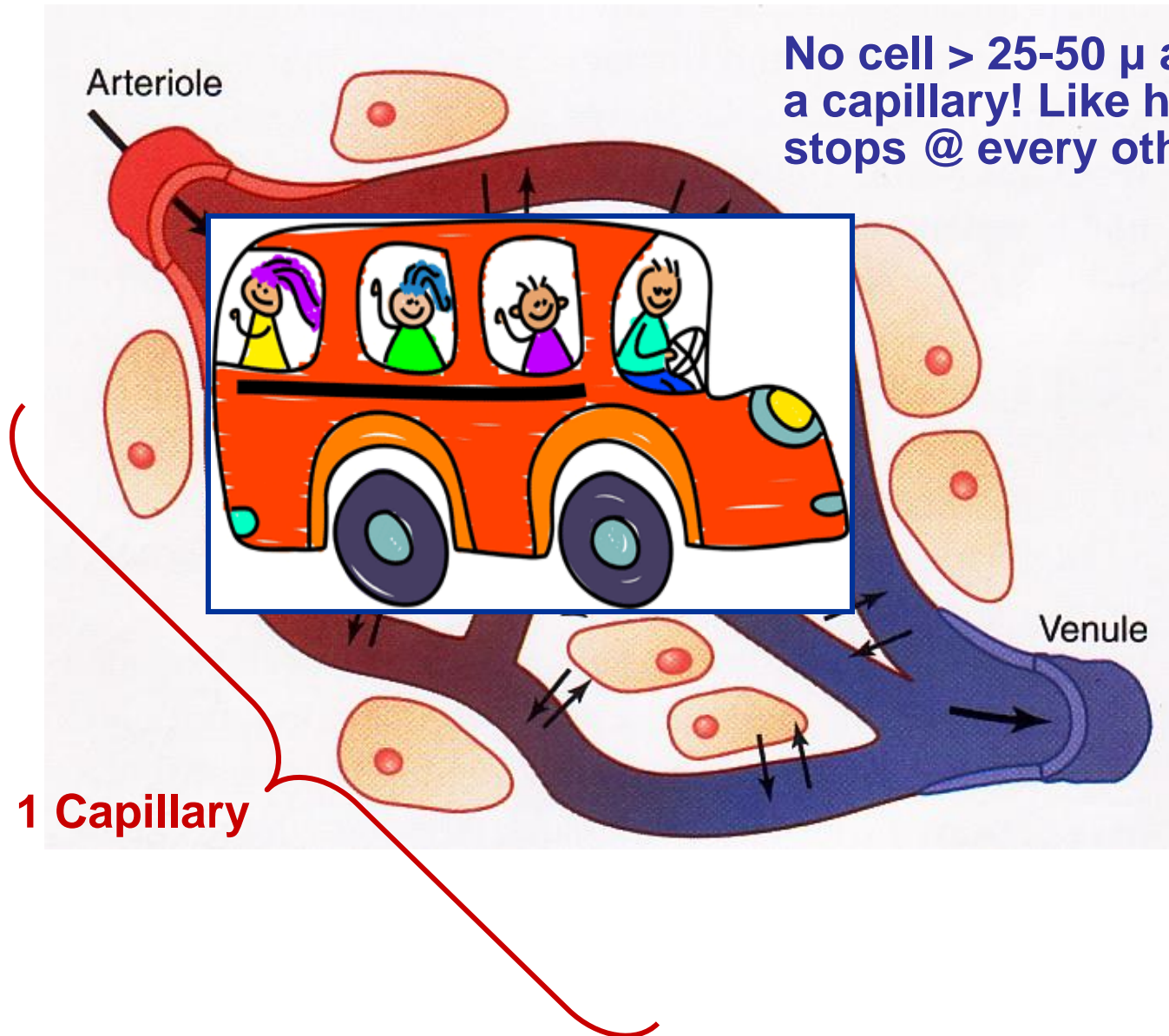




Lymphatics collect run-off & are parallel to venules/small veins!

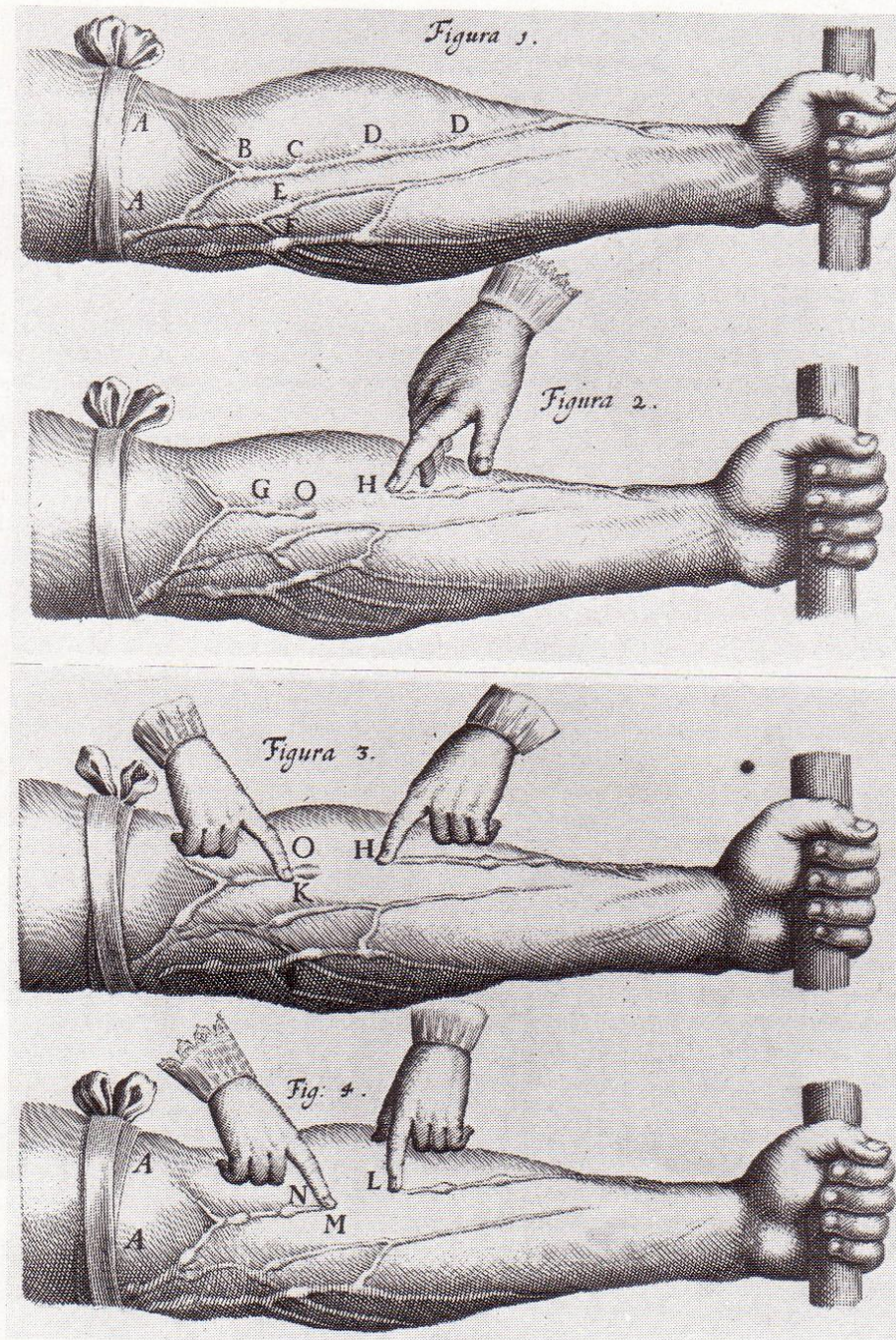
Microcirculation Exchange: 10 Billion Capillaries!

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

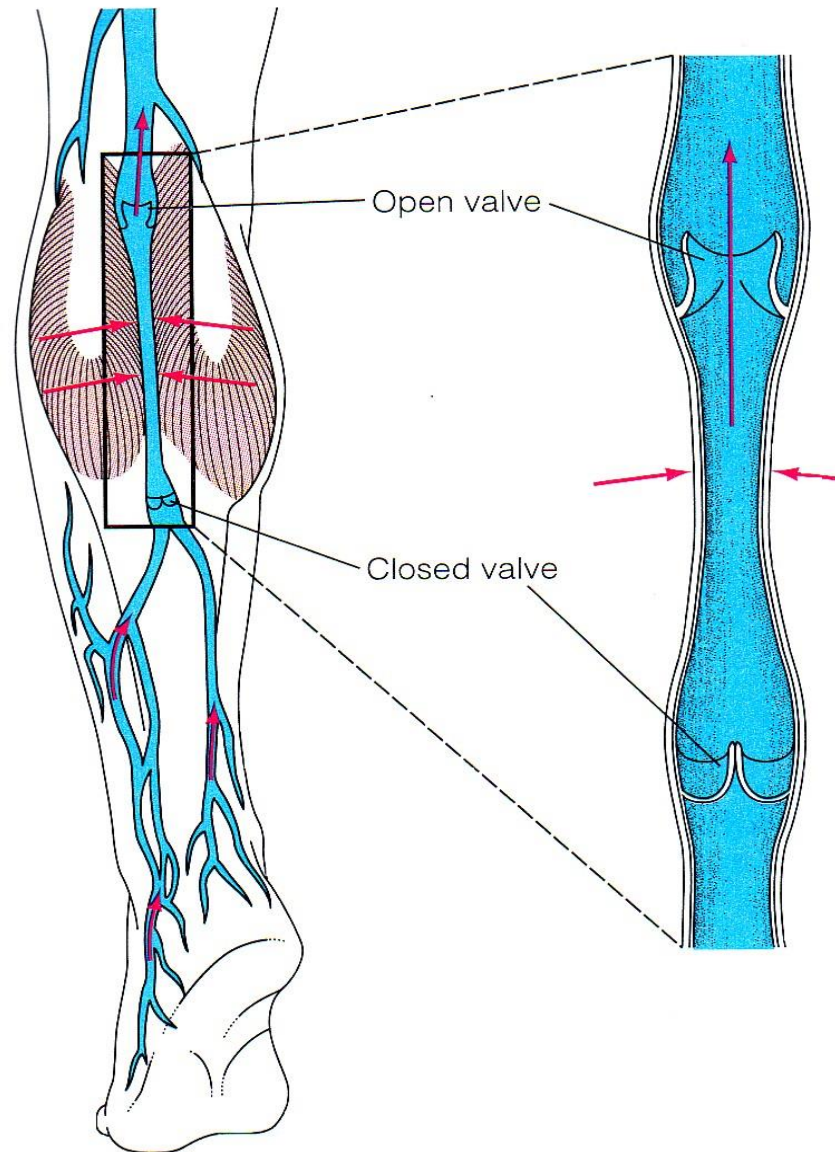




**Harvey
Experiments:
1-way system
of venous
valves!**



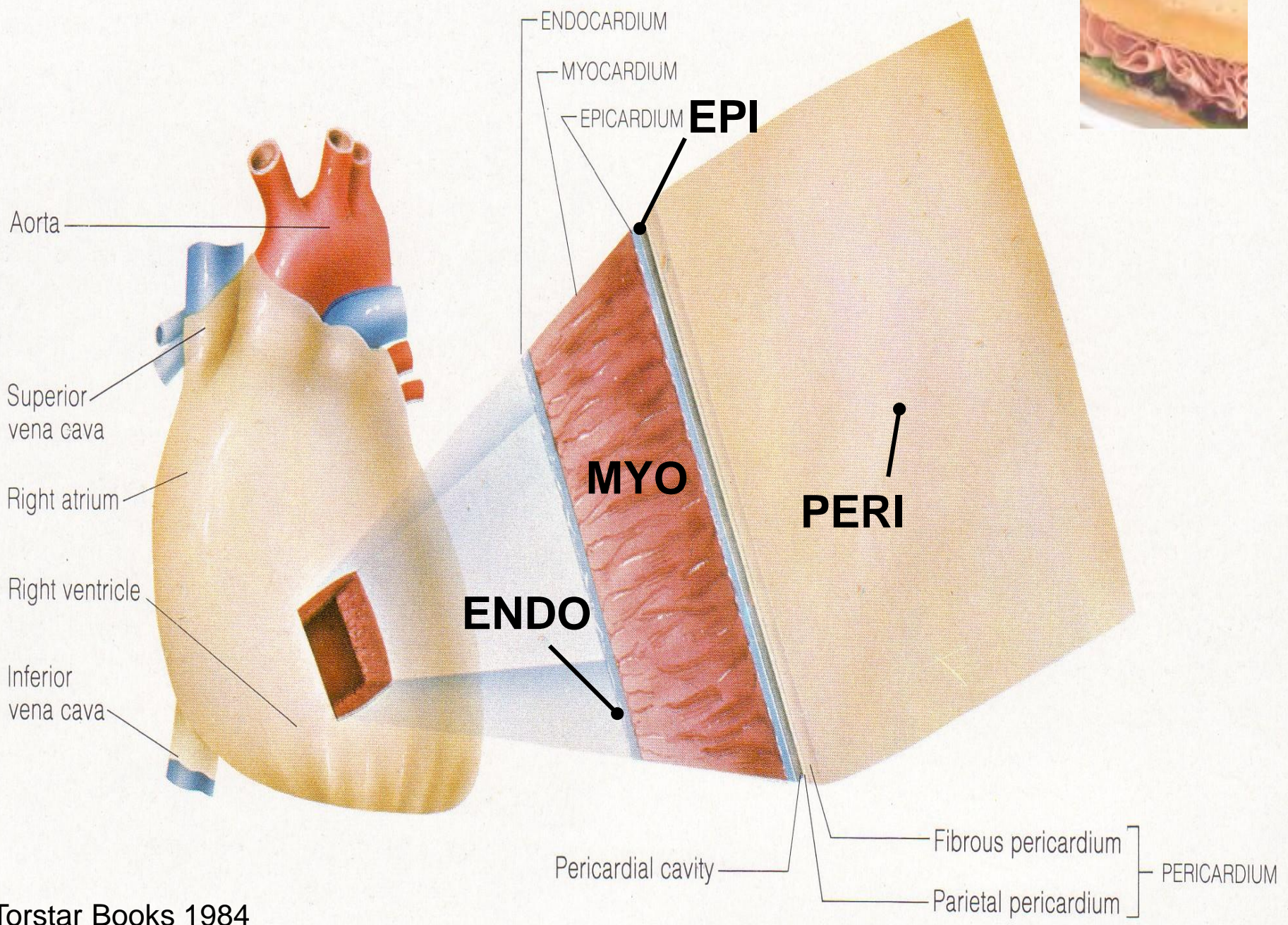
Skeletal Muscle Pump



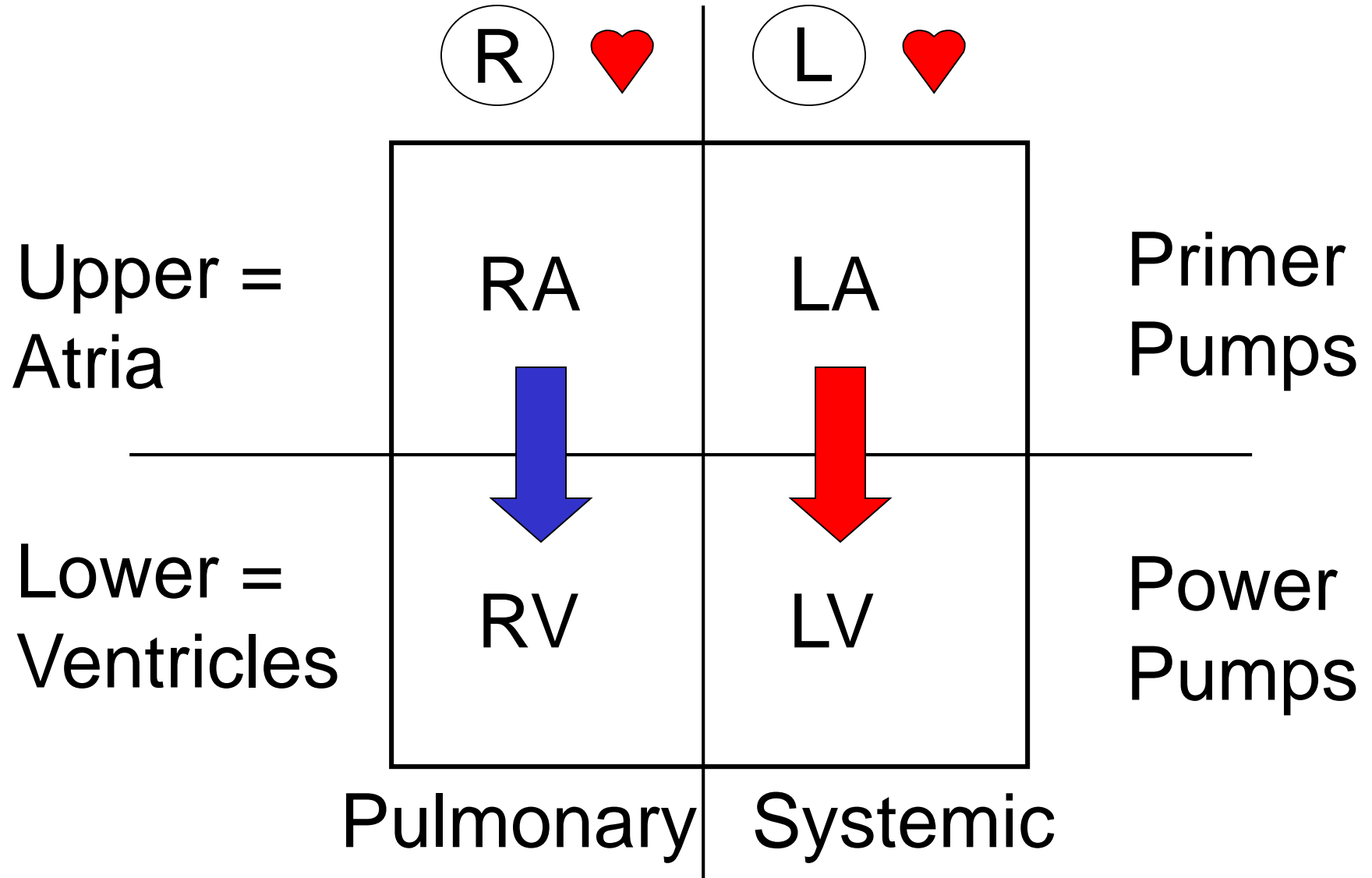


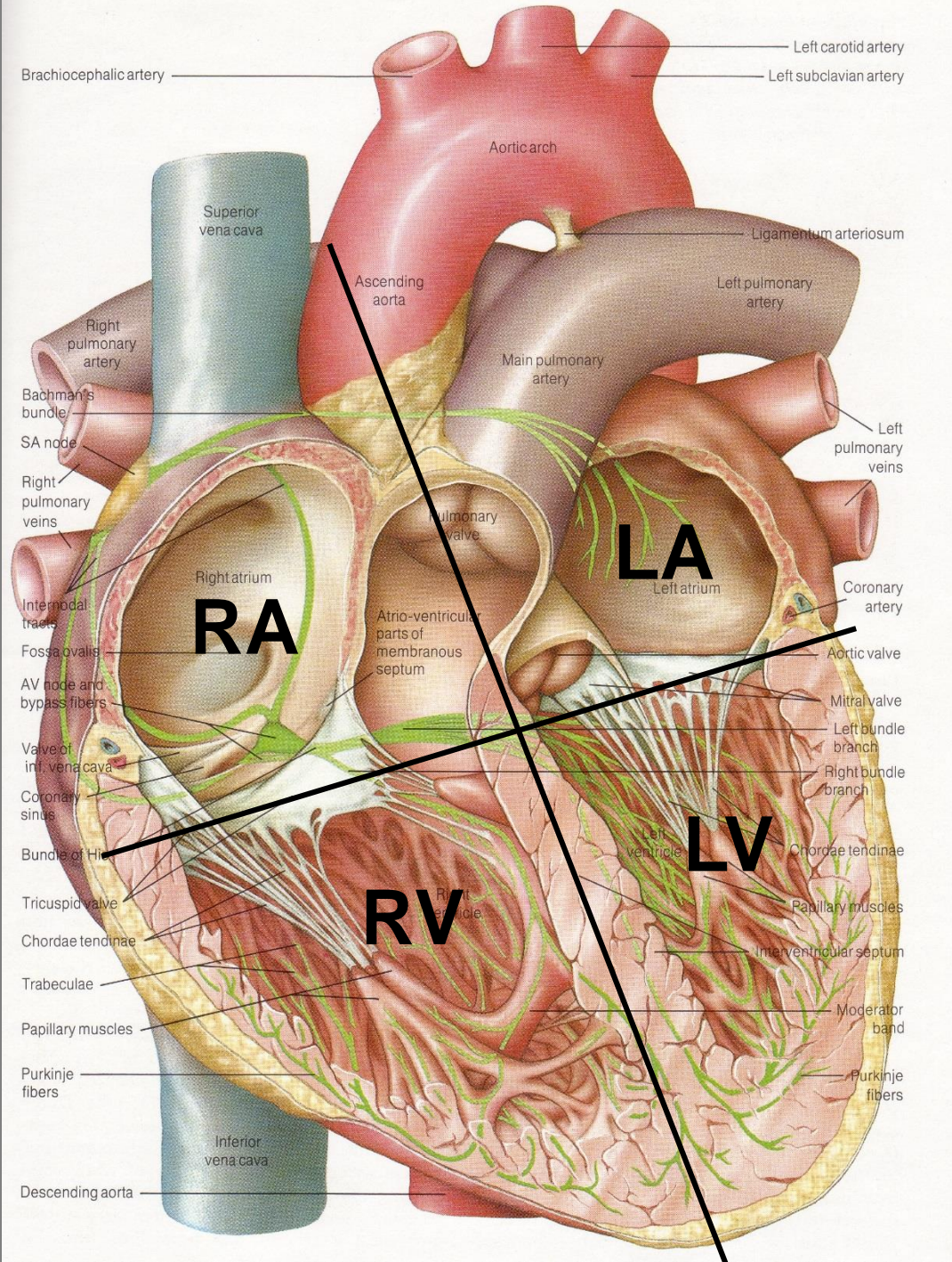
The Heart

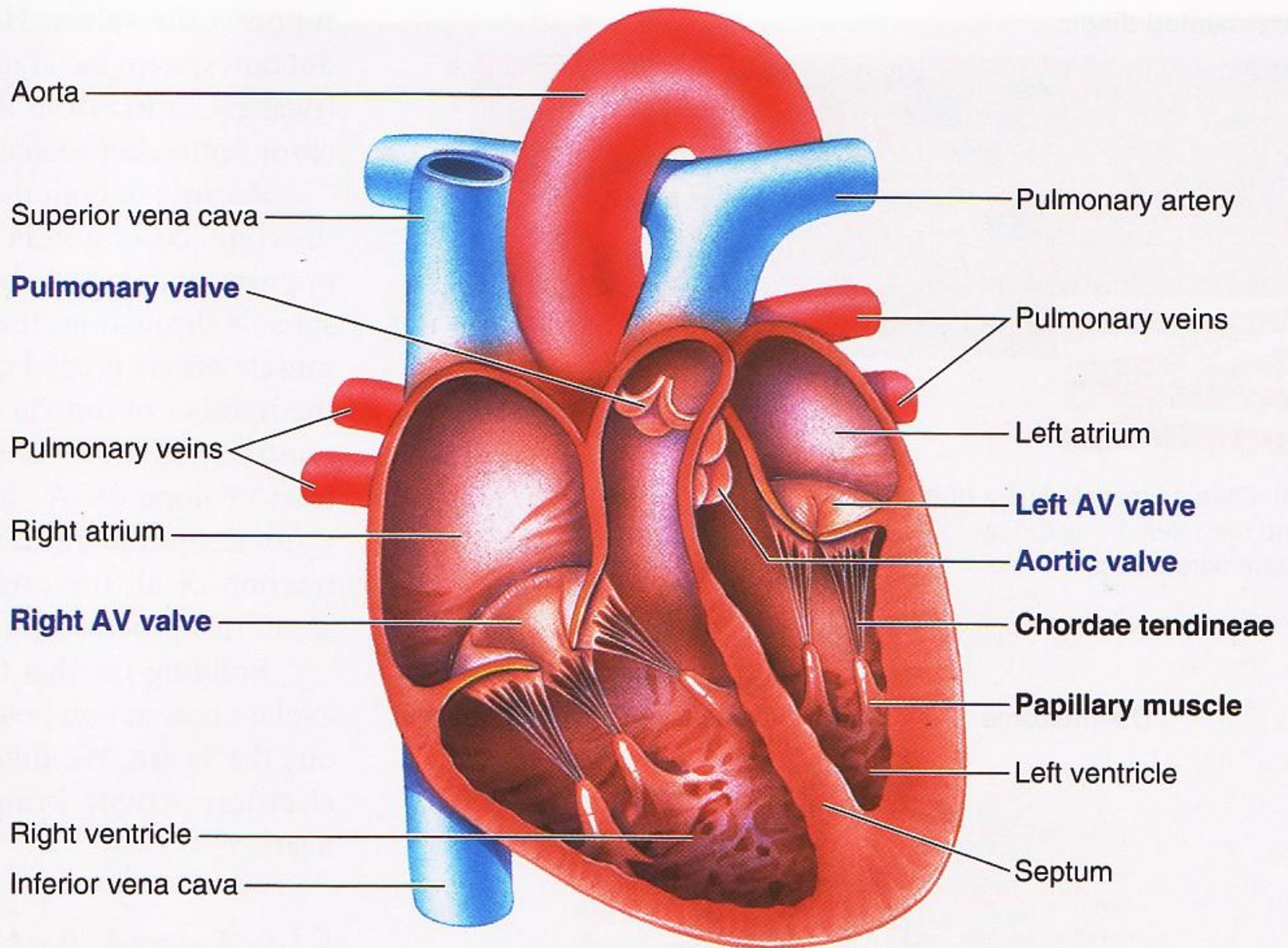
The Living Pump



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



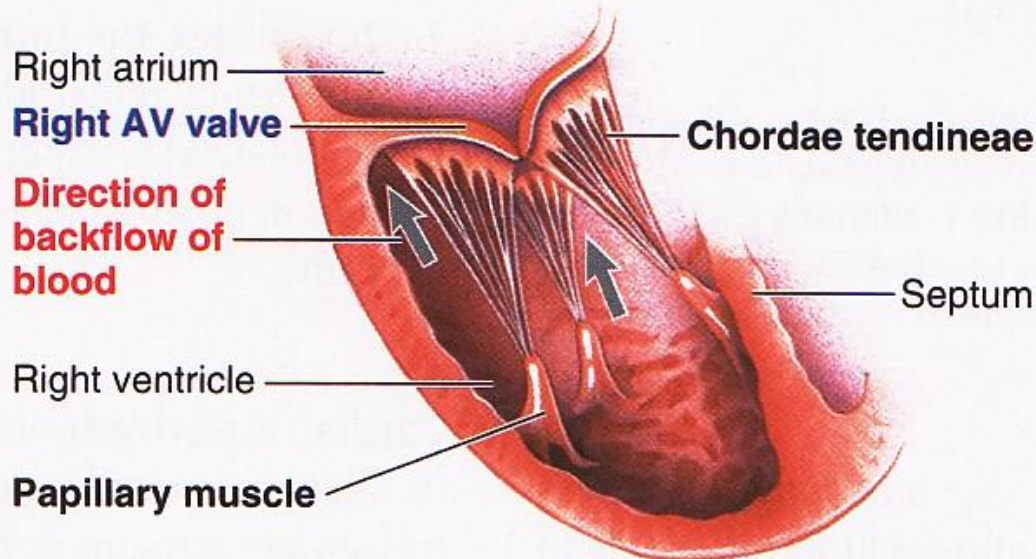
Left AV valve

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



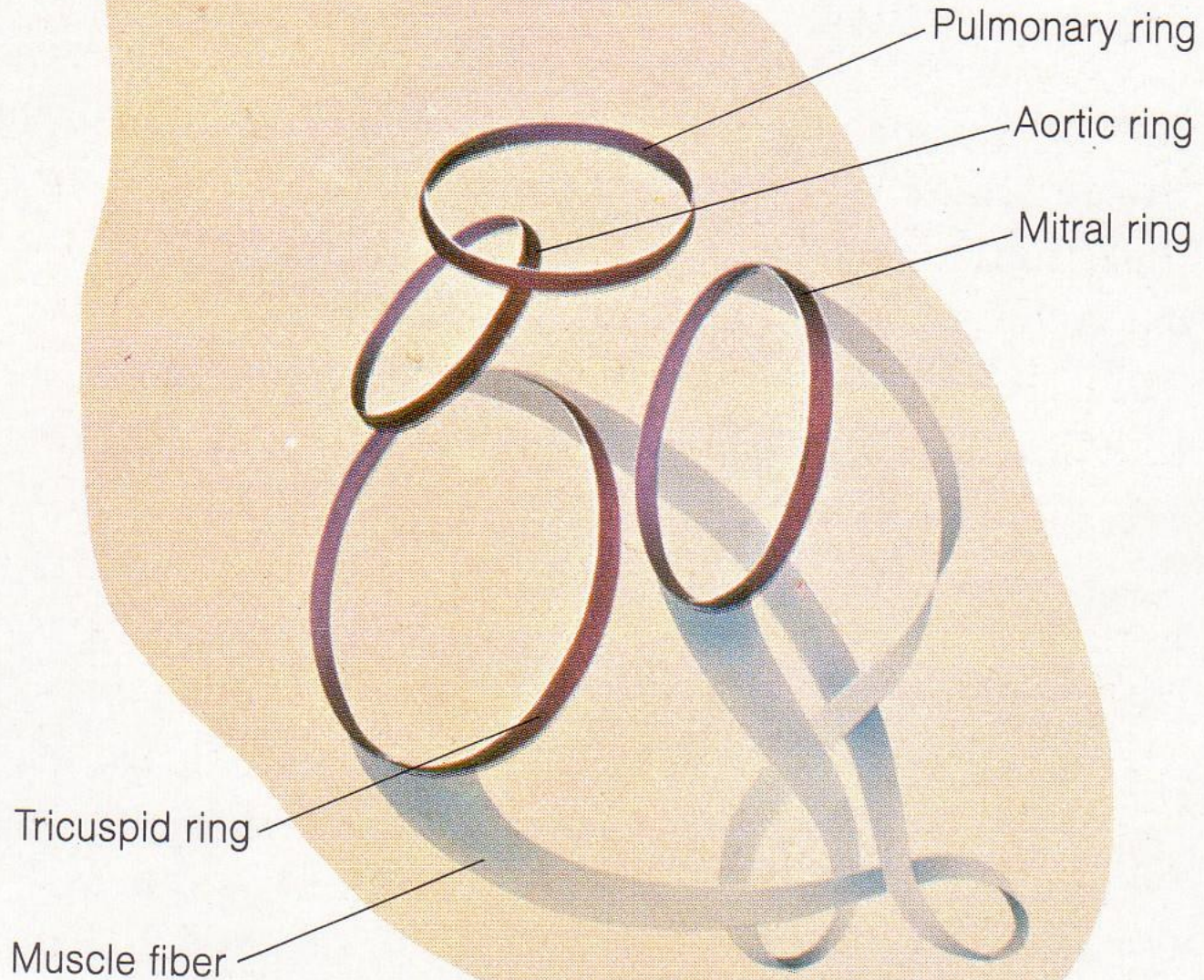
AV = Atrioventricular

More
flimsy

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



Heart Valve Orientation & Scaffolding



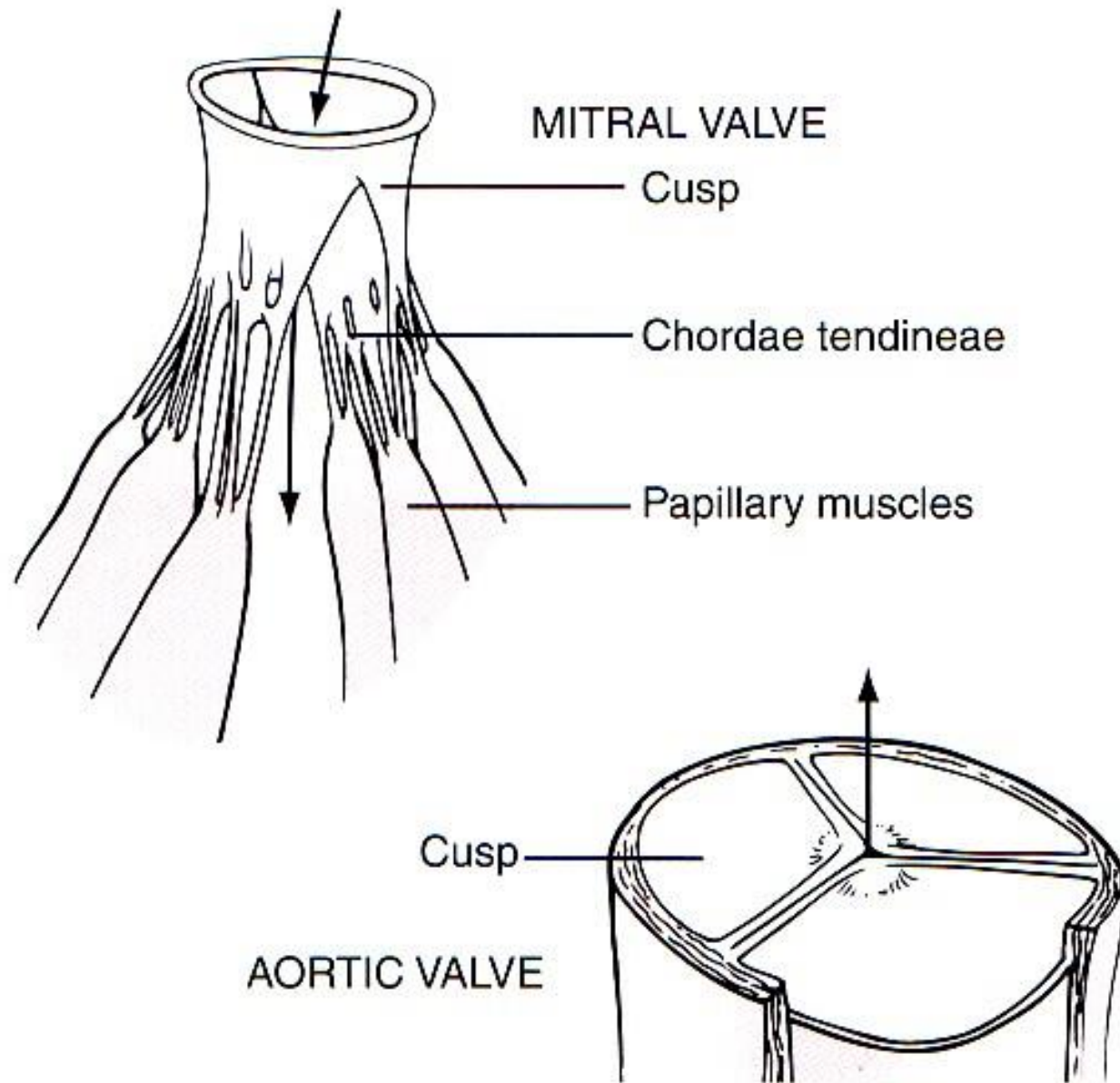
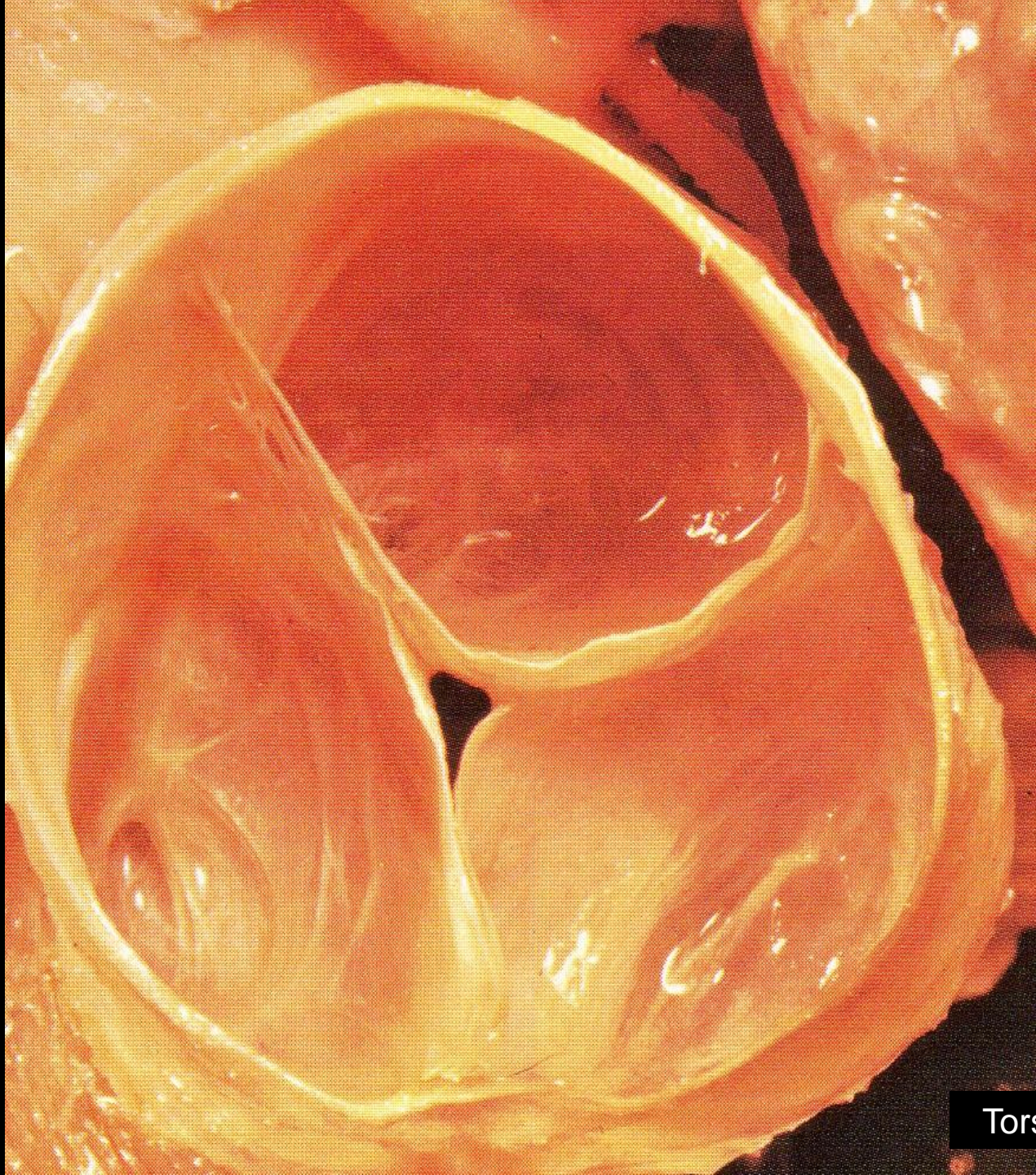
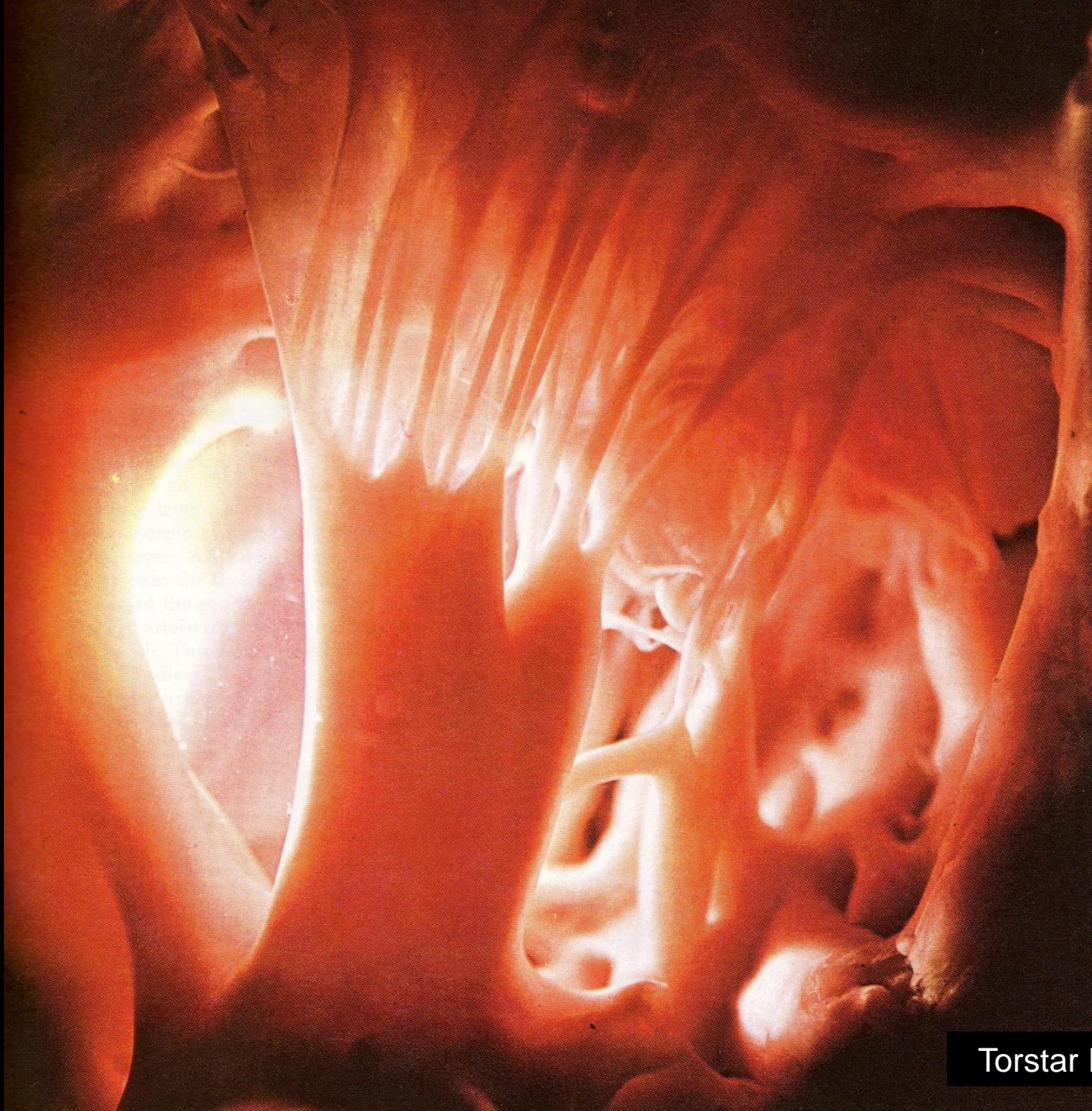


FIGURE 9-6

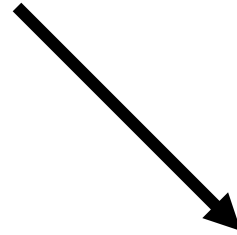
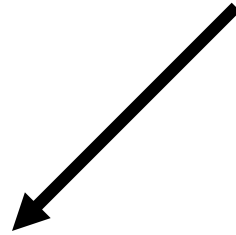
Mitral and aortic valves.







Cardiac Cycle

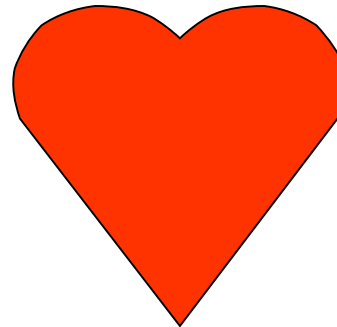
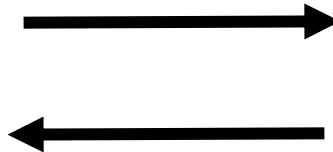
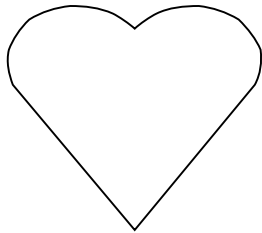


Systole

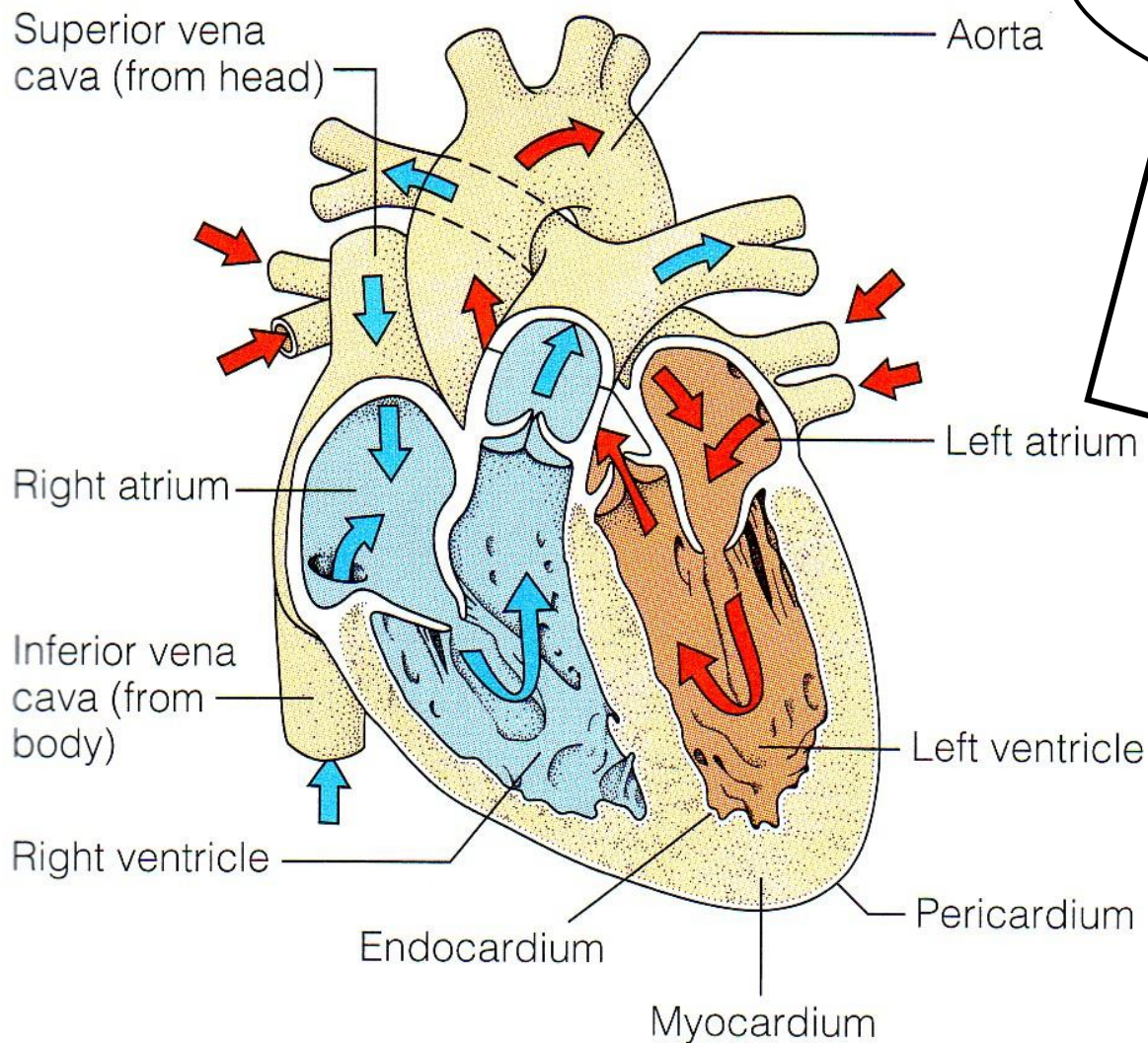
Contract
& Empty

Diastole

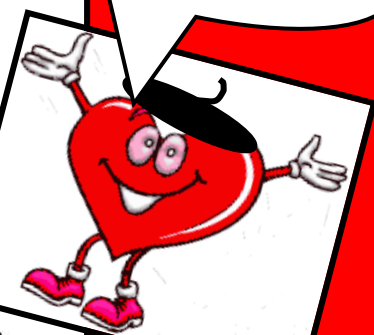
Relax
& Fill



Veins → Atria → Ventricles → Arteries



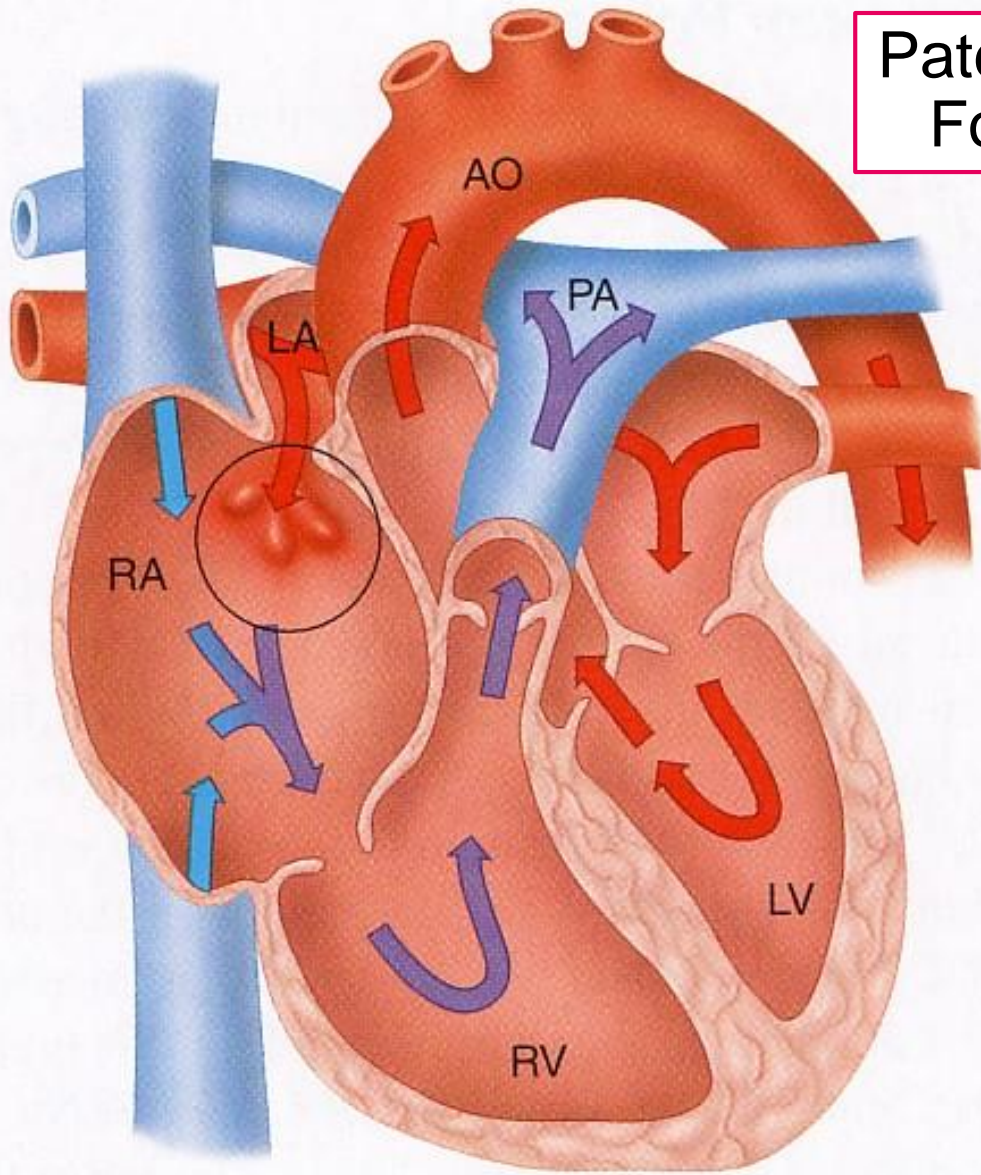
VAVA!

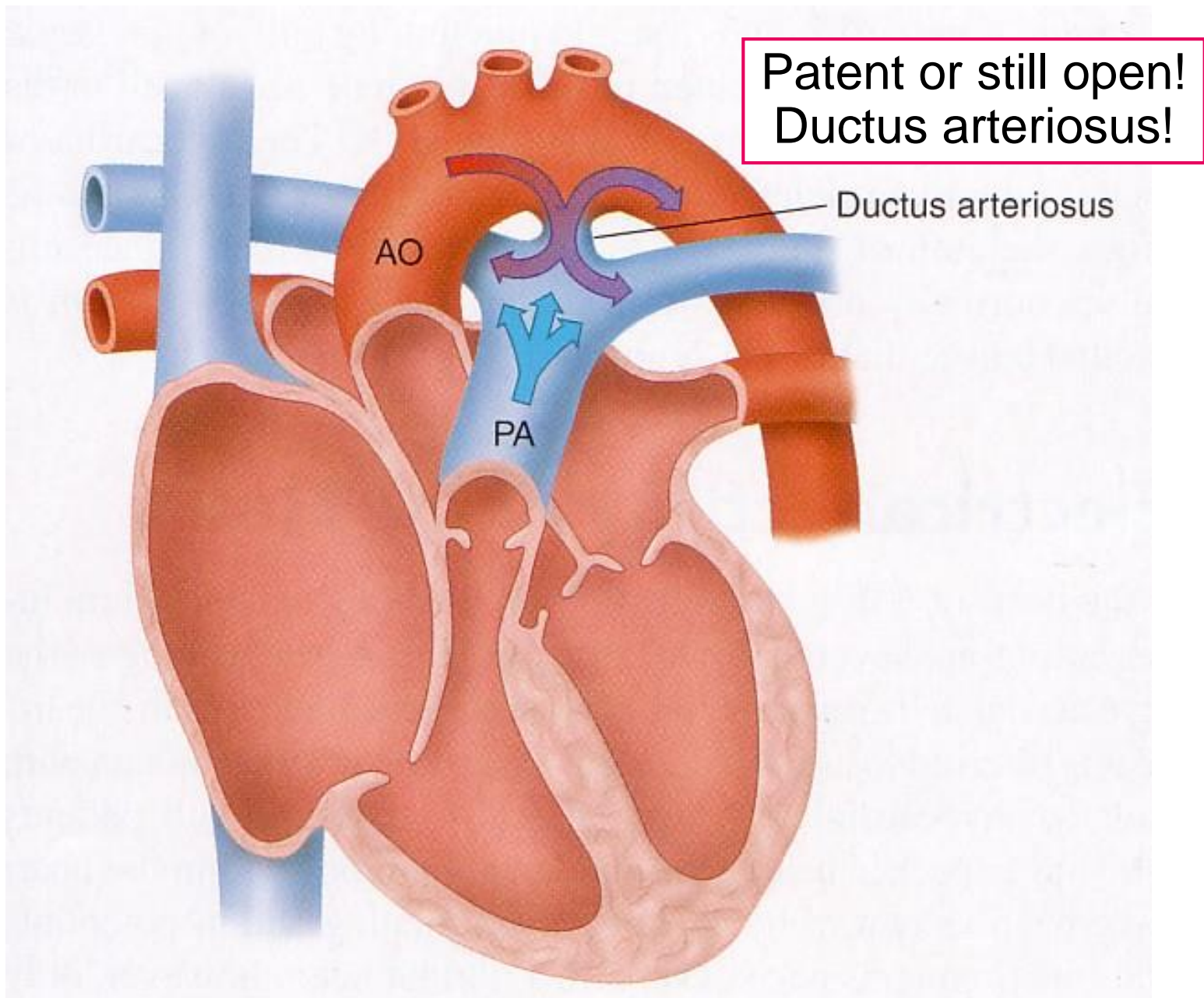


LS2007

<https://www.nhlbi.nih.gov/health-topics/how-heart-works>
<https://www.youtube.com/watch?v=zJXAlh9VDDU>

Patent or still open!
Foramen ovale!

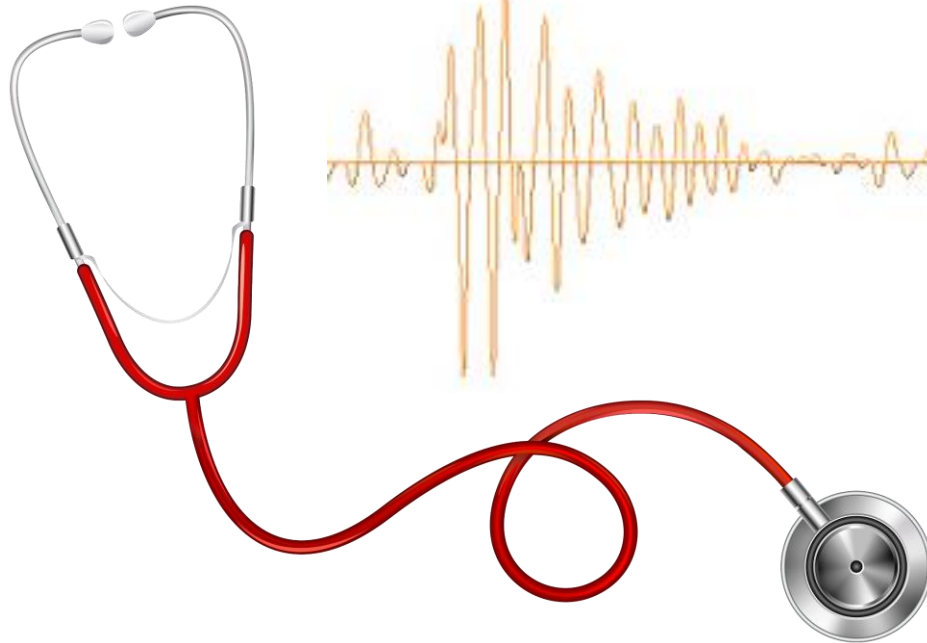




***Heart Murmurs? An unusual or extra heart sound
lub-dup, lub-dup vs lub-gurgle-dup, lub-swish-dup...***

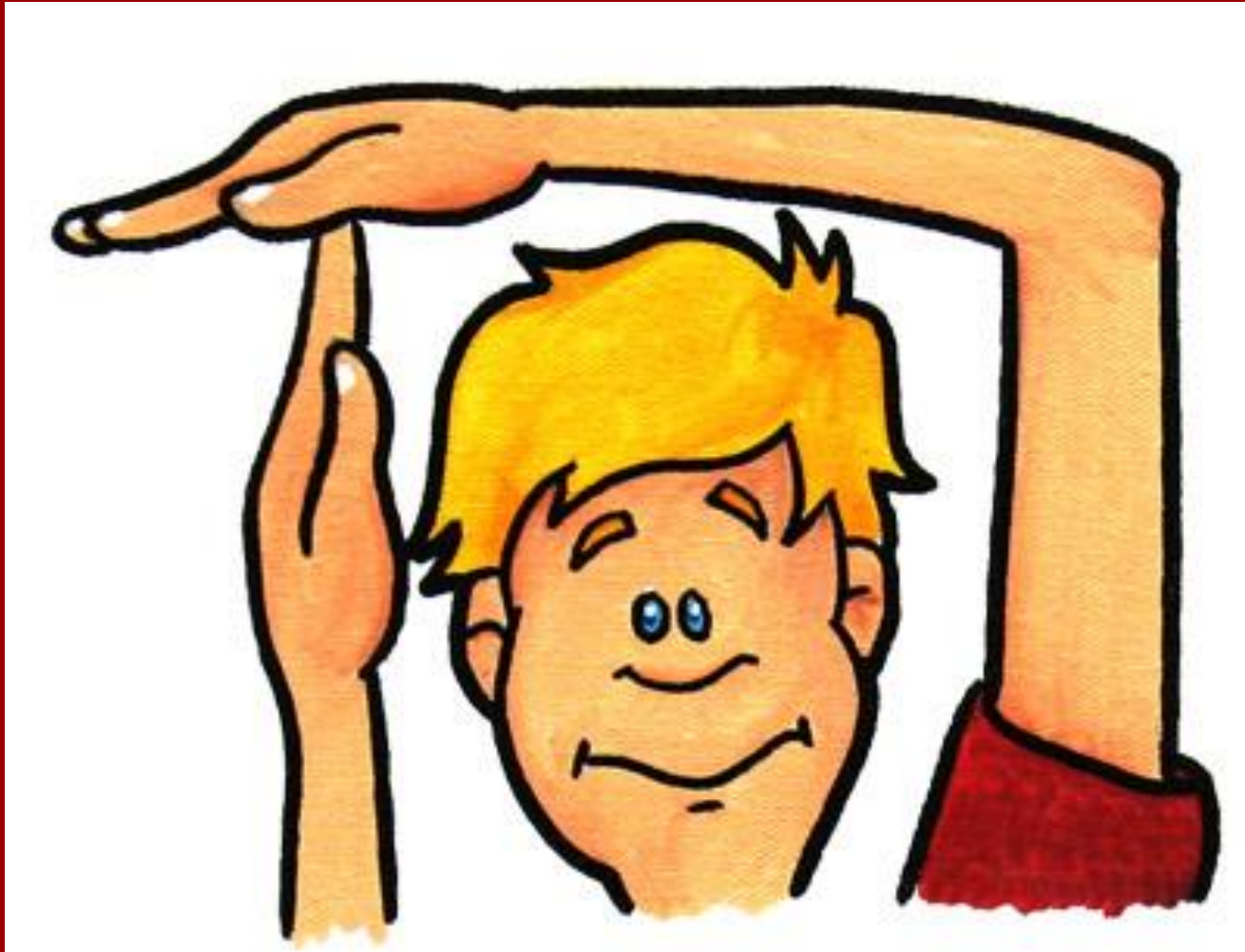
S1 = lub

S2 = dup



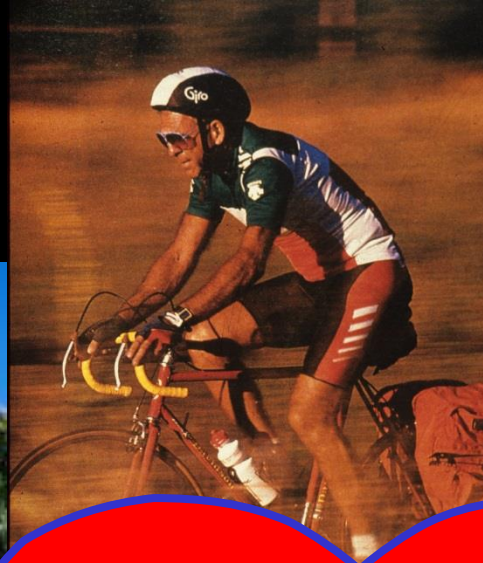
<https://www.thinklabs.com/heart-sounds>

Time-out for Questions!

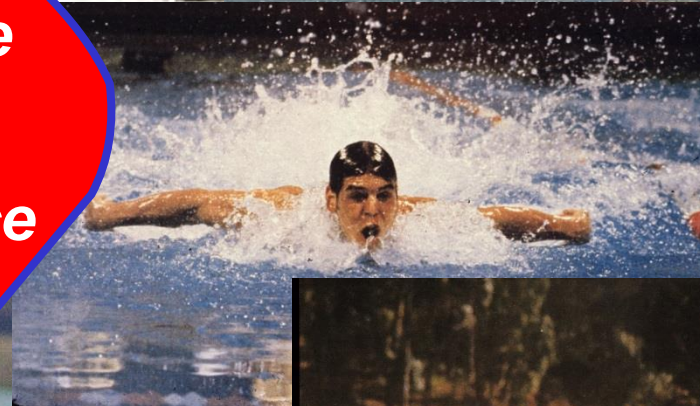


+ Brief Break!

How much aerobic?



Continuous exercise
≥ 50% muscle mass
≥ Conversational pace
20-60 min/session
3-5 days/wk



<https://www.acsm.org/acsm-positions-policy/official-positions/ACSM-position-stands>
<https://www.ncbi.nlm.nih.gov/pubmed/21694556>



AMERICAN COLLEGE
of **SPORTS MEDICINE**

Guidelines: Healthy Adults < 65 yr

American Heart
Association® 
Learn and Live™

**Do moderately intense aerobic exercise
30 min/d, 5 d/wk**

OR

**Do vigorously intense aerobic exercise
20 min/d, 3 d/wk**

AND

**Do 8-10 strength-training exercises
8-12 repetitions/each exercise, 2 d/wk**

How much strength?

- ✓ 2-3 days/wk
- ✓ 8-10 exercises for major muscle groups
- ✓ ≥ 1 set/exercise
- ✓ 8-12 (most) or 10-15 (frail/ $> 50-60$ yr) repetitions/set



CVDs

AMI

CVA



TIA

HTN

PVD

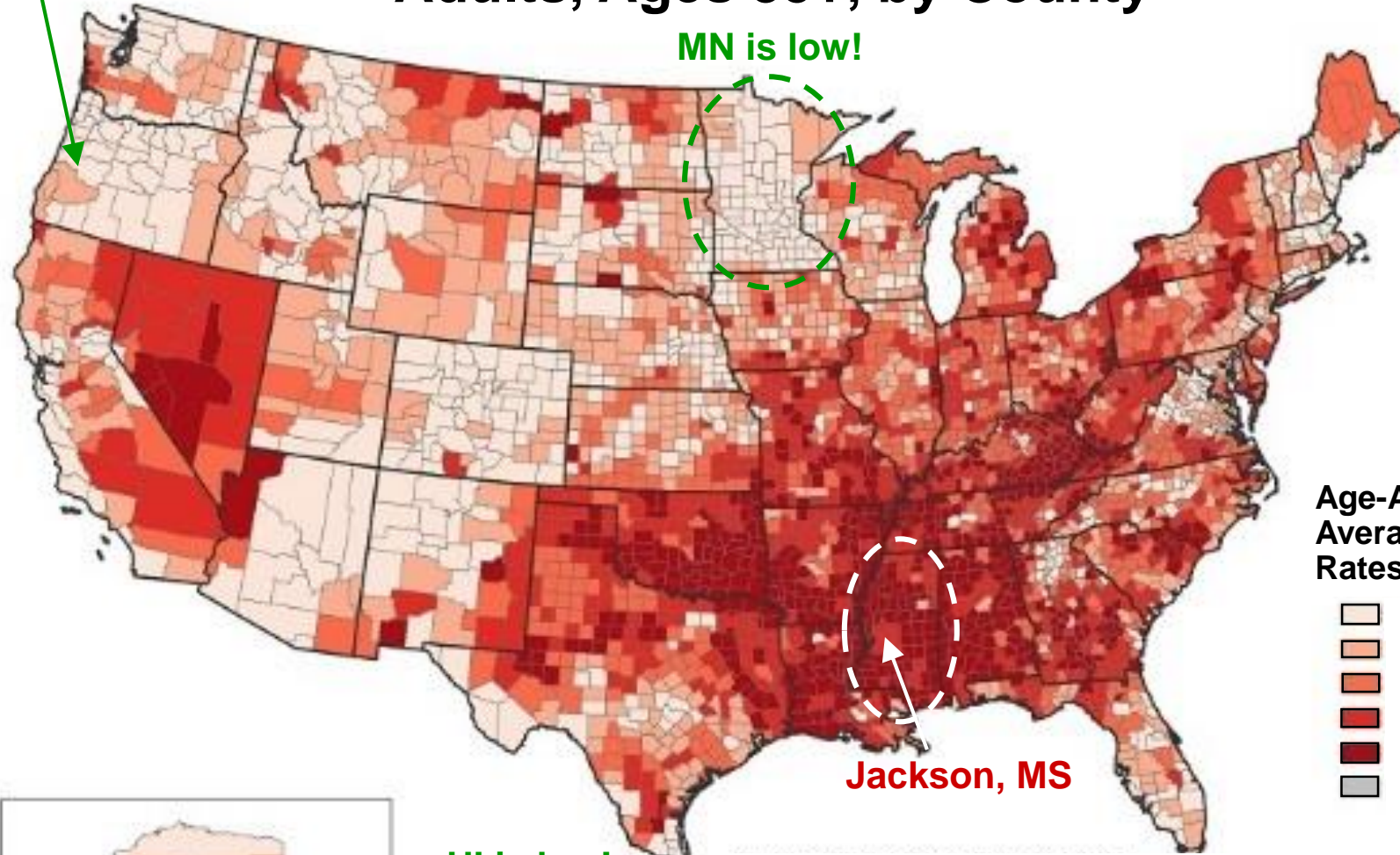
Did you know?

- **Every 40 seconds, someone has a heart attack in the US!**
- **~630,000 Americans die of heart disease each yr – that's 1 in every 4 deaths. Heart disease is the leading cause of death for both men and women.**
- **Heart disease costs the US ~ \$200 billion per yr in health care, medications & lost productivity. By 2035, CVD costs are projected to top \$1 trillion annually.**

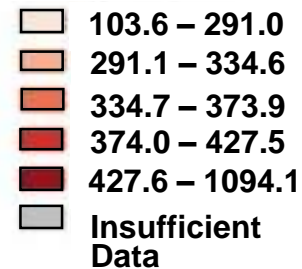
Heart Disease Death Rates, 2011-2013 Adults, Ages 35+, by County

Eugene, OR

MN is low!



Age-Adjusted
Average Annual
Rates per 100,000



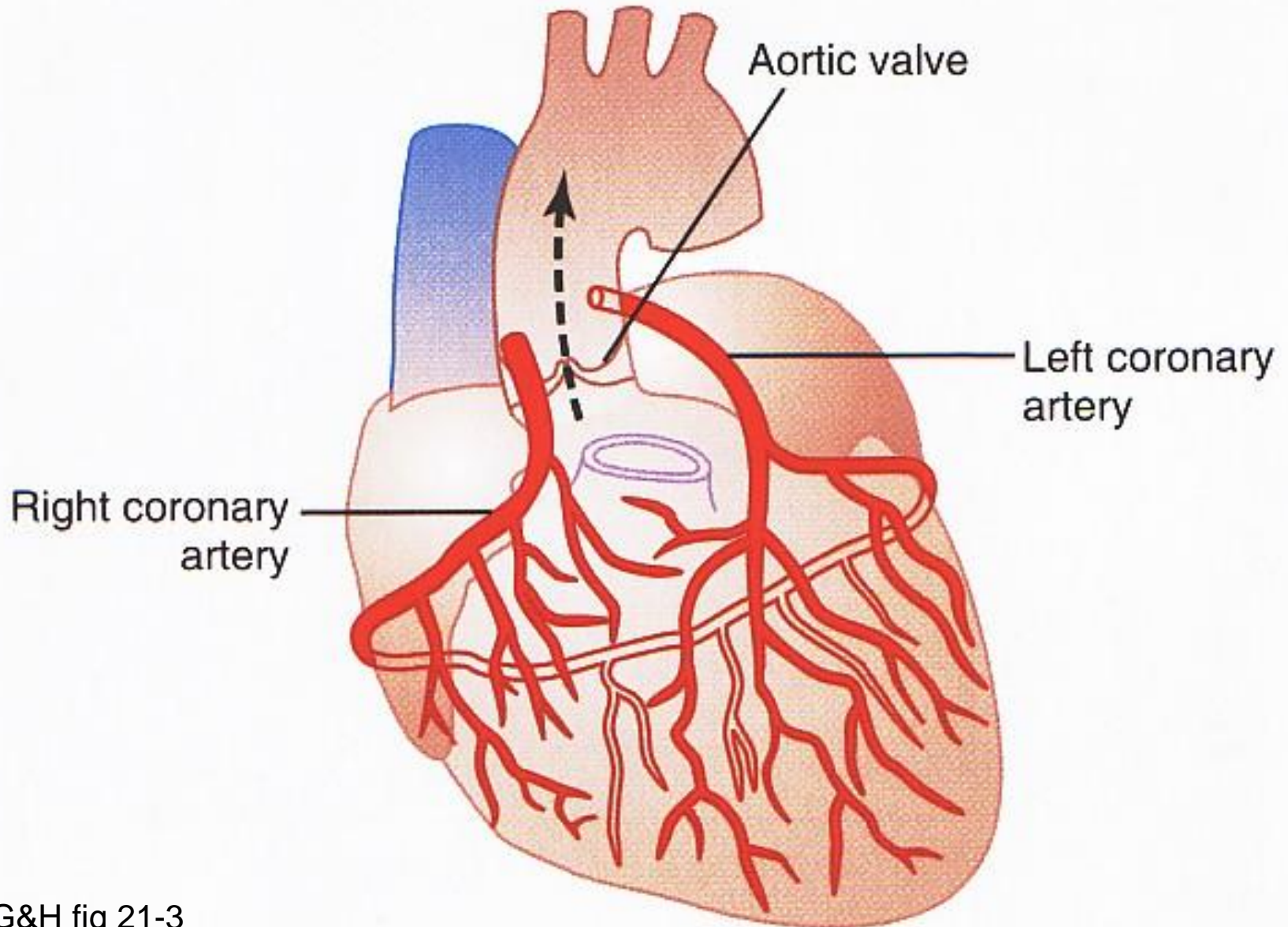
Jackson, MS

Rates are spatially smoothed to enhance the stability of rates in counties with small populations.

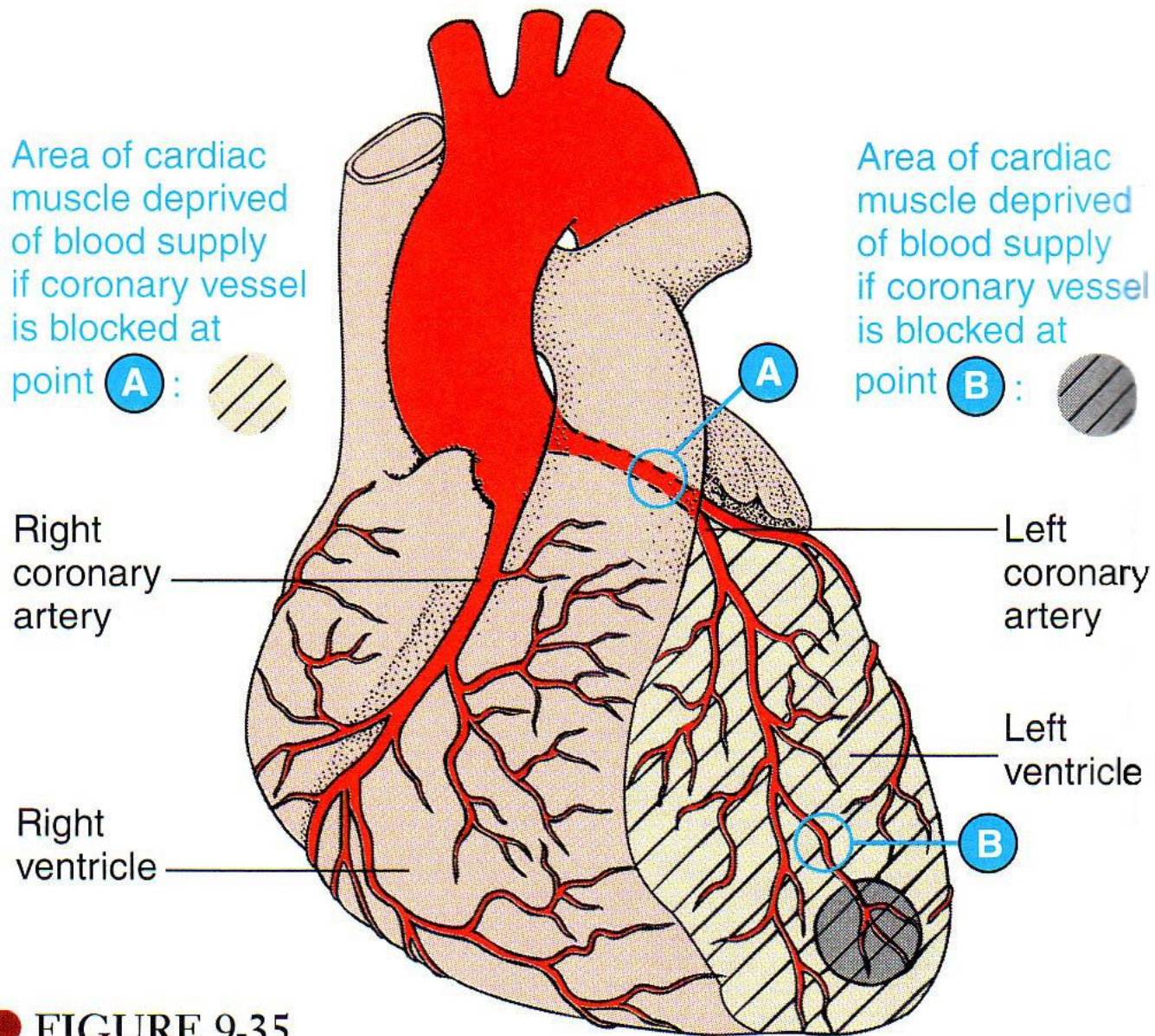
Data Source: National Vital Statistics System
National Center for Health Statistics



Coronary Circulation ≡ Crowns the Heart!

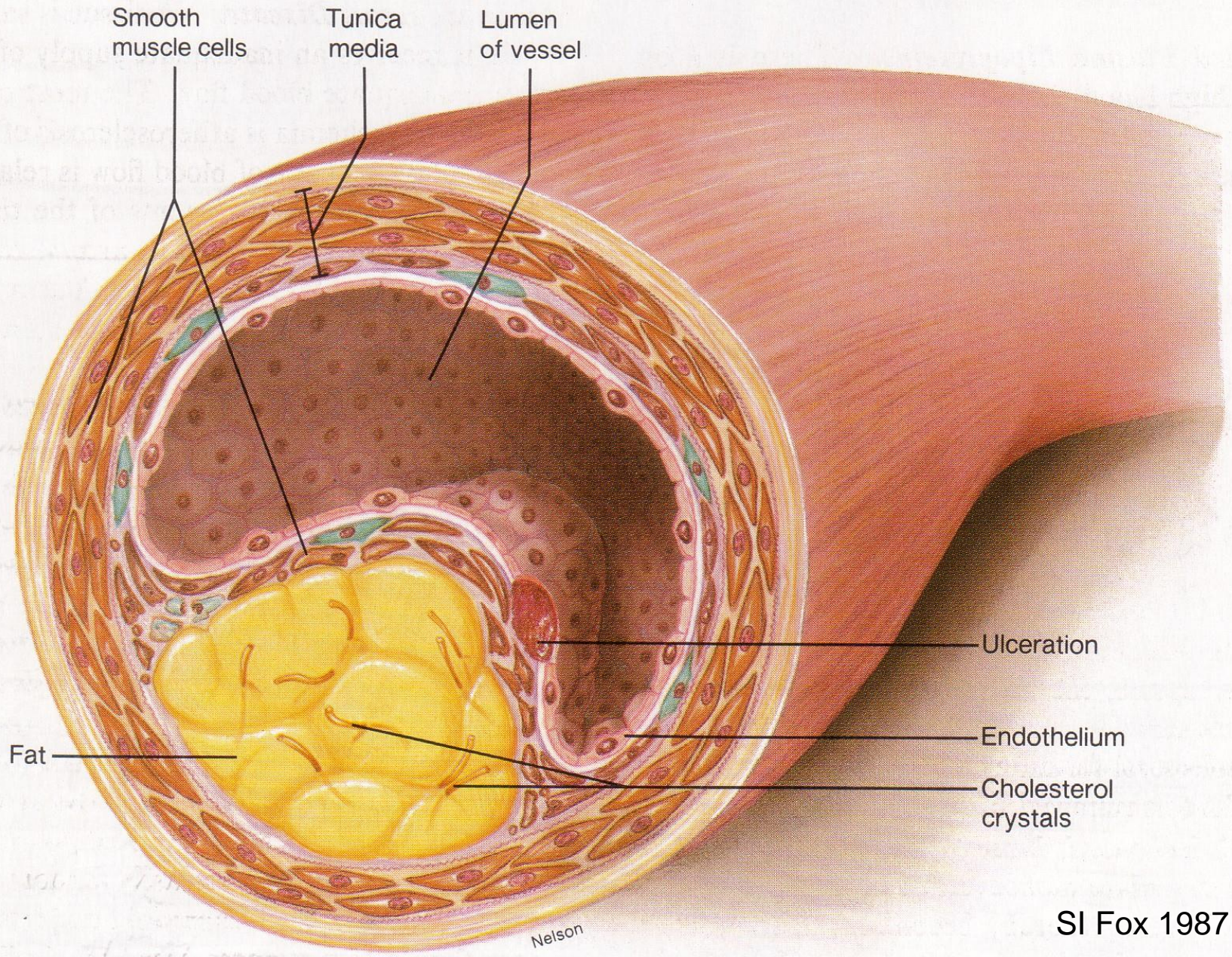






● FIGURE 9-35

Extent of myocardial damage as a function of the size of the occluded vessel



Smooth muscle cells

Tunica media

Lumen of vessel

Fat

Ulceration

Endothelium

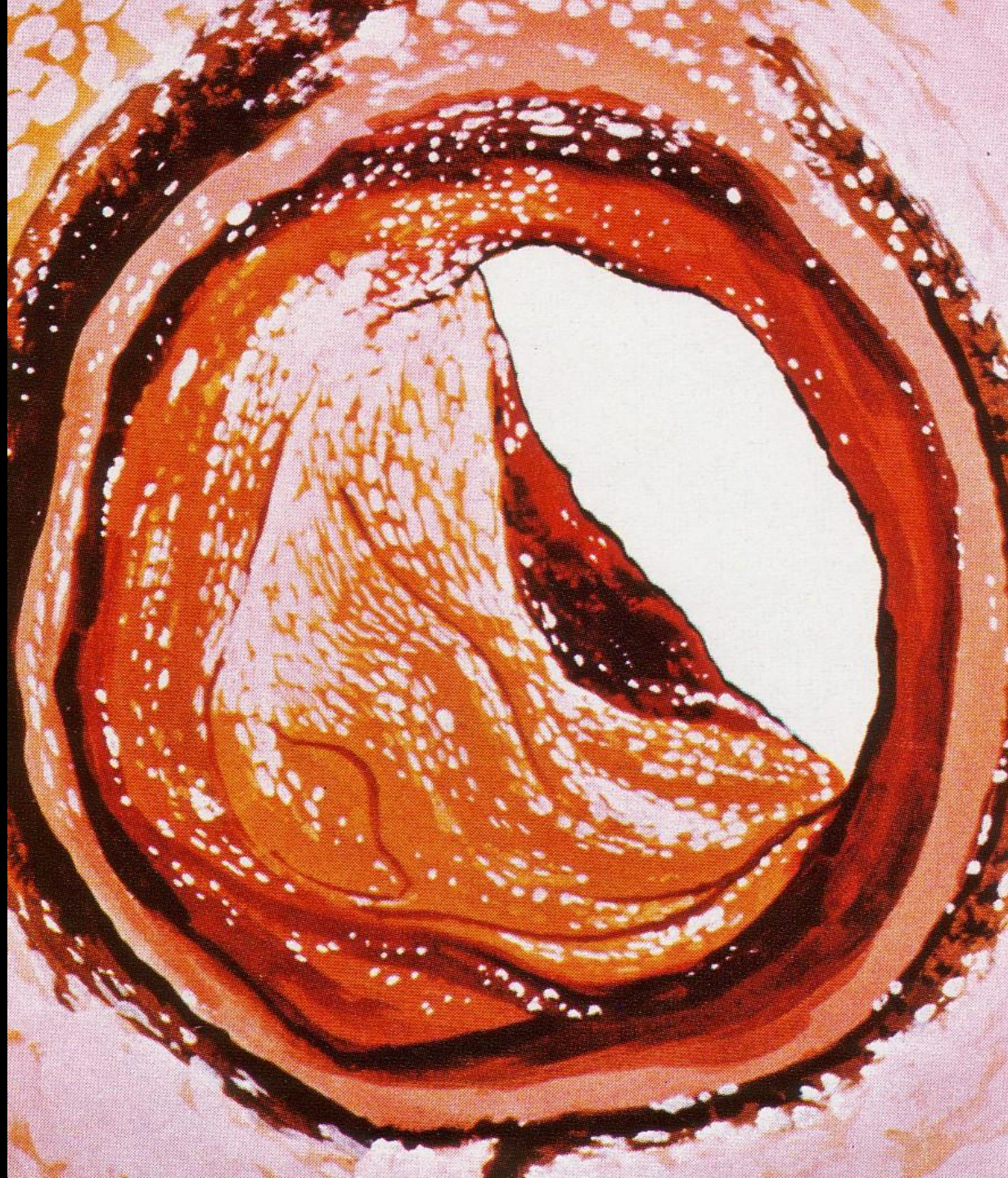
Cholesterol crystals

Nelson

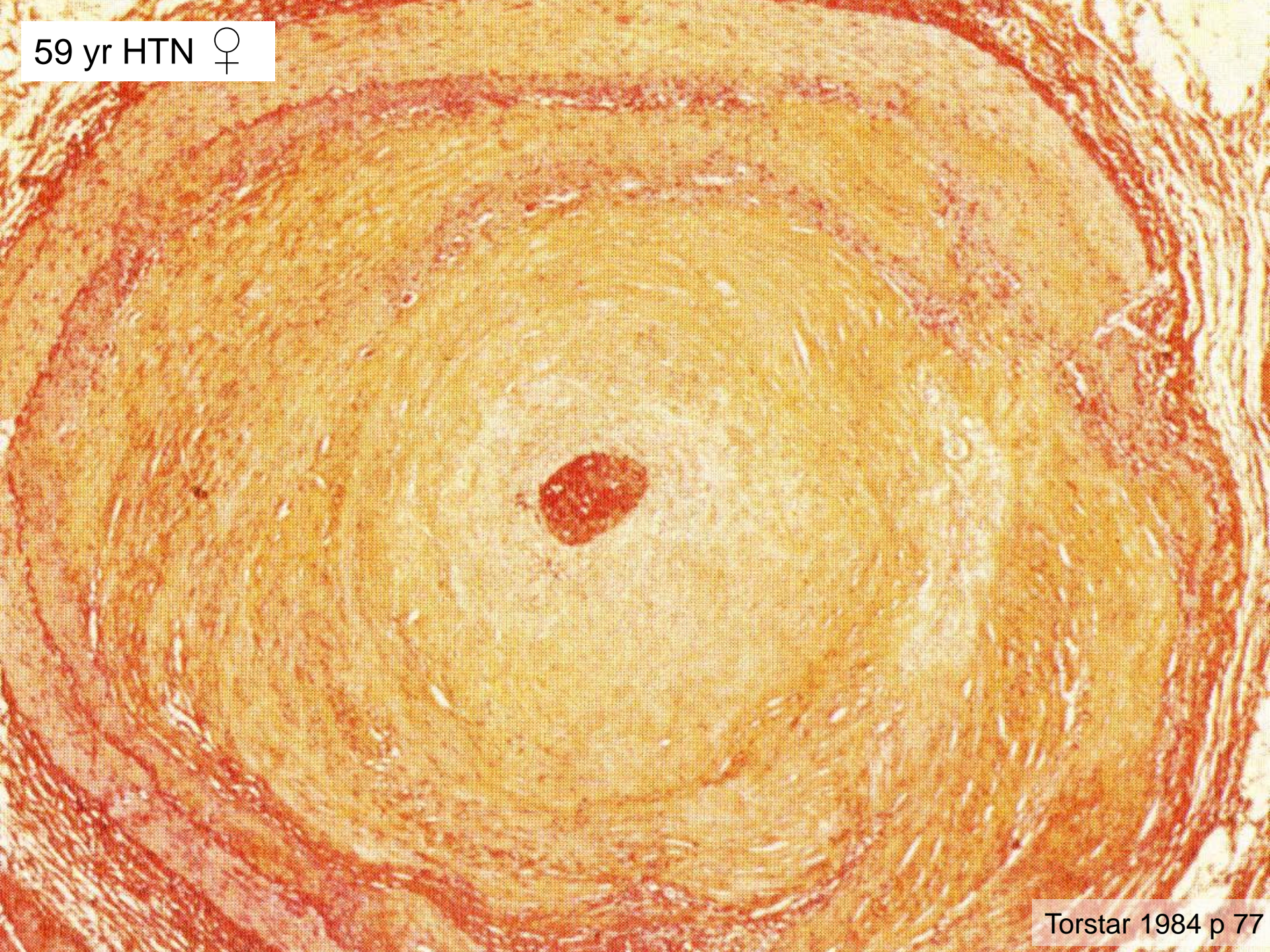
SI Fox 1987 p 370

100 yr ♀





59 yr HTN ♀

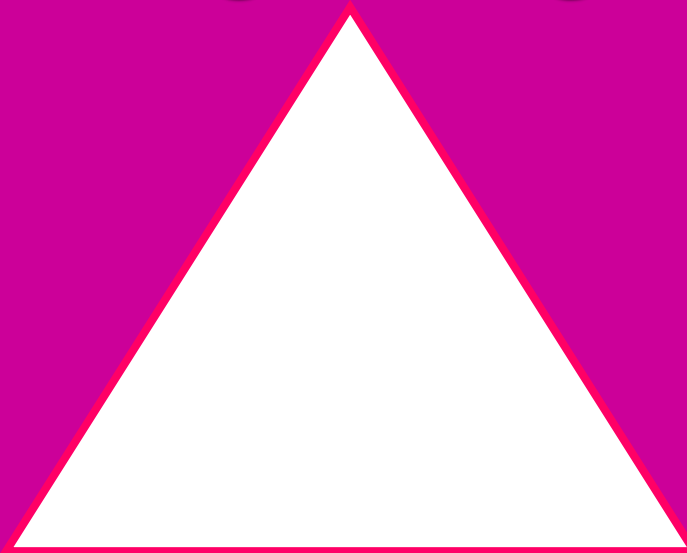


Treatment Triad

NB: Last blasted resort!!



Drugs/Surgery



Exercise

*Dietary
Modification*

WOW!



SUPER



~ TOP 5-10!

EXCELLENT!!



~ TOP 15!

GREAT EFFORT



~ TOP 20-25!