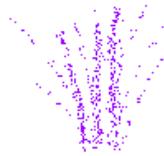
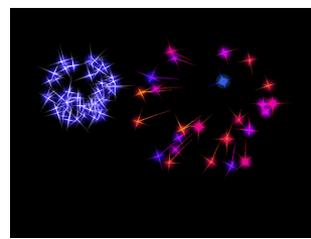


... **Have a Safe, Happy 4th of July!!**



**BI 121
Lecture 8**



I. Announcements Next Tues HR & BP Lab 4 + **Required Notebook Check**. Turn in today? Next Thurs Blood Chemistry Lab 5. Please read 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
LS pp 229, CV vs Lymphatic, 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

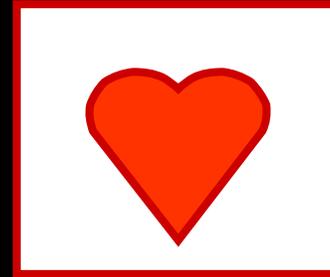
E. ♥ layers, box, chambers, valves, inlets, outlets
LS fig 9-4 p 233, fig 9-2a p 231; DC pp 23-6

F. Normal vs abnormal blood flow thru ♥ & CV system
Billy has a hole in his ♥ SI Fox 2009 fig 13.16, 13.17

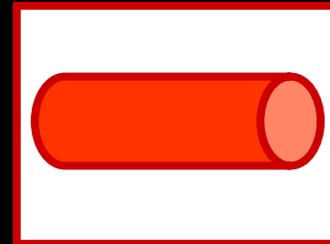


III. Comments on Midterm & Tests Returned?

Cardiovascular (CV) = Heart + Vessels + Blood!



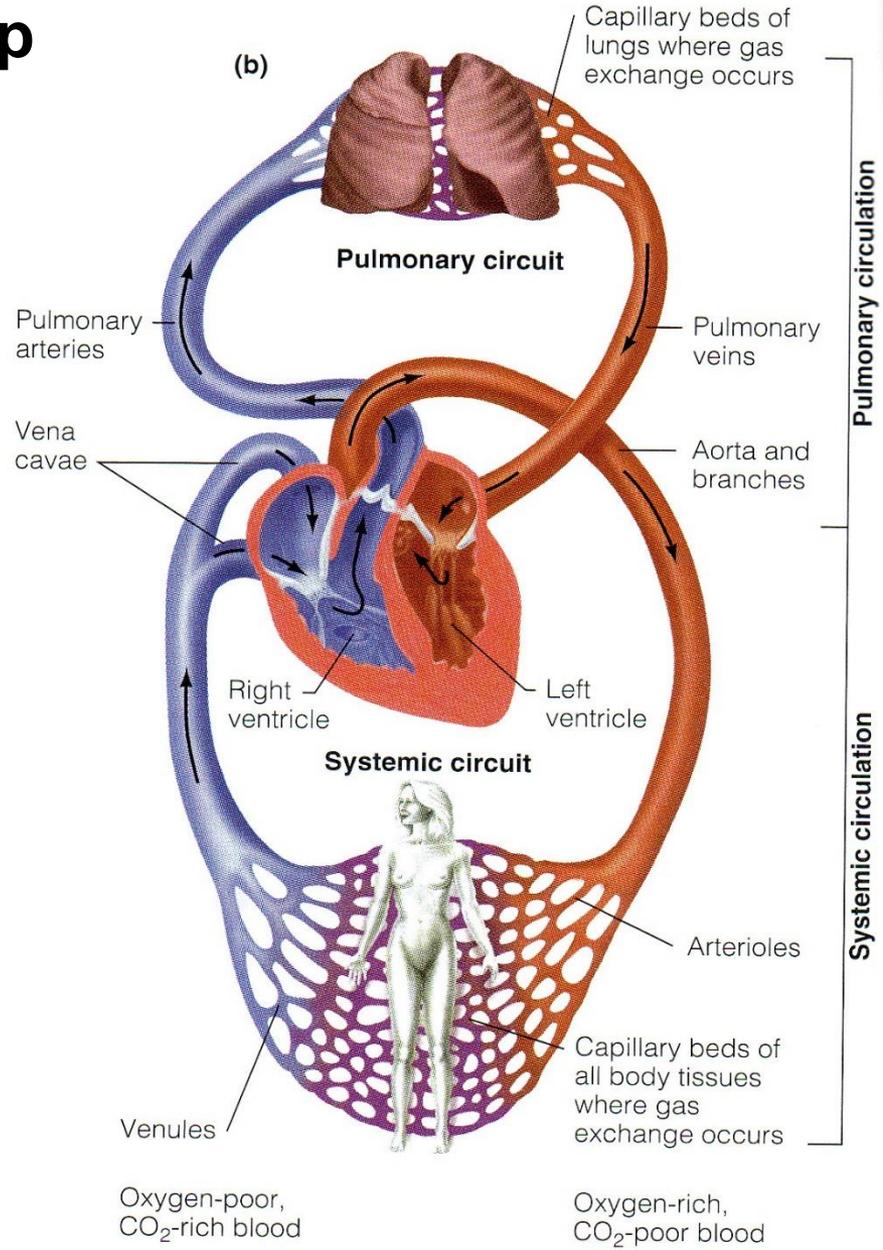
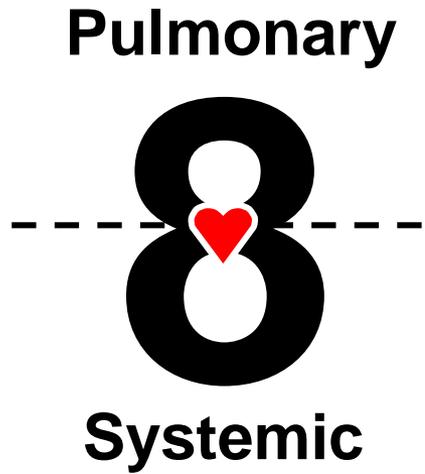
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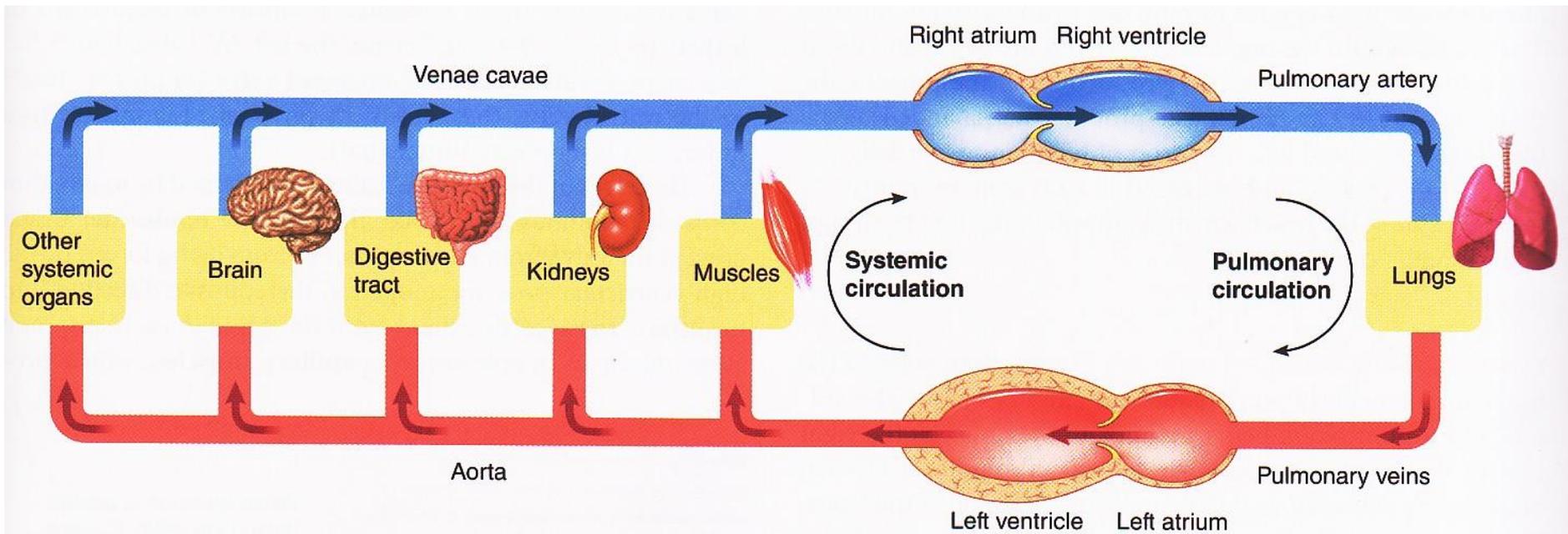
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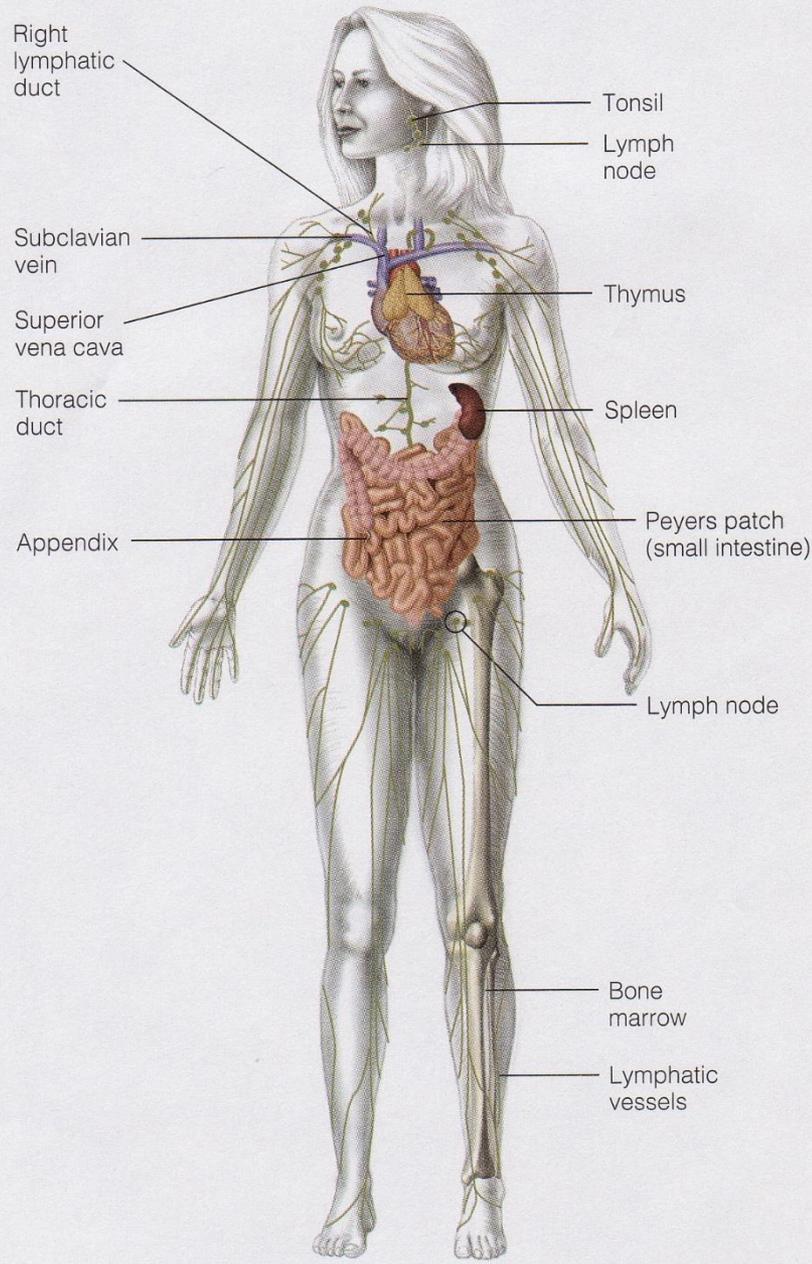


NB: Figure-8 loop



Dual Pump Action & Parallel Circulation



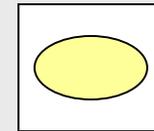


Lymphatic System

1. Lymph Nodes

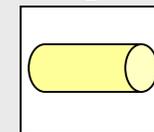
2. Vessels

3. Lymph

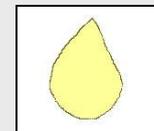


No pump!

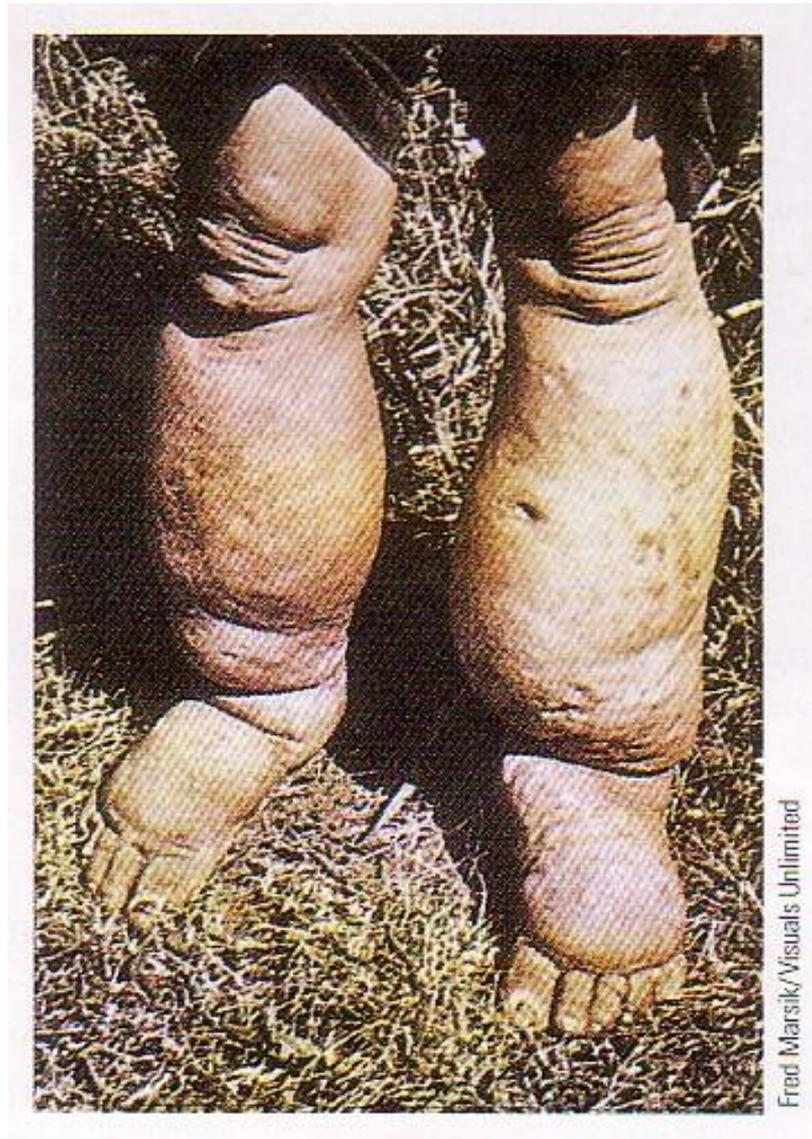
+



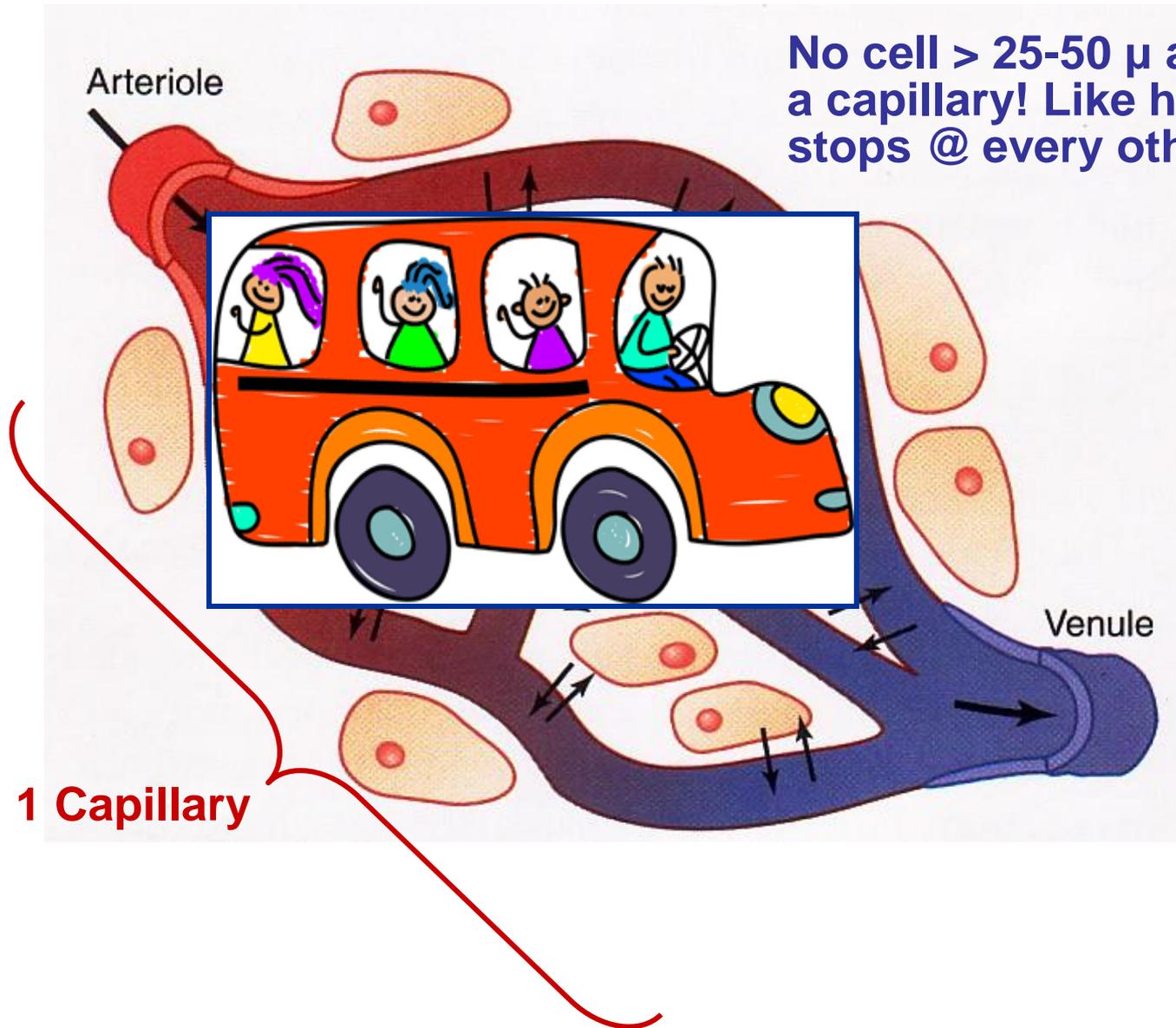
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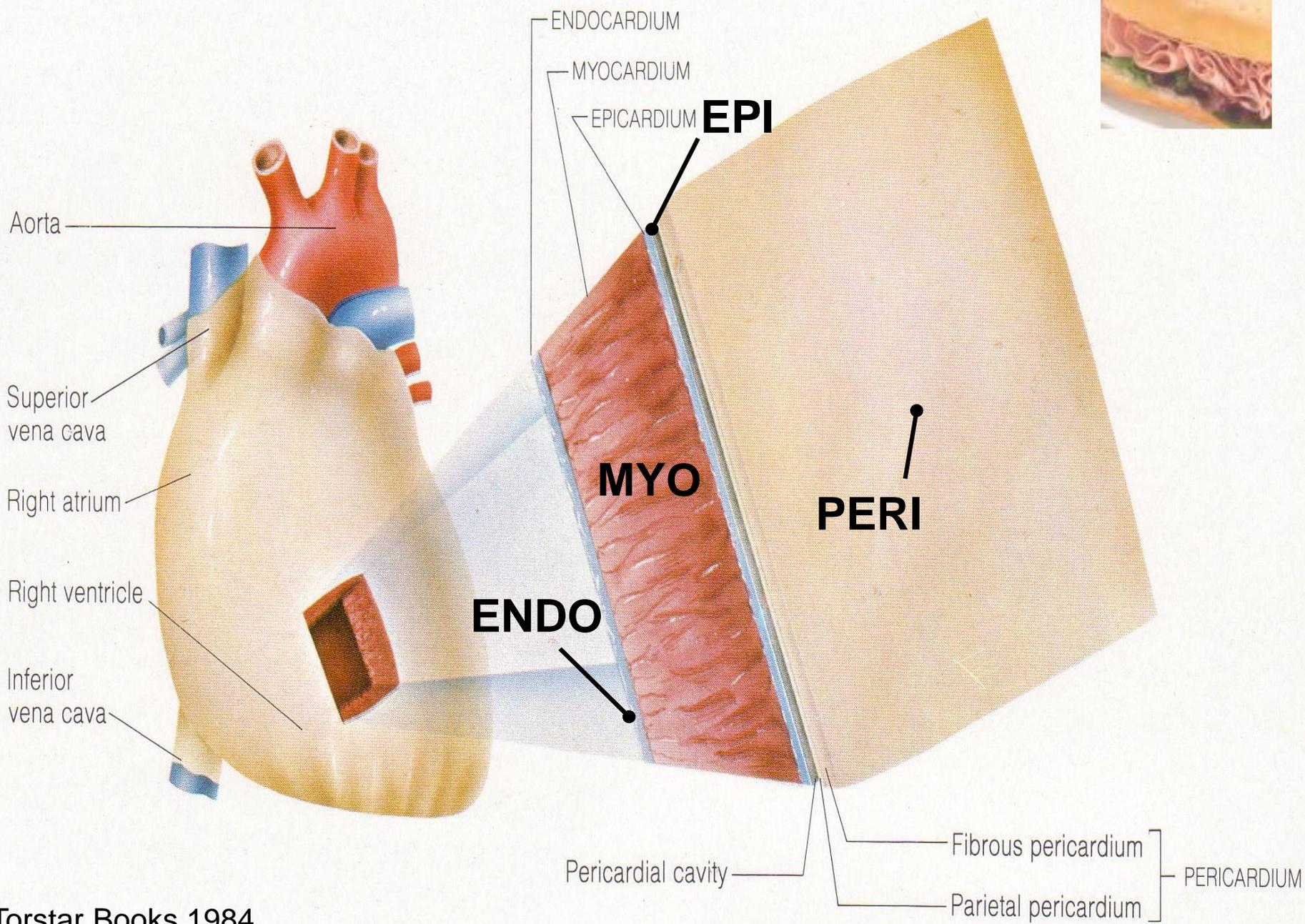
Lymphatic System Blockage in Elephantiasis from Mosquito-borne Parasitic Filaria Worm



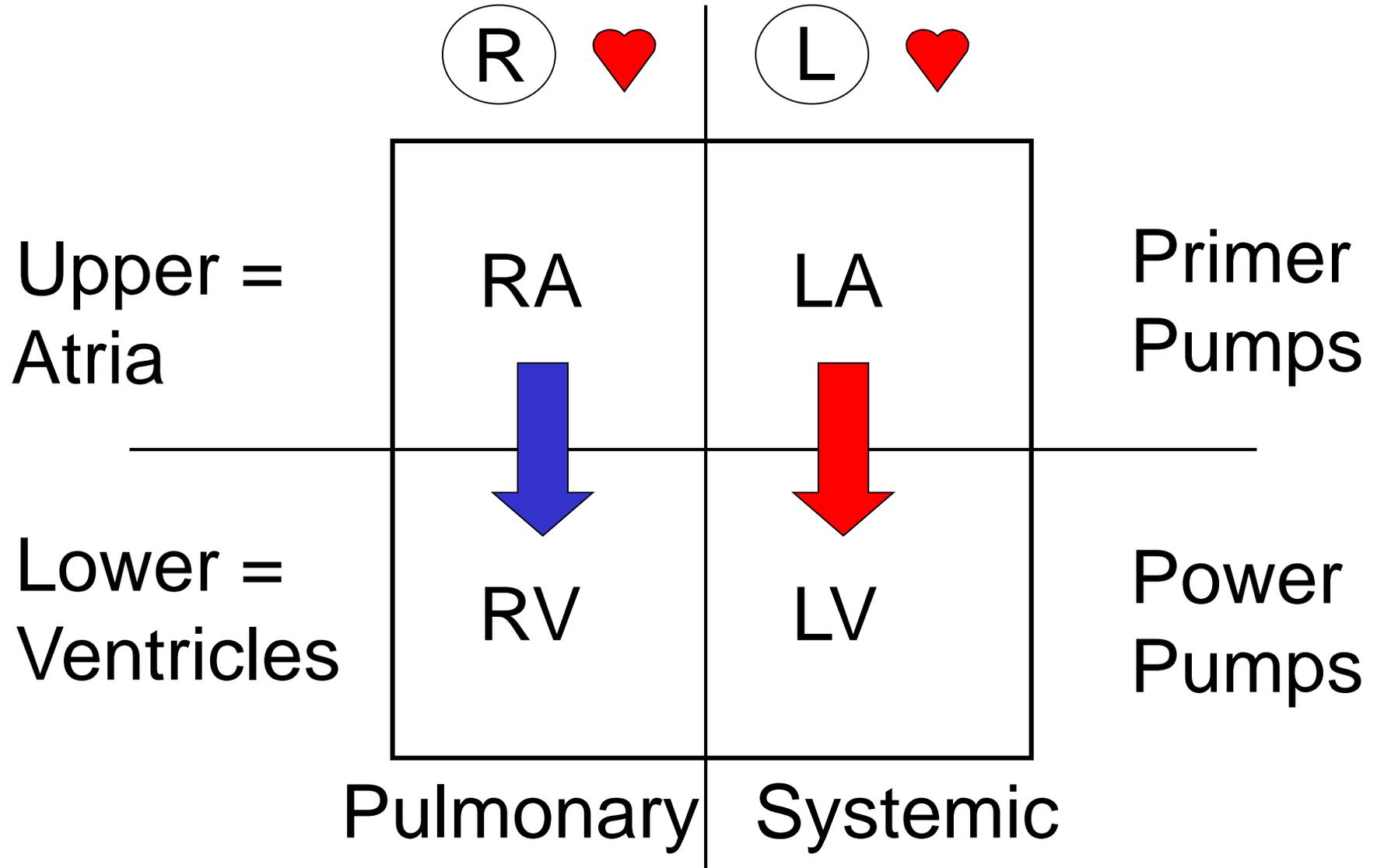
Microcirculation Exchange: 10 Billion Capillaries!



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



Human  = 4-chambered box?
2 separate pumps?



Human ♥ = 4 unique valves?
2 valve sets?

Semilunar = Half-moon shaped

More
rigid

1. Pulmonic/Pulmonary
2. Aortic



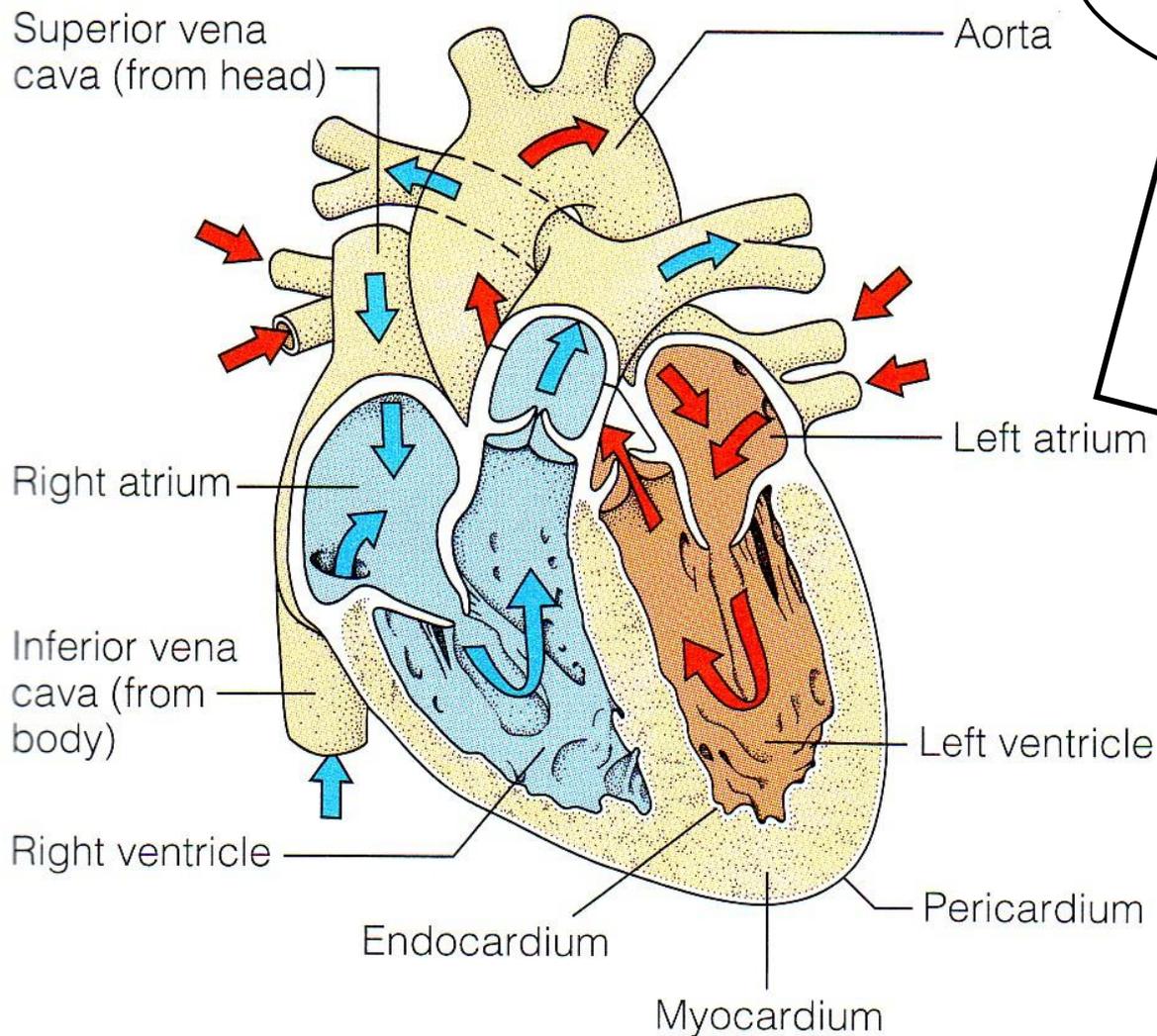
AV = Atrioventricular

More
flimsy

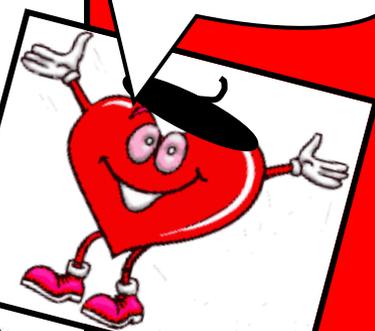
3. (R) AV = Tricuspid
4. (L) AV = Mitral/Bicuspid



Veins → Atria → Ventricles → Arteries



VAVA!



<http://www.nhlbi.nih.gov/health/health-topics/topics/hhw/contraction.html>

BI 121 Lecture 9

What about MT scores?... 

I. Announcements Lab notebook due today! Lab 4 HR & BP.
Thursday, Lab 5 Blood Chemistry. Read 2x pp 5-1 thru 5-6. Q?

II. Overview of Labs HR & BP. ♥ Cycle. Blood chem lab review

III. Cardiovascular Connections LS 2012 ch 9

A. Normal vs abnormal blood flow!

B. ♥'s electrical highway + Pacemaker activity

LS fig 9-7 p 235, tab 9-1 p 236, fig 9-8 p 237



IV. CV Physiology in the News Randy Foye, NBA player with
Situs Inversus? 1:10,000! NHLBI & AHA websites

Nicole Kidman & exercise? ACSM, AHA, CDC guidelines

V. CV Pathophysiology & Risk Reduction LS ch 9, 10 +...

A. AMI, CVA, CVD, PVD, TIA, HTN? + surgical treatments

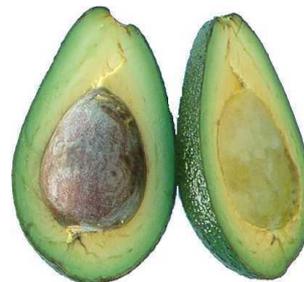
B. Atherosclerosis? LS fig 9-27, 9-25, 9-26 pp 266-8

C. How to minimize risk of CVDs? Treatment triad:

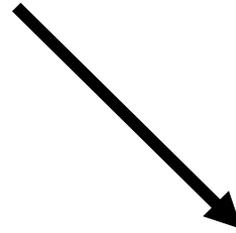
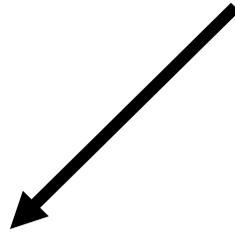
Exercise, Diet, Drugs + Surgery

D. Food choices make a difference?

What's HAPOC?



Cardiac Cycle

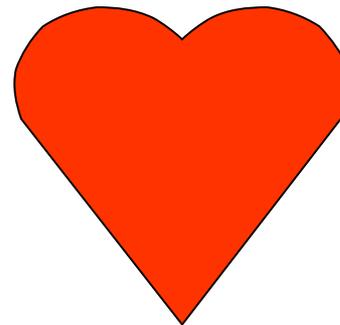
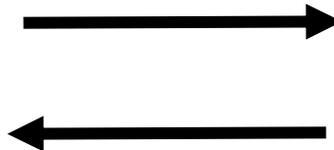
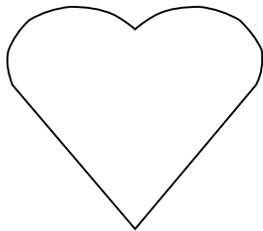


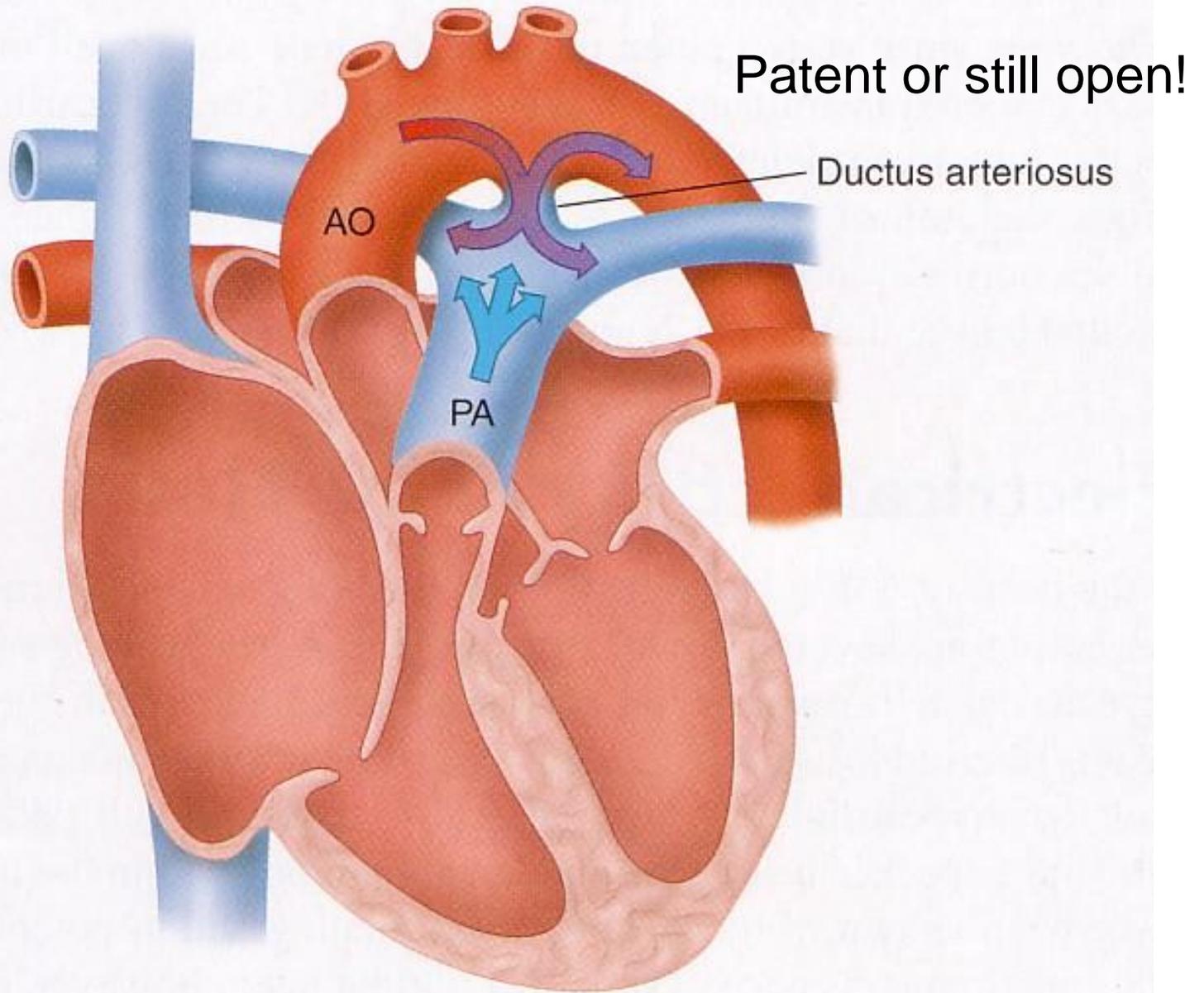
Systole

Contract
& Empty

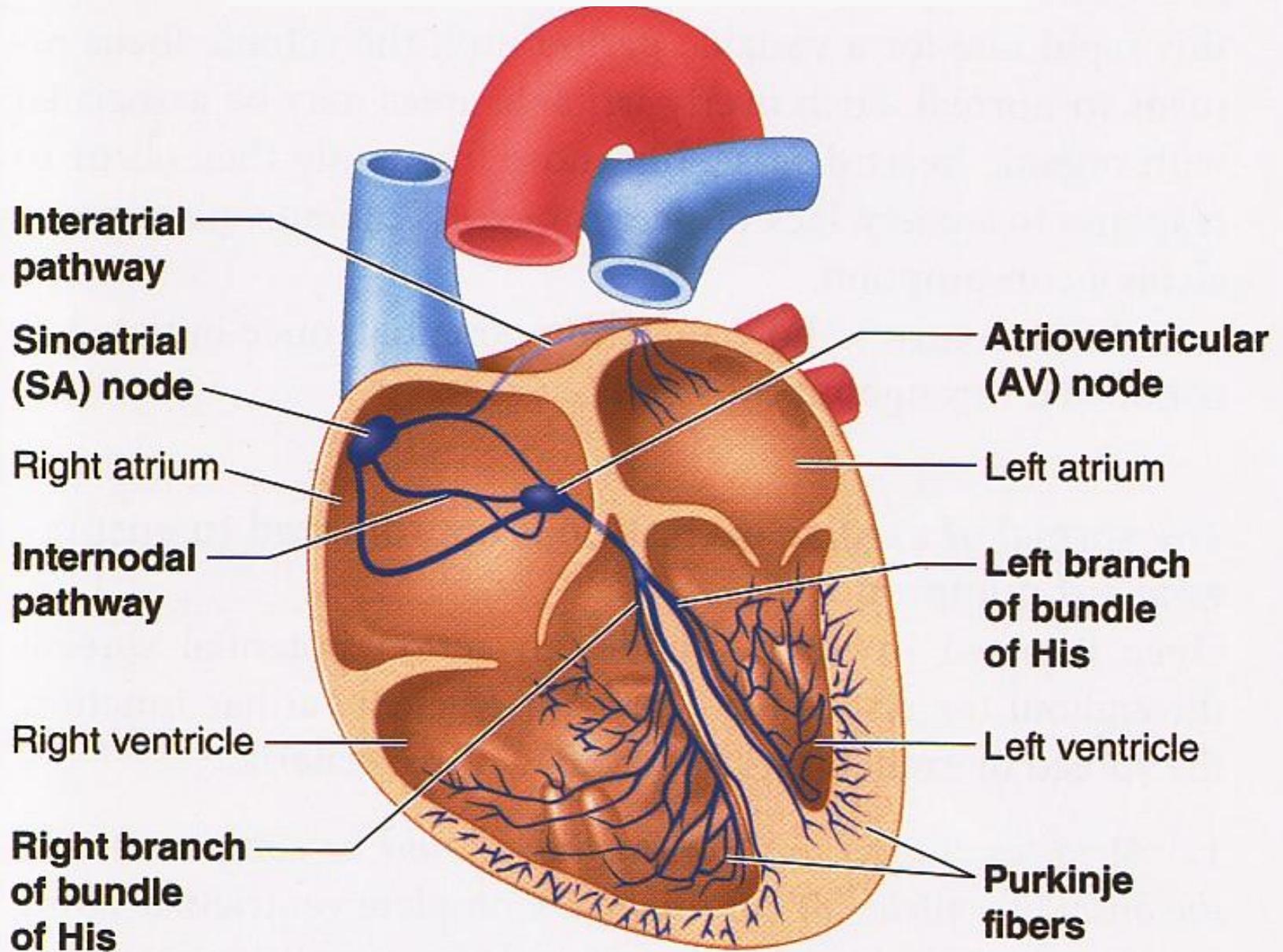
Diastole

Relax
& Fill

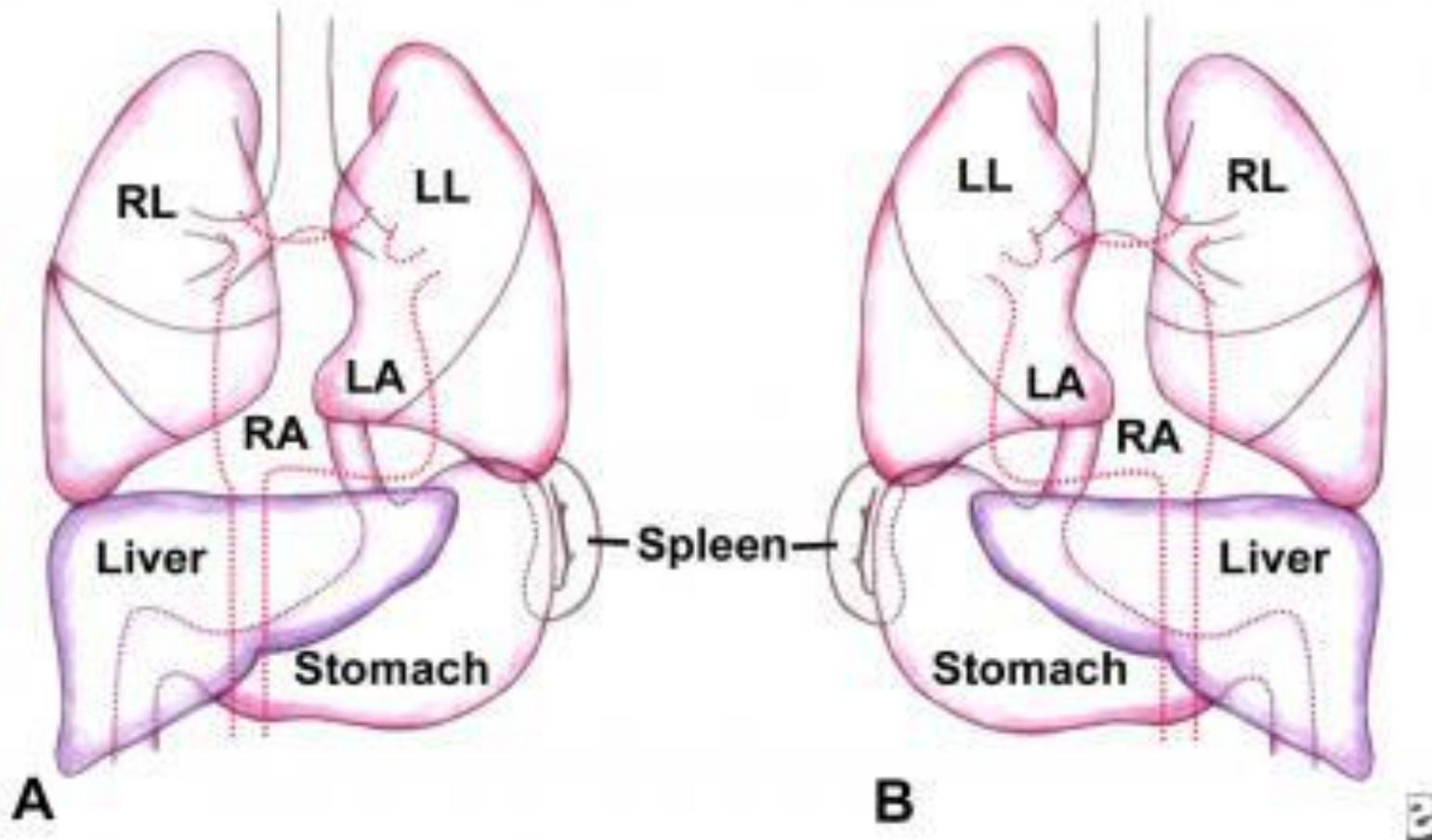




Heart's Electrical Highway!



Normal (A) vs *Situs Inversus* (B): 1:10,000 live births!



SOURCE: Medscape <http://emedicine.medscape.com/article/413679-overview>

Randy Foye, NBA Player & Situs Inversus!



<http://www.pbs.org/program/nine-months-that-made-you/>

American Heart Association (AHA) & National Heart, Lung & Blood Institute

<http://www.my.americanheart.org>



<http://www.nhlbi.nih.gov/>

Department of Health and Human Services · National Institutes of Health

National Heart Lung and Blood Institute

People Science Health





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**

CVDs

AMI

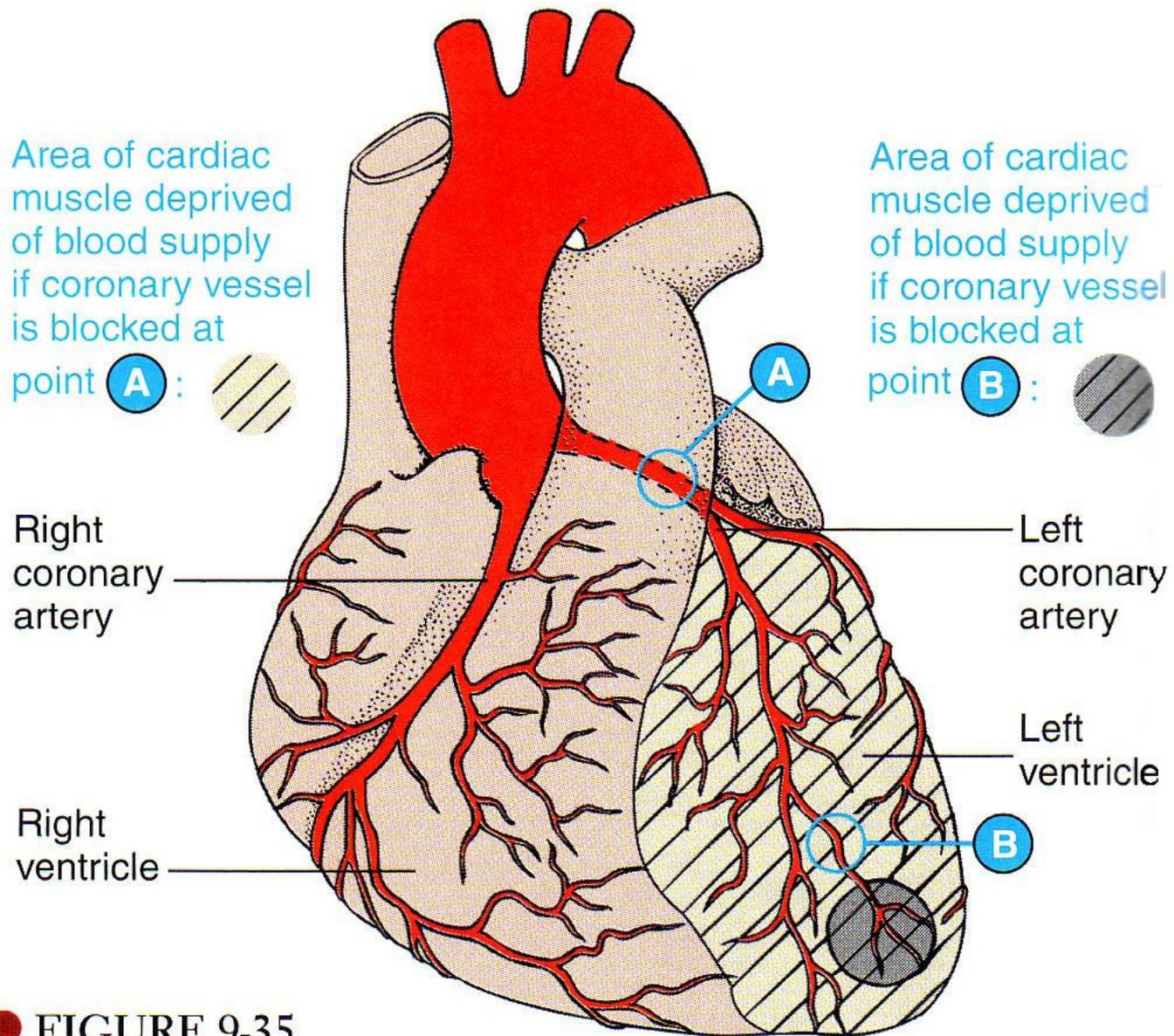
CVA



TIA

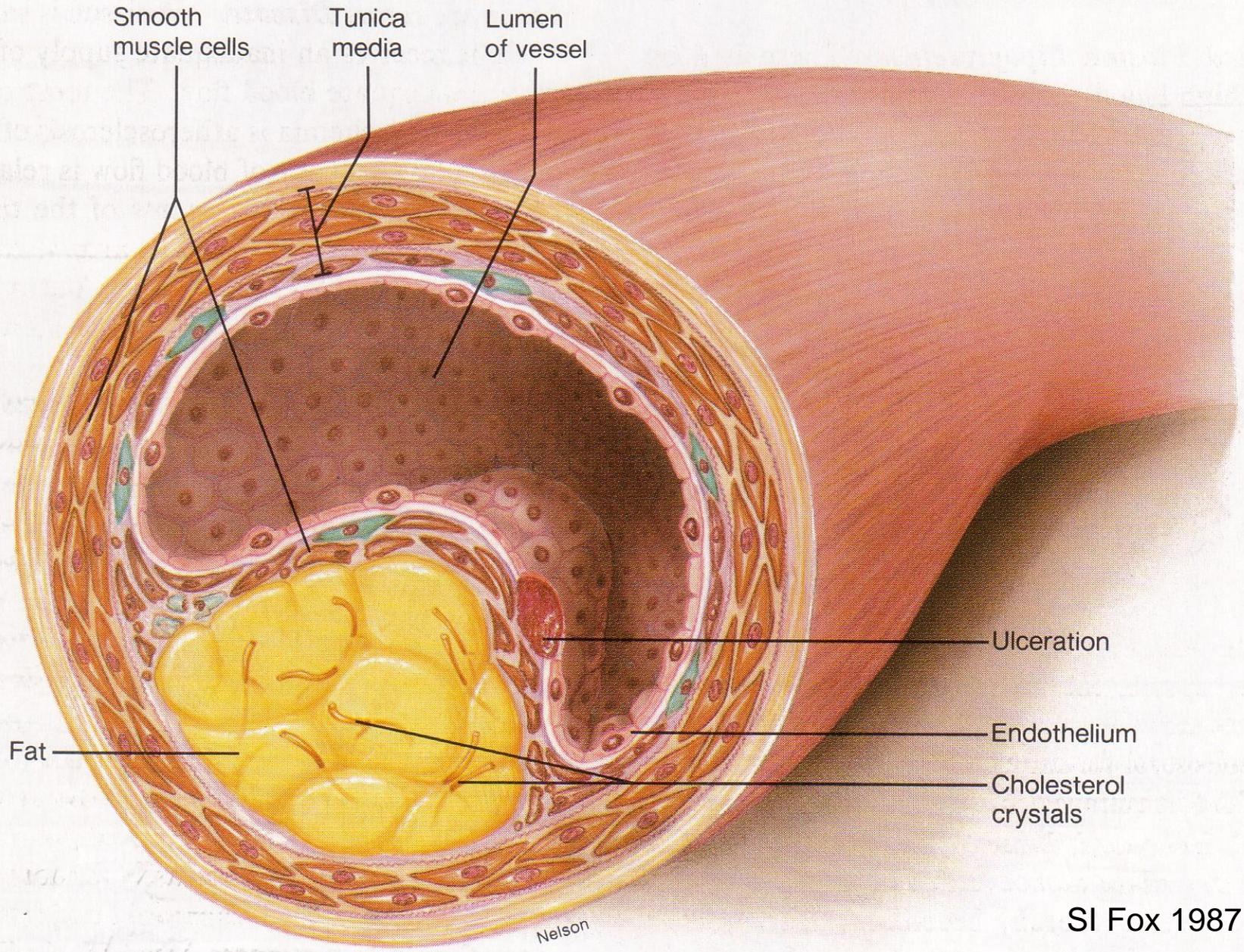
HTN

PVD



● FIGURE 9-35

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





...Fun lab week with much personal data!

BI 121 Lecture 10

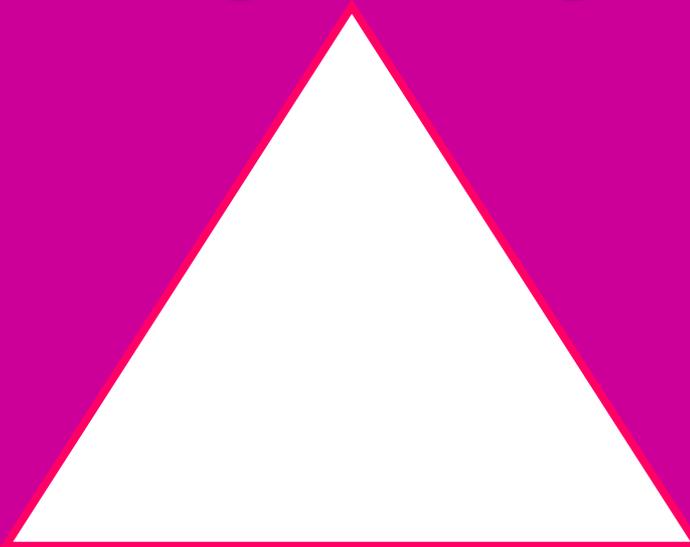
- I. Announcements** Remember to read Lab 5 before Thursday. Thanks for helping us be well-prepared. Q from last time? Calculating grade from estimated final. Keys to success? Q?
- II. CVDs Prevention & Treatment** Exercise, dietary modifications anti-inflammatory oils? PTCA, CABG, ... Torstar, S&W ch 5+...
- III. Blood Form & Function** LS ch 11 pp 296-304, 309-12
DC Module 5 + SI Fox + *National Geographic* Lennart Nilsson
 - A. Formed vs. nonformed/cells vs. plasma fig+tab 11-1
 - B. Red blood cells/erythrocytes: O₂-carrying
sickle cells, ABO blood typing, Rh factor pp 299-304.
 - C. White blood cells/leukocytes: Defense/immunity
differential + general functions pp 309-12
 - D. Platelets/thrombocytes: Initial clotting p 304
- IV. Blood Glucose & Diabetes Mellitus** LS ch 17, DC Module 13

Treatment Triad

NB: Last blasted resort!!

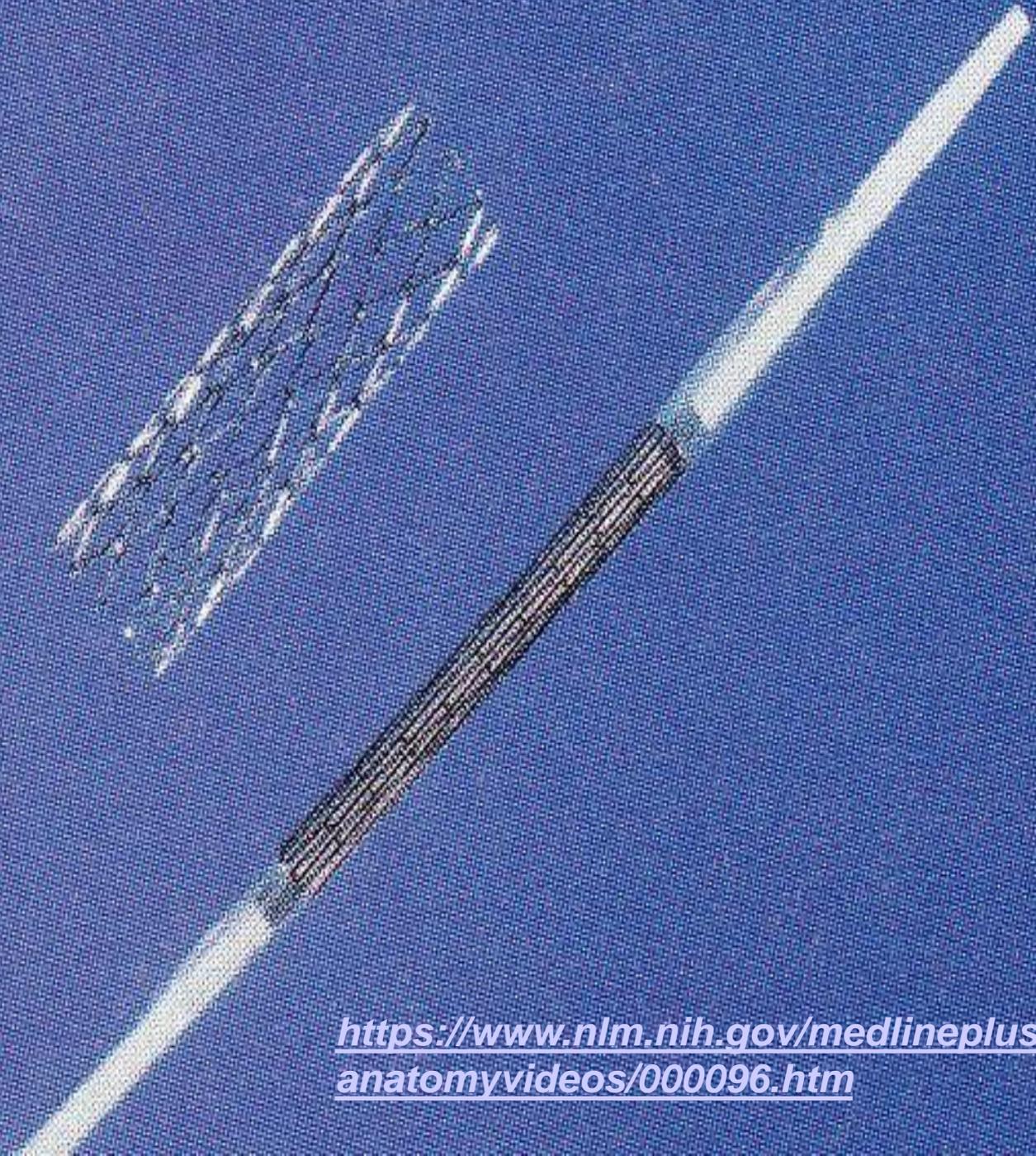


Drugs/Surgery



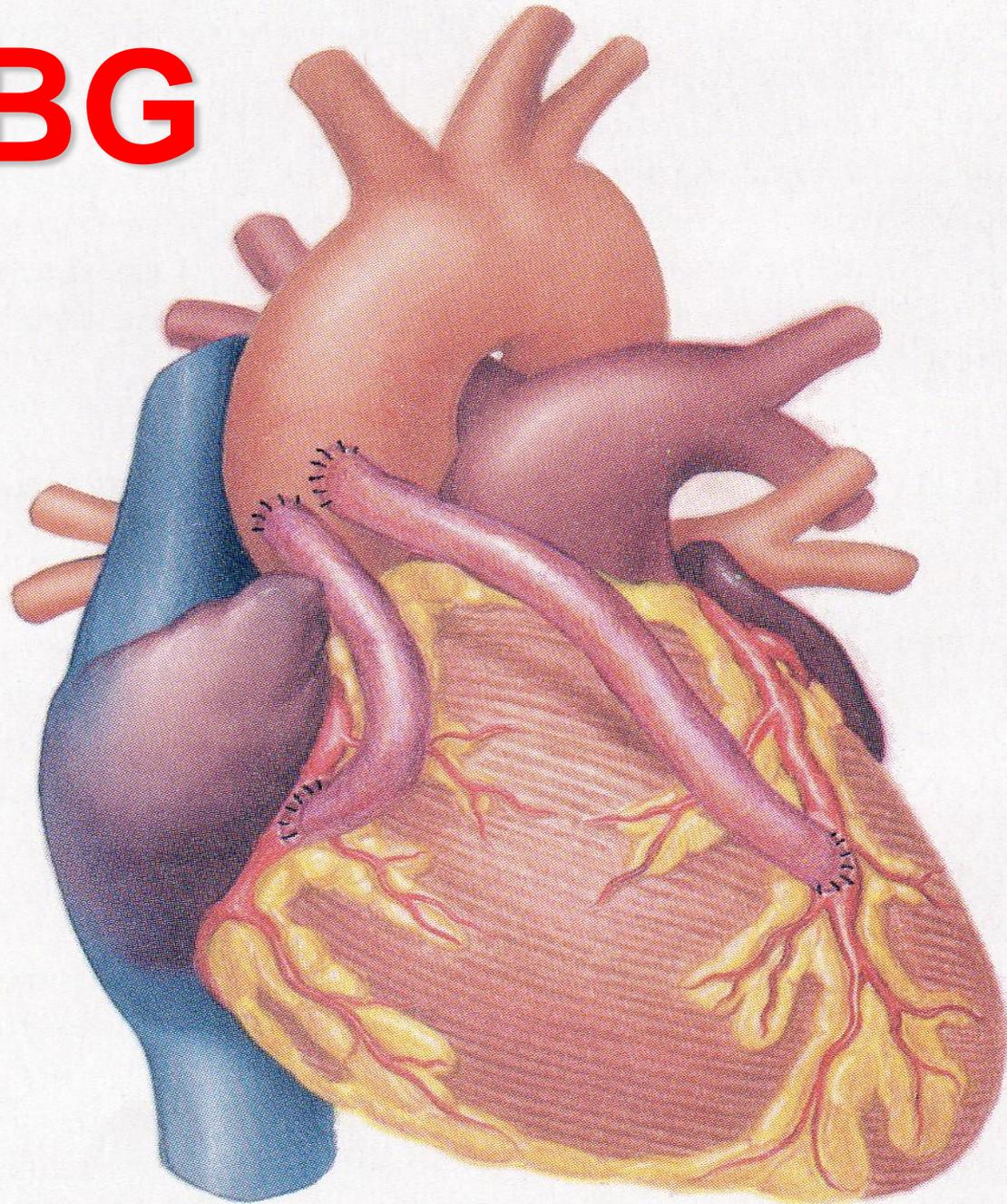
Exercise

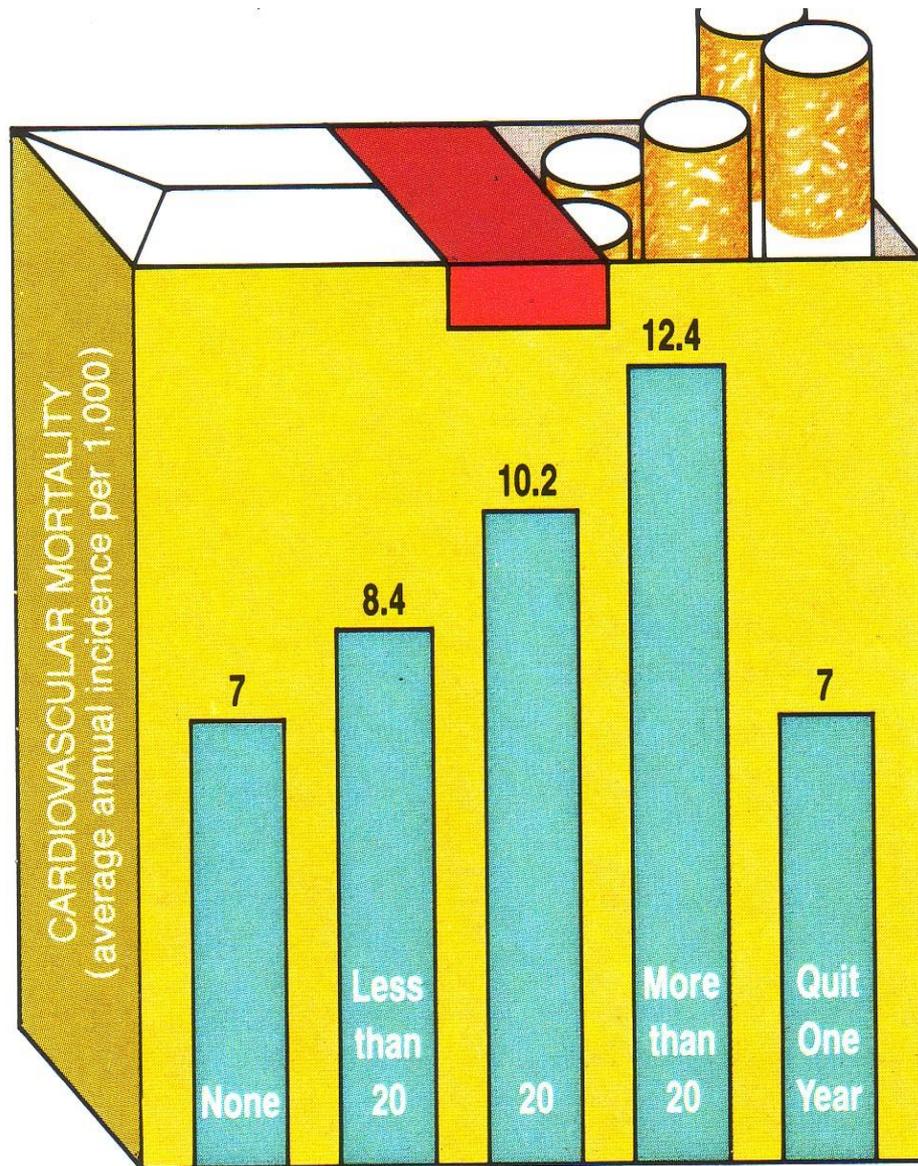
*Dietary
Modification*



[https://www.nlm.nih.gov/medlineplus/ency/
anatomyvideos/000096.htm](https://www.nlm.nih.gov/medlineplus/ency/anatomyvideos/000096.htm)

CABG

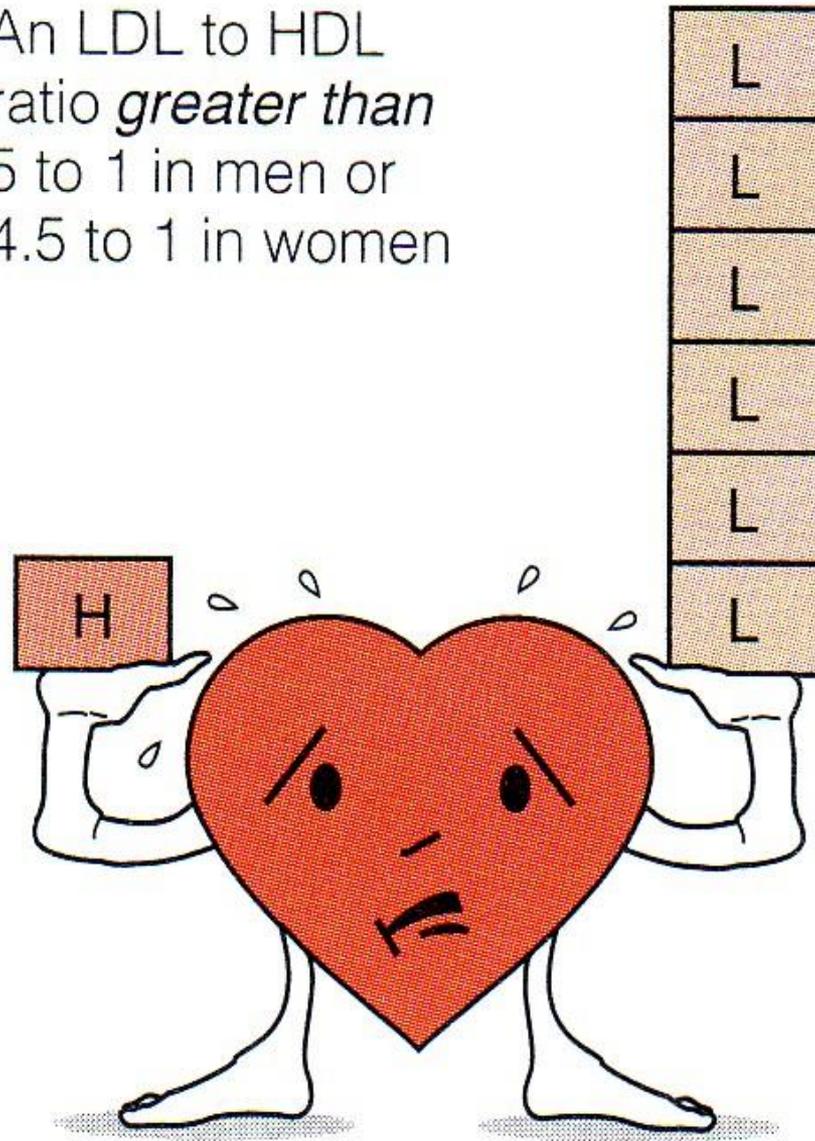




CIGARETTES SMOKED PER DAY



An LDL to HDL
ratio *greater than*
5 to 1 in men or
4.5 to 1 in women



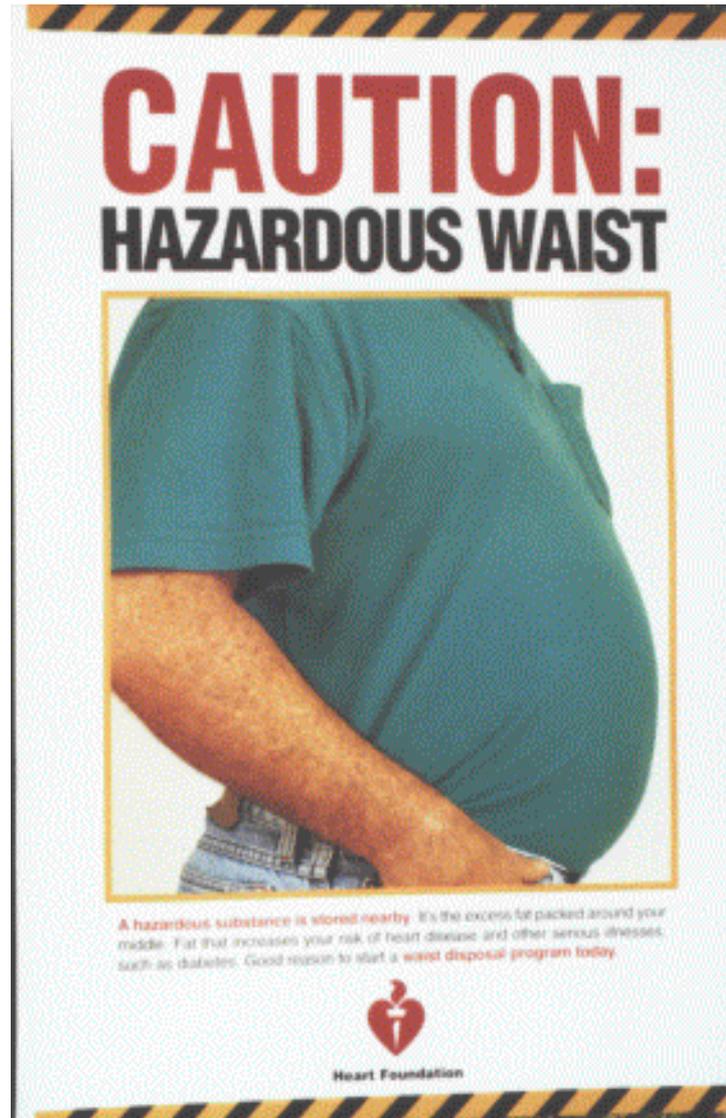
Increased risk of
heart disease

Apple type of obesity predisposed to CVD!

Pear type of fat pattern...



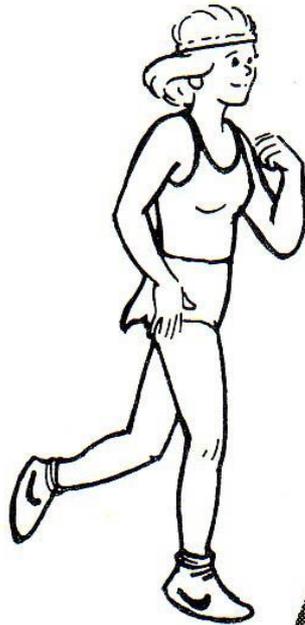
implies lower disease risk!



Eat more apples...



to help prevent the apple type of obesity!



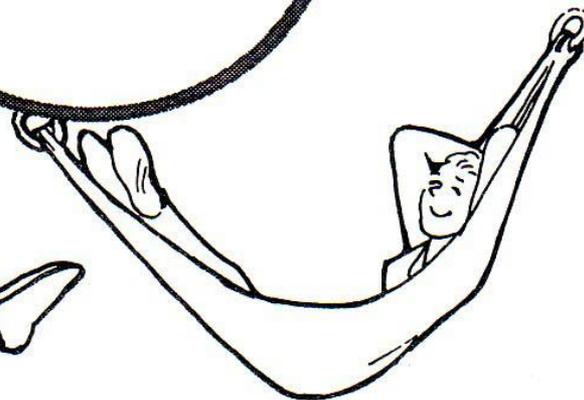
**Cardiorespiratory
Endurance**



**Muscular
Strength/Endurance**

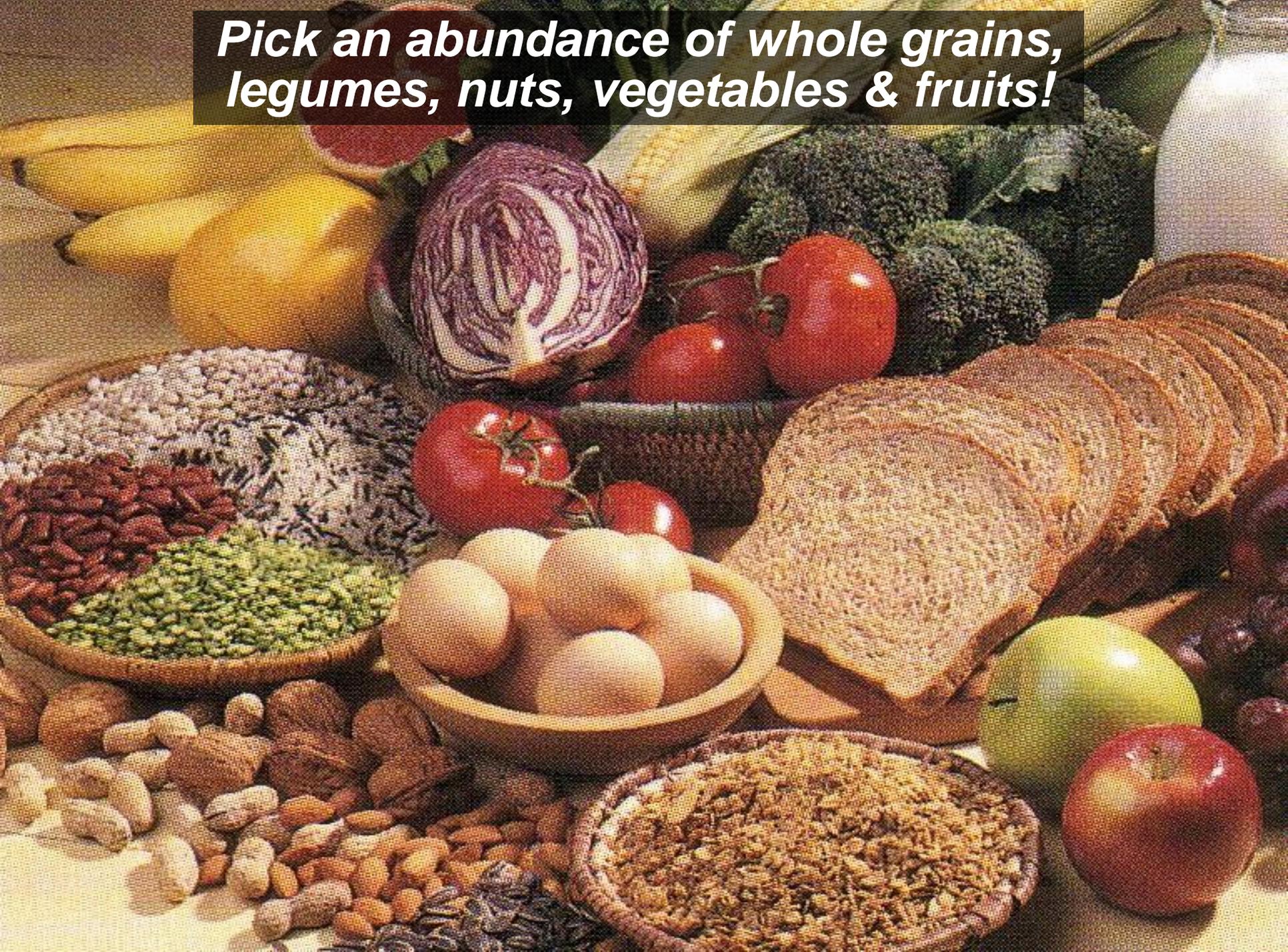


Flexibility



Neuromuscular Relaxation

Pick an abundance of whole grains, legumes, nuts, vegetables & fruits!





Healthy Oils to Minimize Atherosclerosis HAPOC?

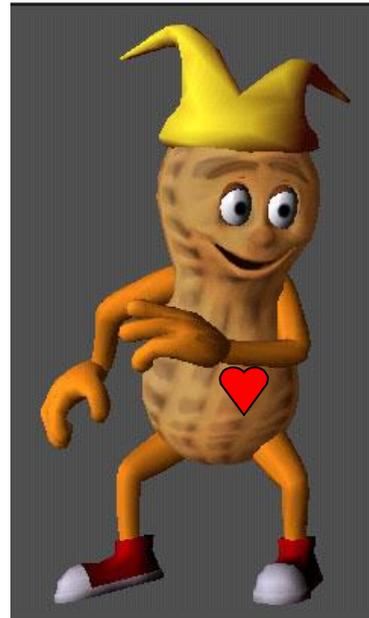
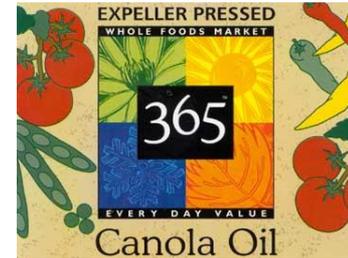
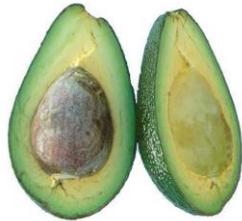
H

A

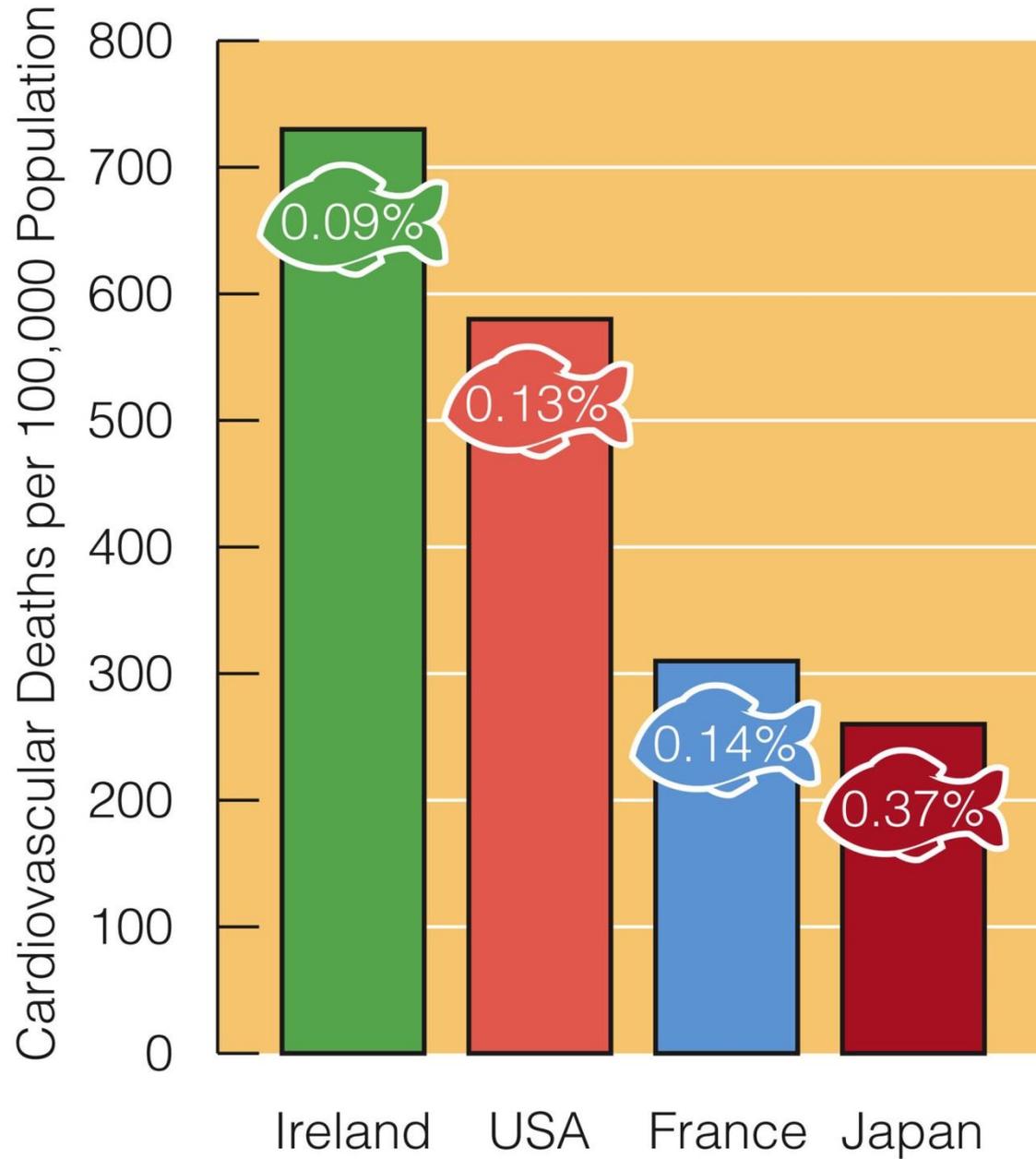
P

O

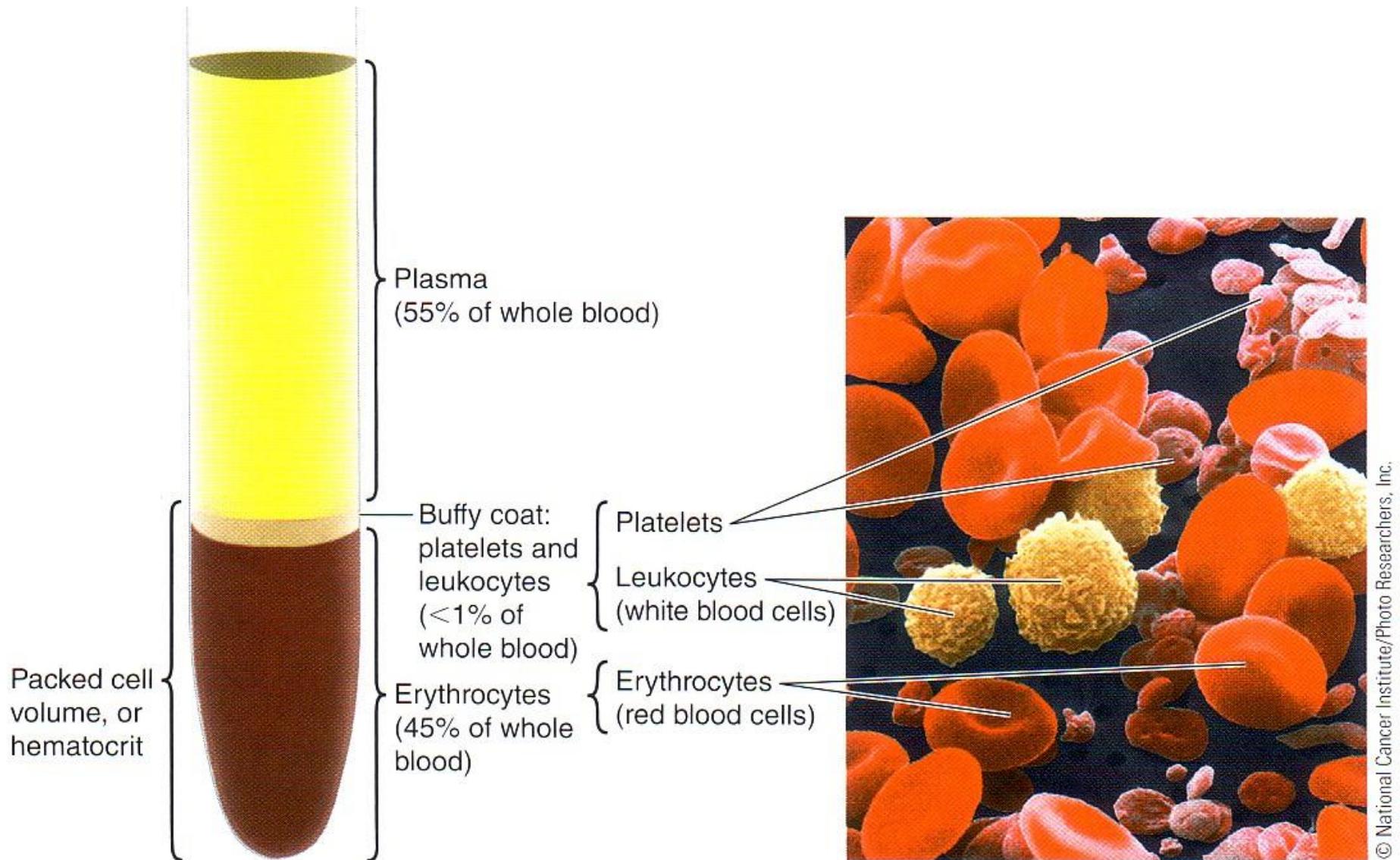
C



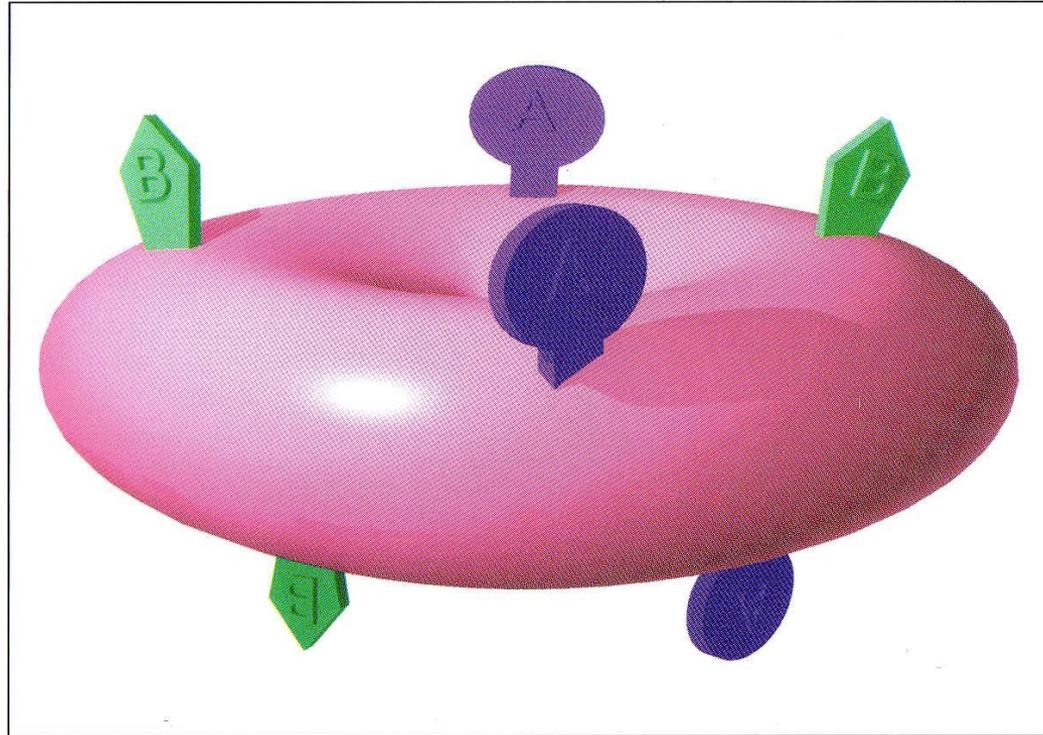
Fish Oil Intakes & Cardiovascular Death Rates



What's in Blood? Plasma & Blood Cells



AB



A & B Antigens
(Agglutinogens)

Erythroblastosis Fetalis?

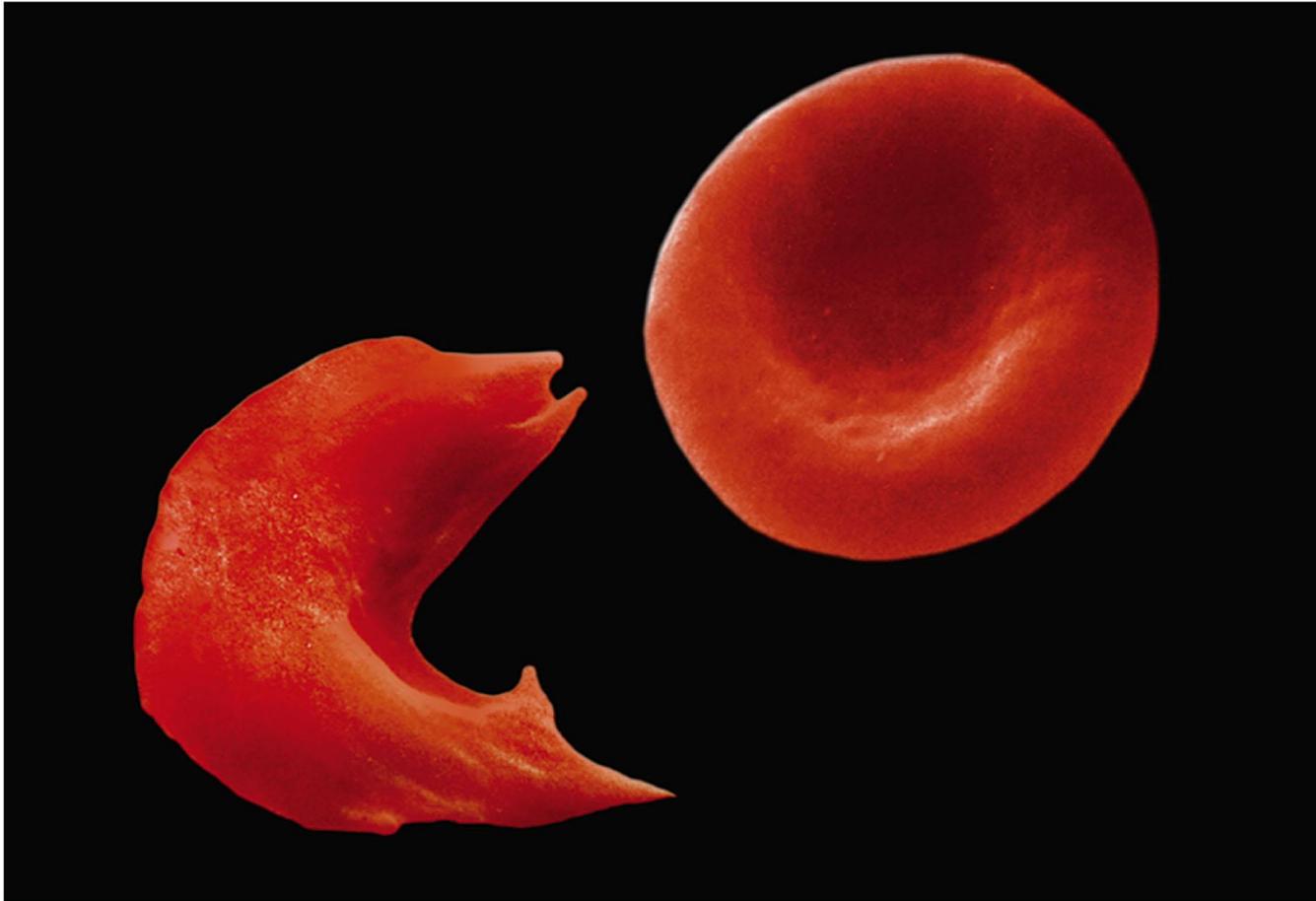
**eg, Rh- mom
Rh+ baby**

<http://www.nlm.nih.gov/MEDLINEPLUS/ency/article/001298.htm#Alternative%20Names>

Sickle-shaped blood cells

Normal red blood cells

© Dr. Stanley Flegler/Visuals Unlimited



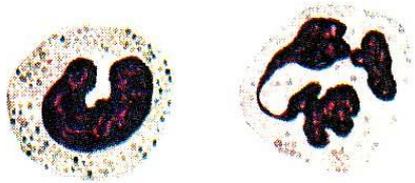
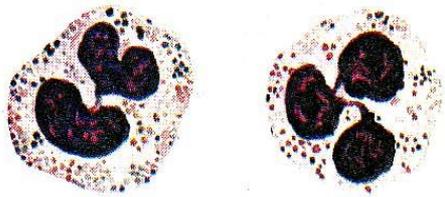
What a difference one amino acid can make!

Amino acid sequence of normal hemoglobin:

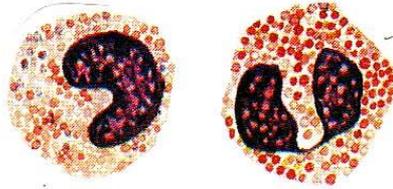
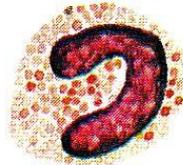
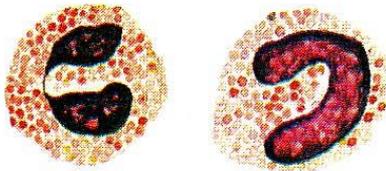


Amino acid sequence of sickle-cell hemoglobin:

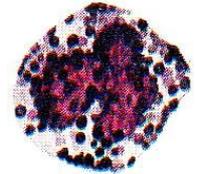
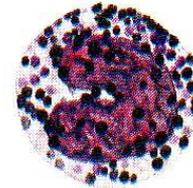
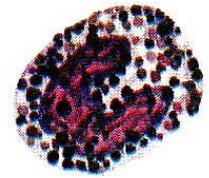
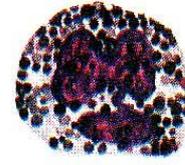




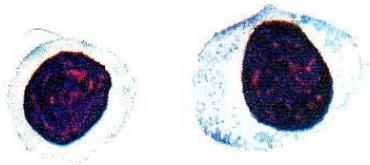
NEUTROPHILS



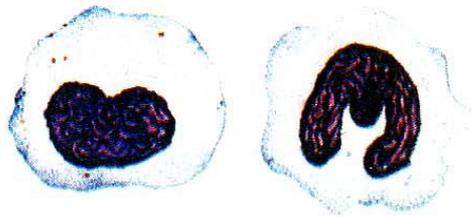
EOSINOPHILS



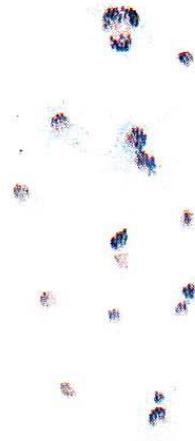
BASOPHILS



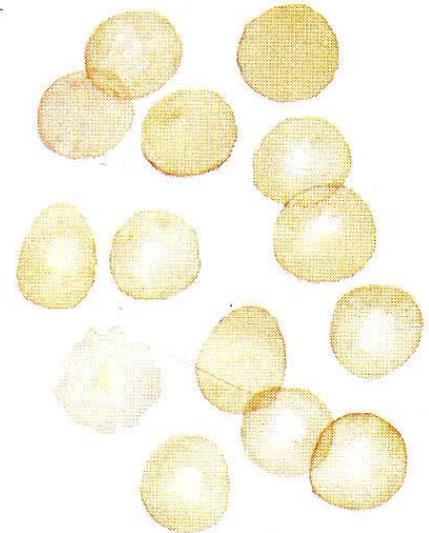
LYMPHOCYTES



MONOCYTES

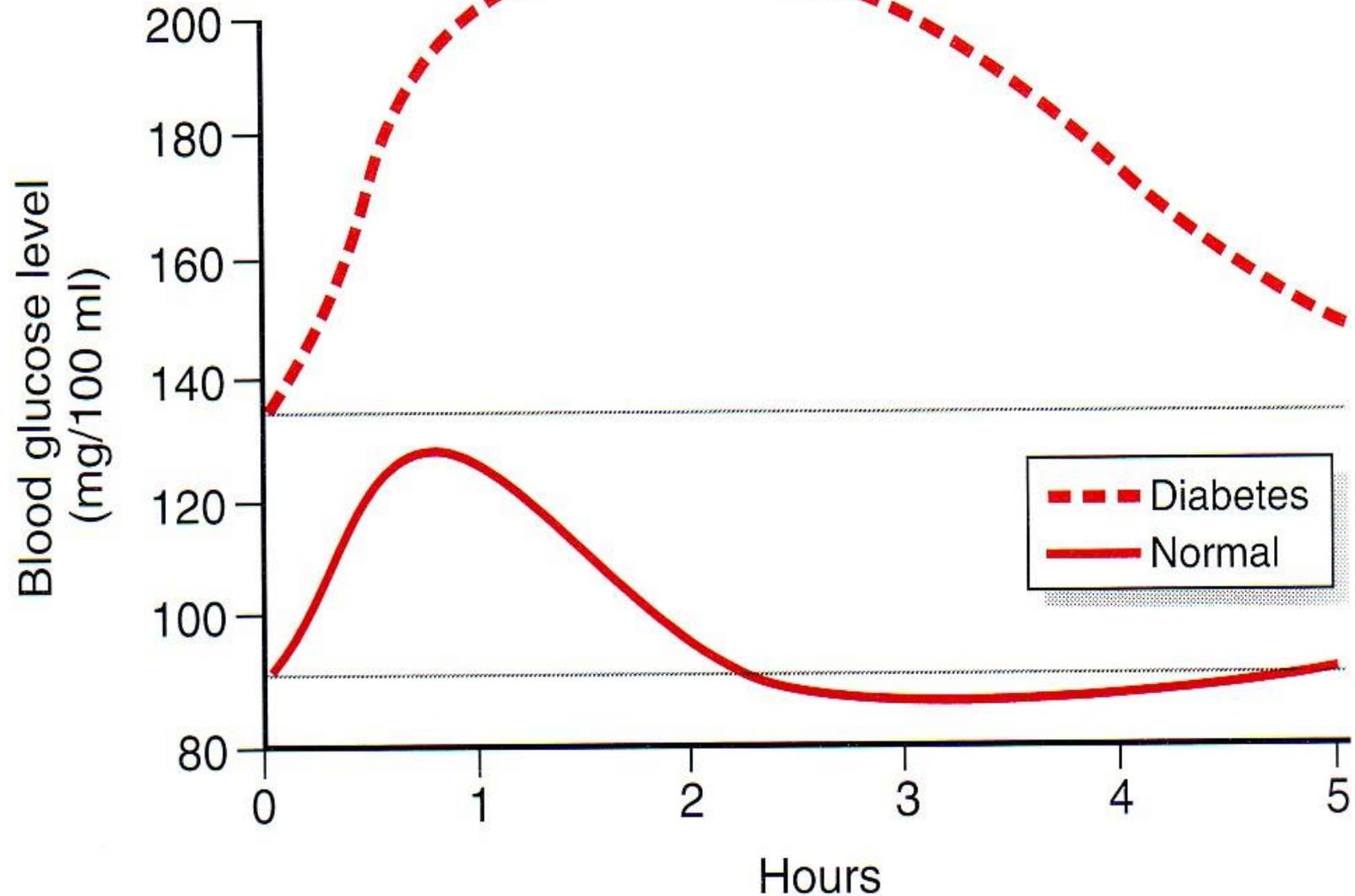


PLATELETS



ERYTHROCYTES

Diabetic & Normal Response to Glucose Load





I. Lab 5 Review: Safety & Techniques Q?

II. Introduction to Endocrinology LS ch 17, DC Module 13, SI Fox+

- A. Endocrine vignette: Cushing's syndrome LS fig17-20 p 521-2
- B. Endocrine system DC p 103 fig 13-1, LS fig 17-1, tab 17-1
- C. What's an endocrine? + classes ~ LS pp 495 – 6
- D. Hypothalamus (Master) – Pituitary (subcontroller)
DC pp 104-6 + LS pp 499-506
- E. Posterior pituitary + hormones DC p 108, LS fig 17-4 p 502
- F. Anterior pituitary + hormones DC pp 105-7, LS pp 502-6
- G. GH: Body builder's dream? Fountain of youth? LS pp 506-11
- H. Peripheral endocrine organs DC pp 109-13, LS pp 513-36
 - 1. Pancreas (insulin, glucagon, diabetes) 2. Thyroid 3. Adrenals

III. Nervous System & Excitable Cell Connections LS ch 5, 4, 7

- A. How is the nervous system organized? fig 5-1 p 108
- B. Neurons? What kind? fig 5-2 p 109
- C. Brain structure & function fig 5-7, 5-8 pp 116 - 7
- D. **Protect your head with a helmet!** Bicycle head injury statistics, *NHTSA & BHSI*

No food, drink or gum in lab today! Thanks sincerely!



...Healthy, tasty & fresh, but not in lab!!

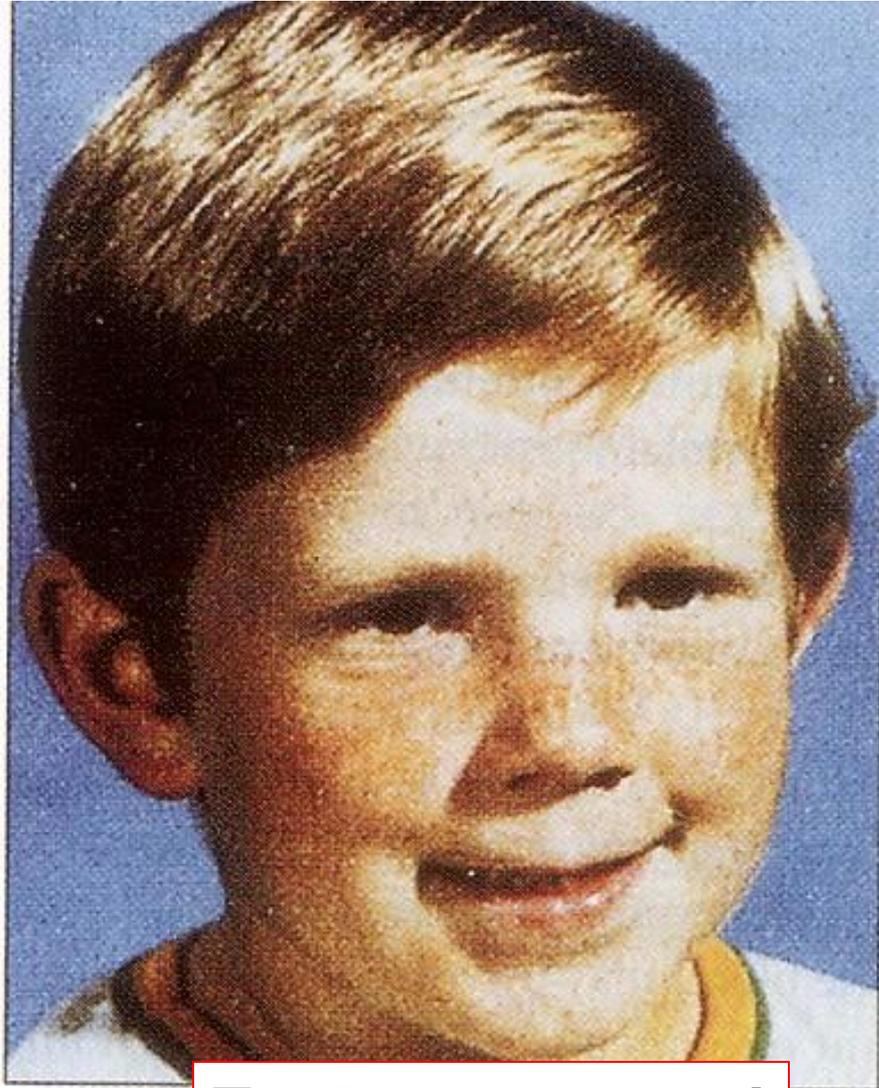


Glucose:
Sugar in Blood

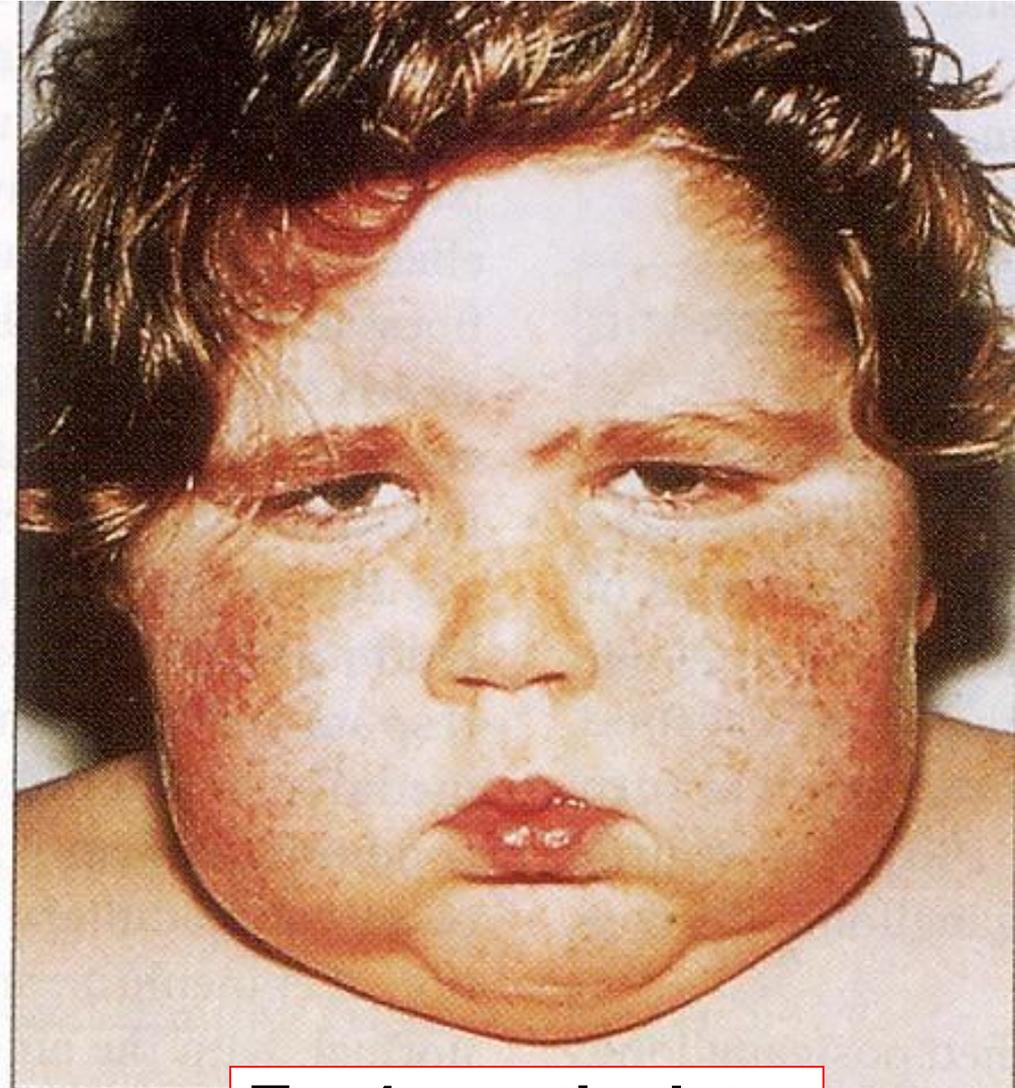


Normal: 70-99
Pre-Diabetes: 100-125
Diabetes: \geq 126 mg/dL

***Cushing's Syndrome = Hypersecretion
of Cortisol: Hypothalamic (CRH),
Pituitary (ACTH), or Adrenal (Cortisol)***



T = 0, near normal

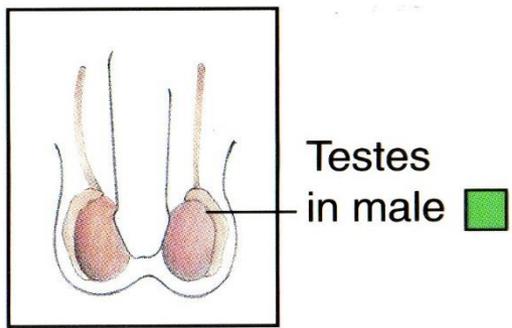
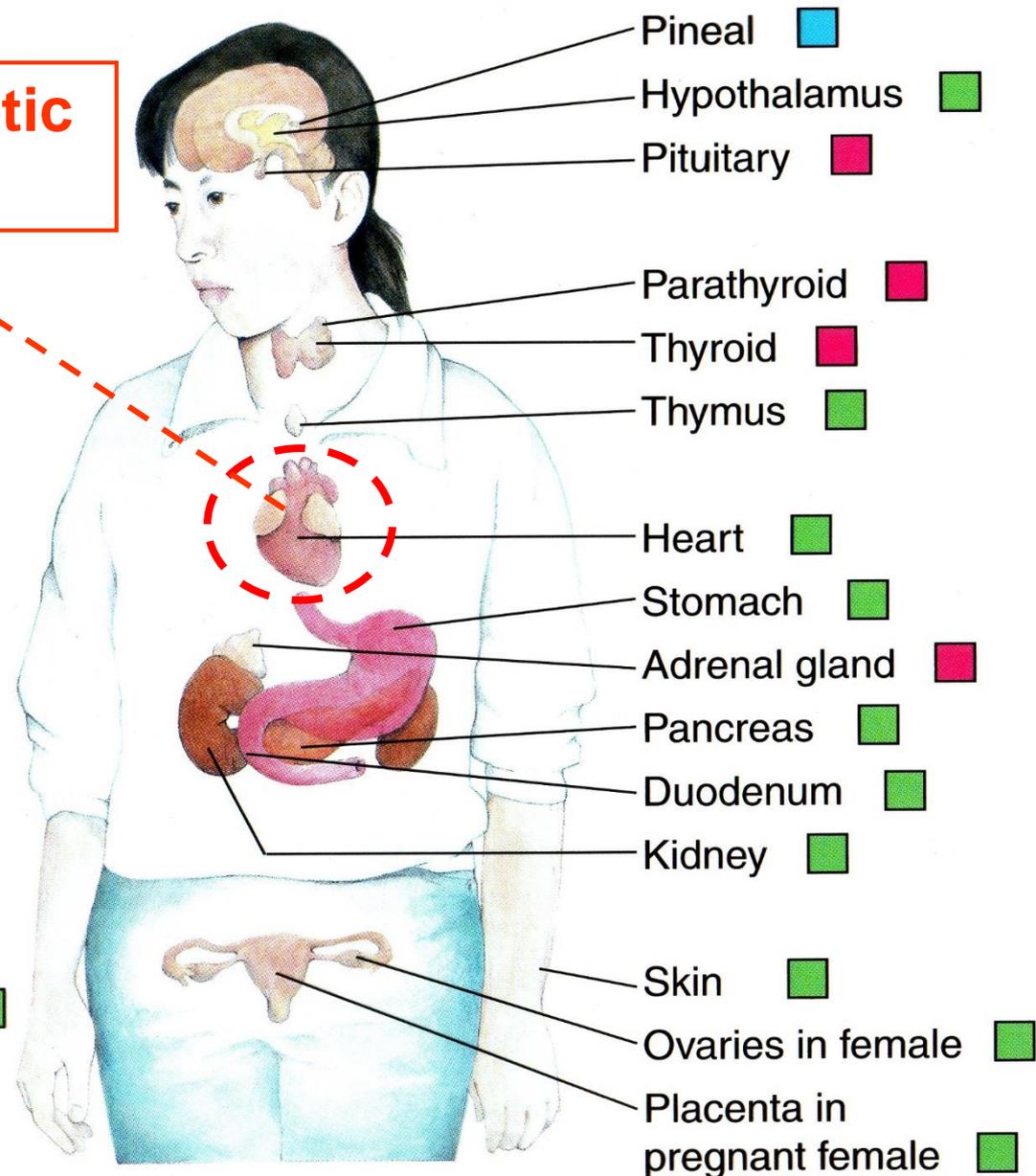


T = 4 months later

Endocrine System

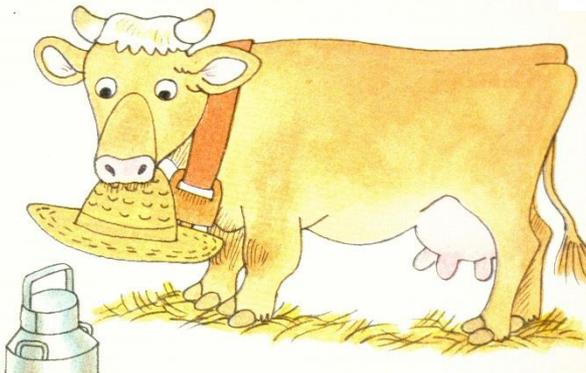
ANP = Atrial Natriuretic Polypeptide

- Solely endocrine function
- Mixed function
- Complete function uncertain

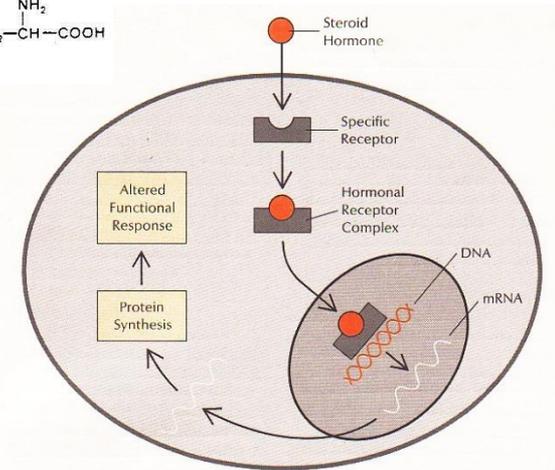
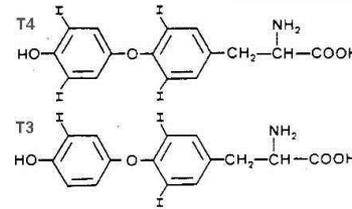
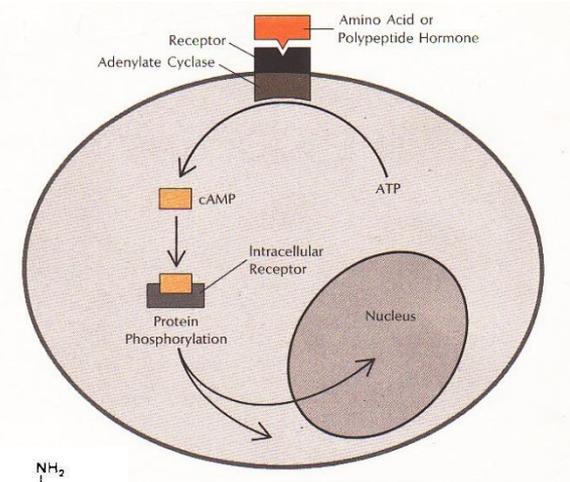


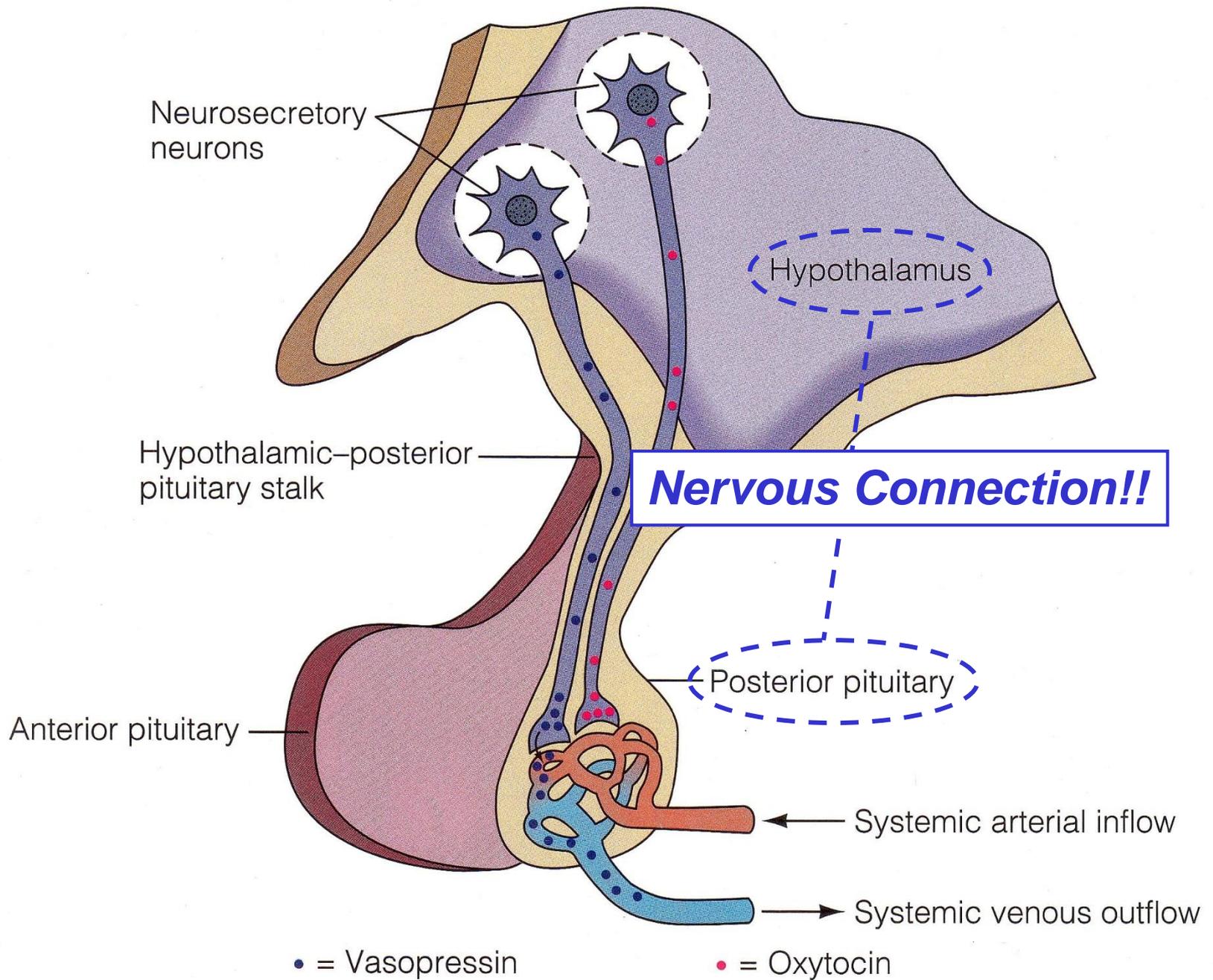
Hormone/Endocrine Classifications

Exogenous

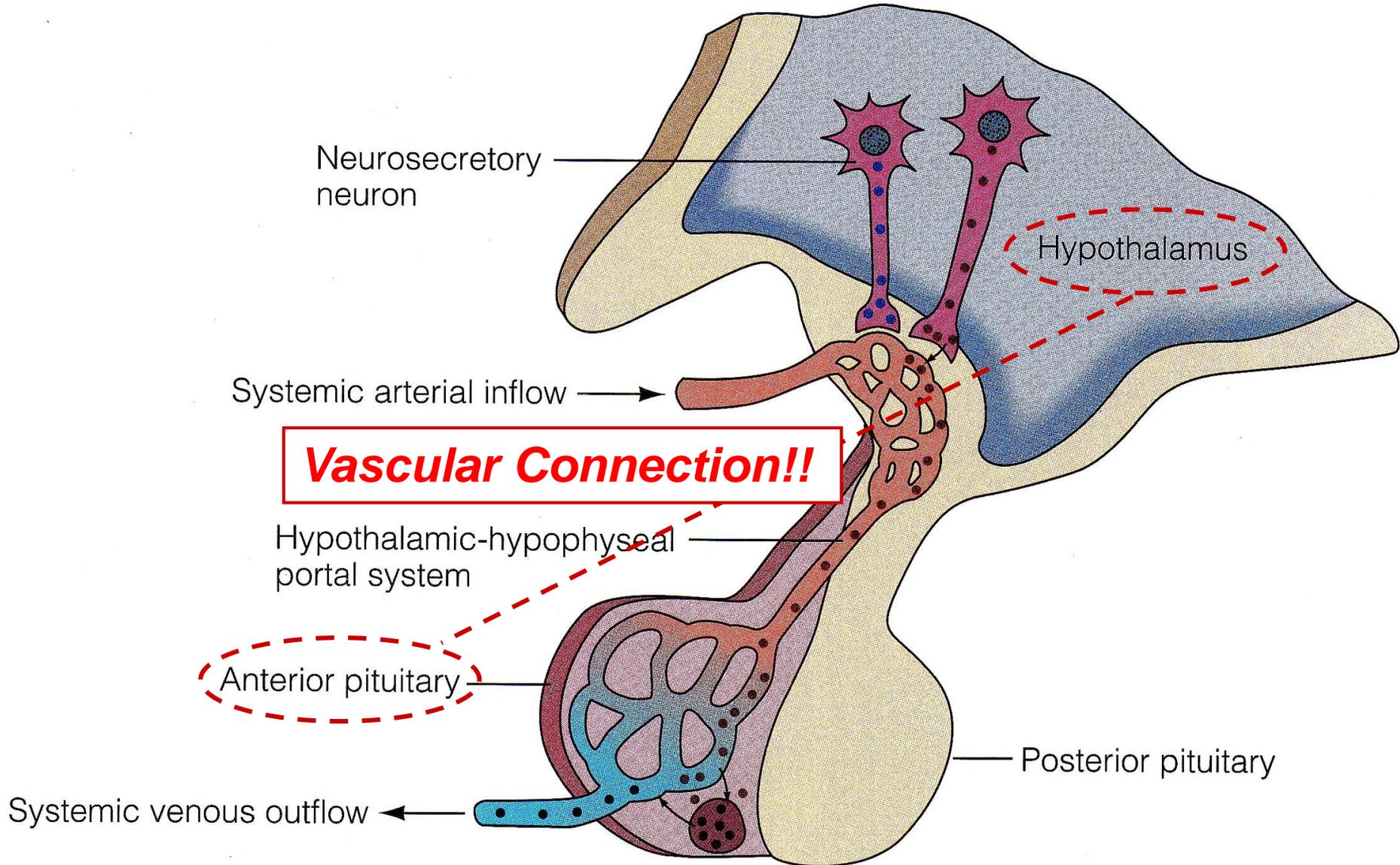


Endogenous



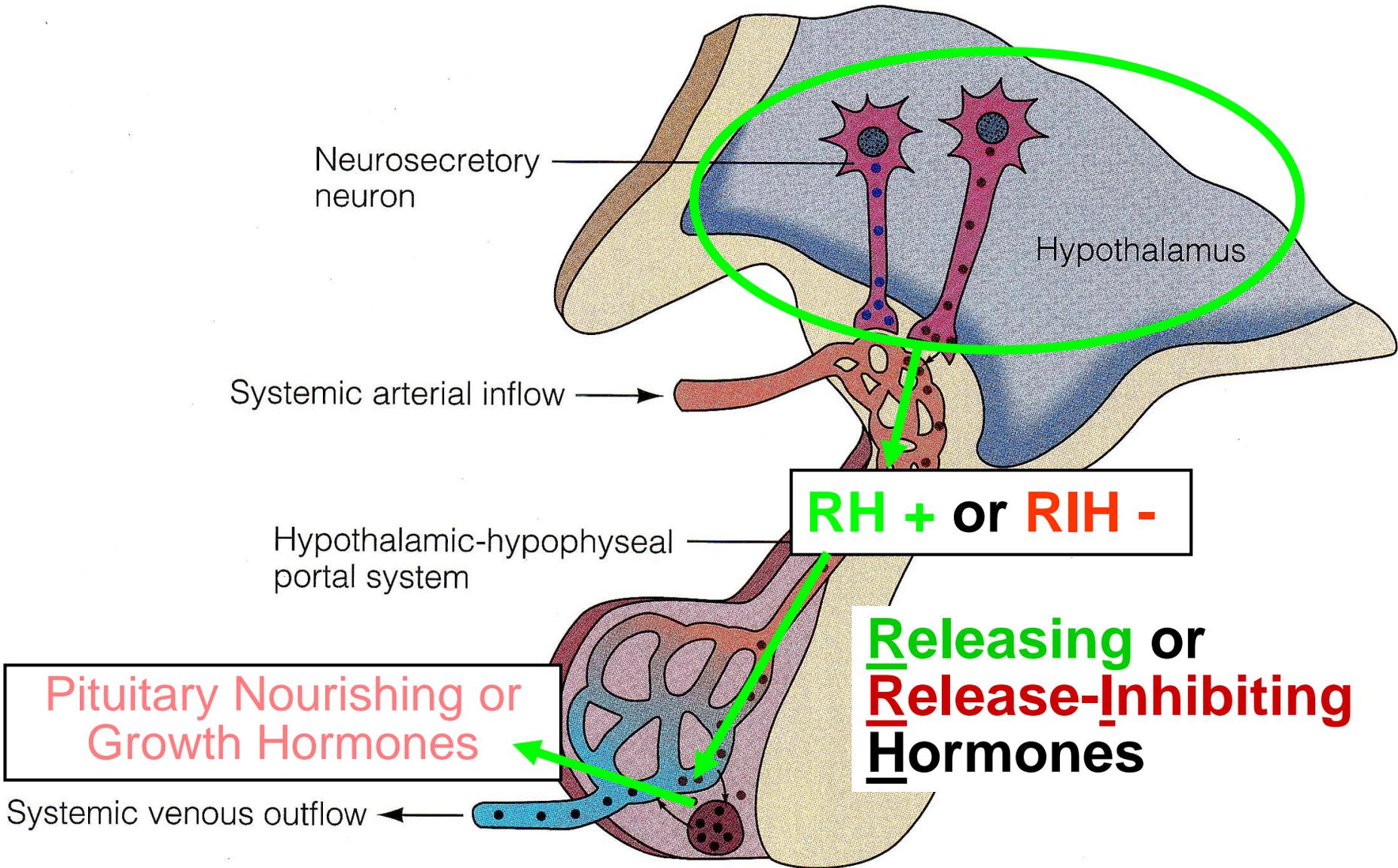


Hypothalamus-Anterior Pituitary Vascular Connection!



• = Hypophysiotropic hormones

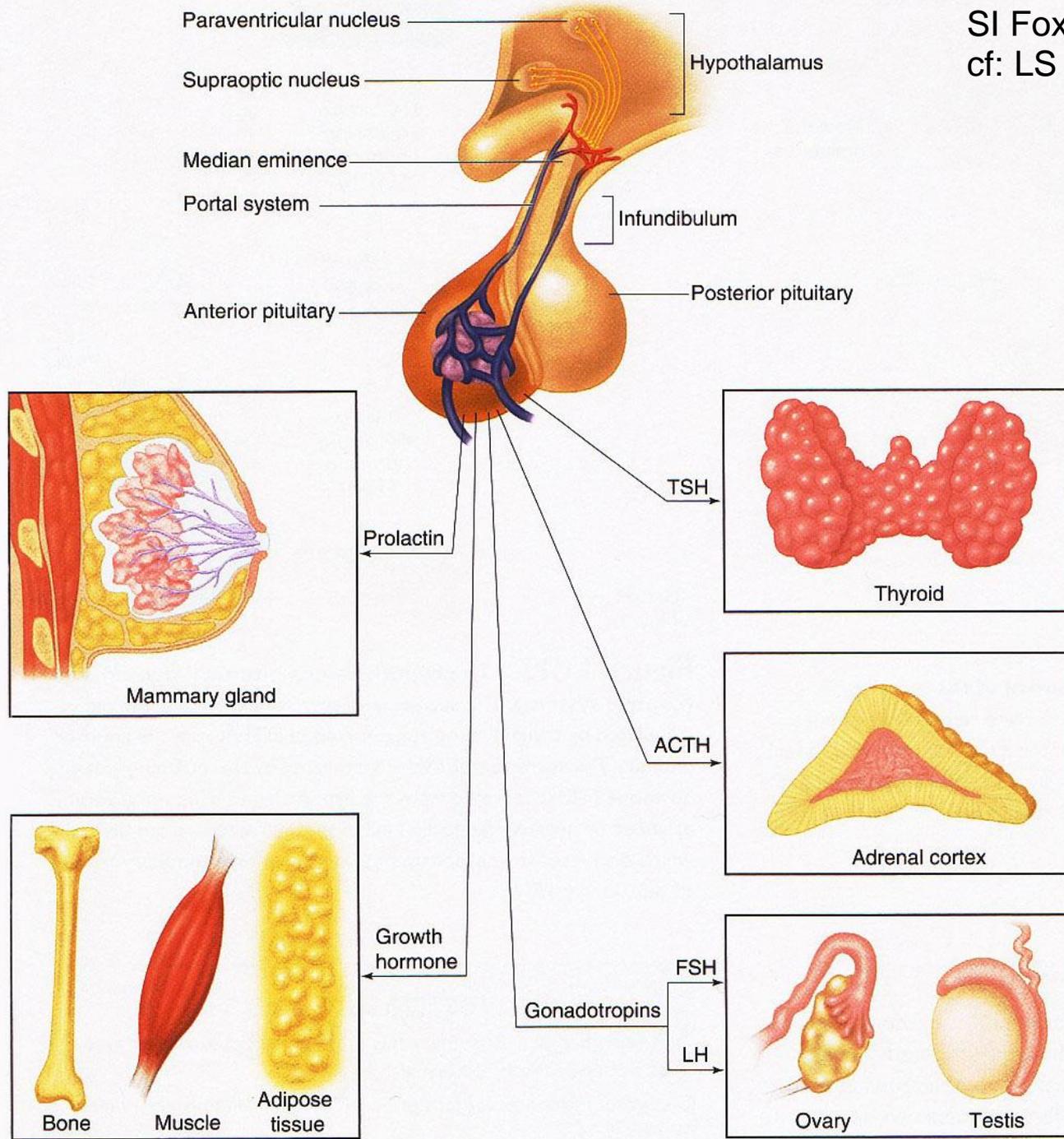
• = Anterior pituitary hormone

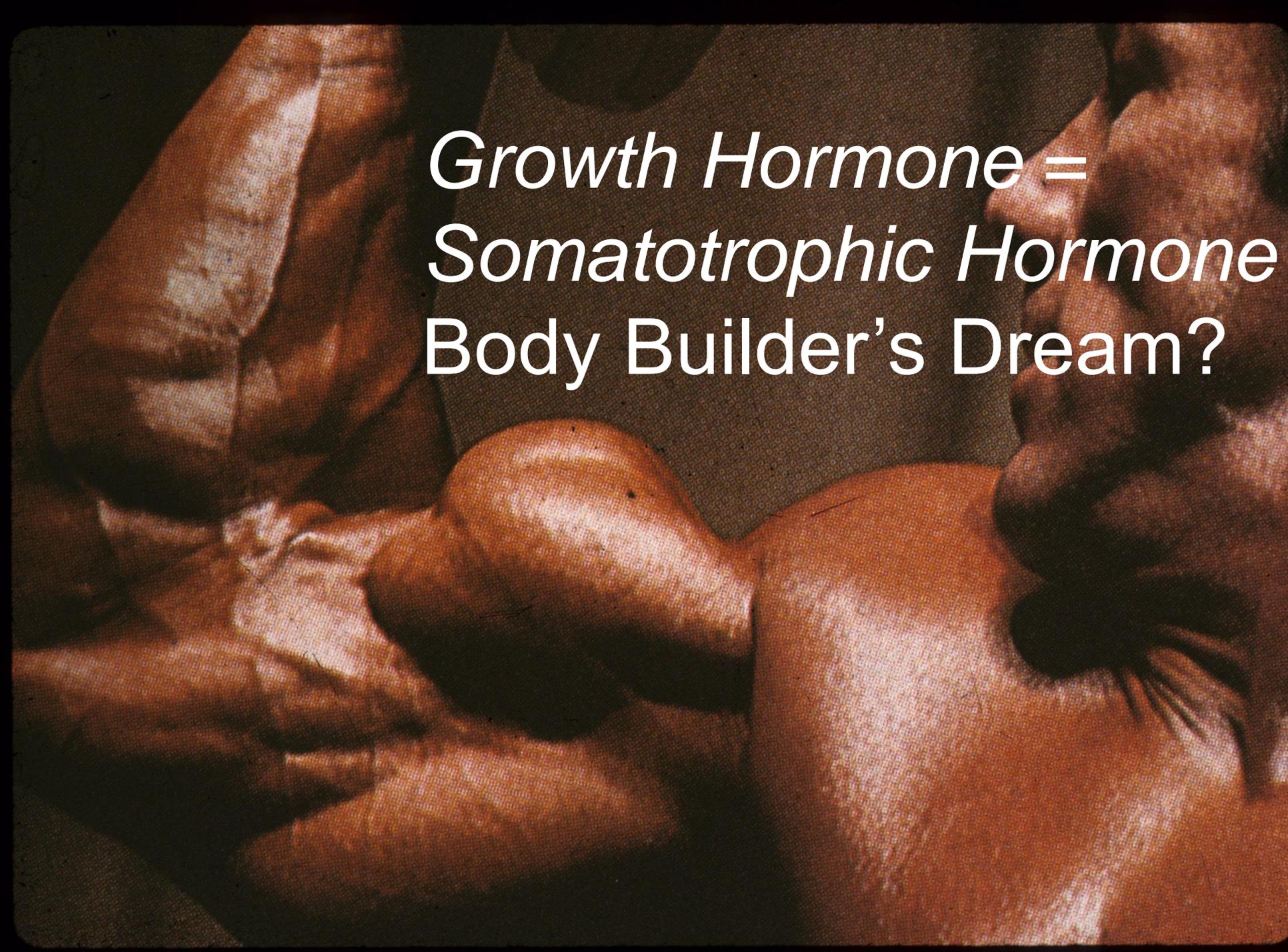


• • = Hypophysiotropic hormones

• = Anterior pituitary hormone

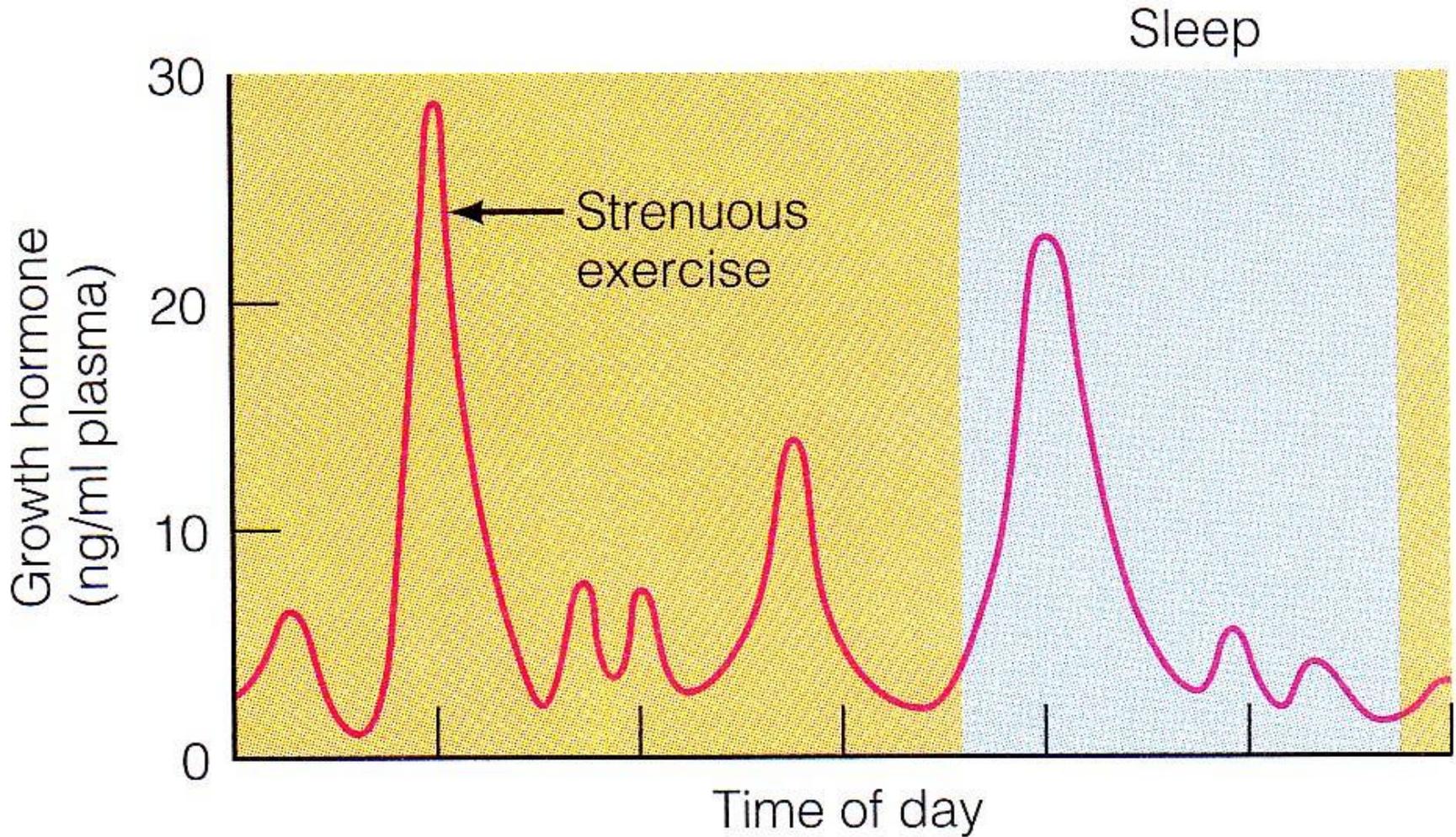
Hypophysis ≡ Pituitary





*Growth Hormone =
Somatotrophic Hormone
Body Builder's Dream?*

Increase GH naturally with exercise & sleep!!



ng/ml = nanograms per milliliter

Times of Plenty!!

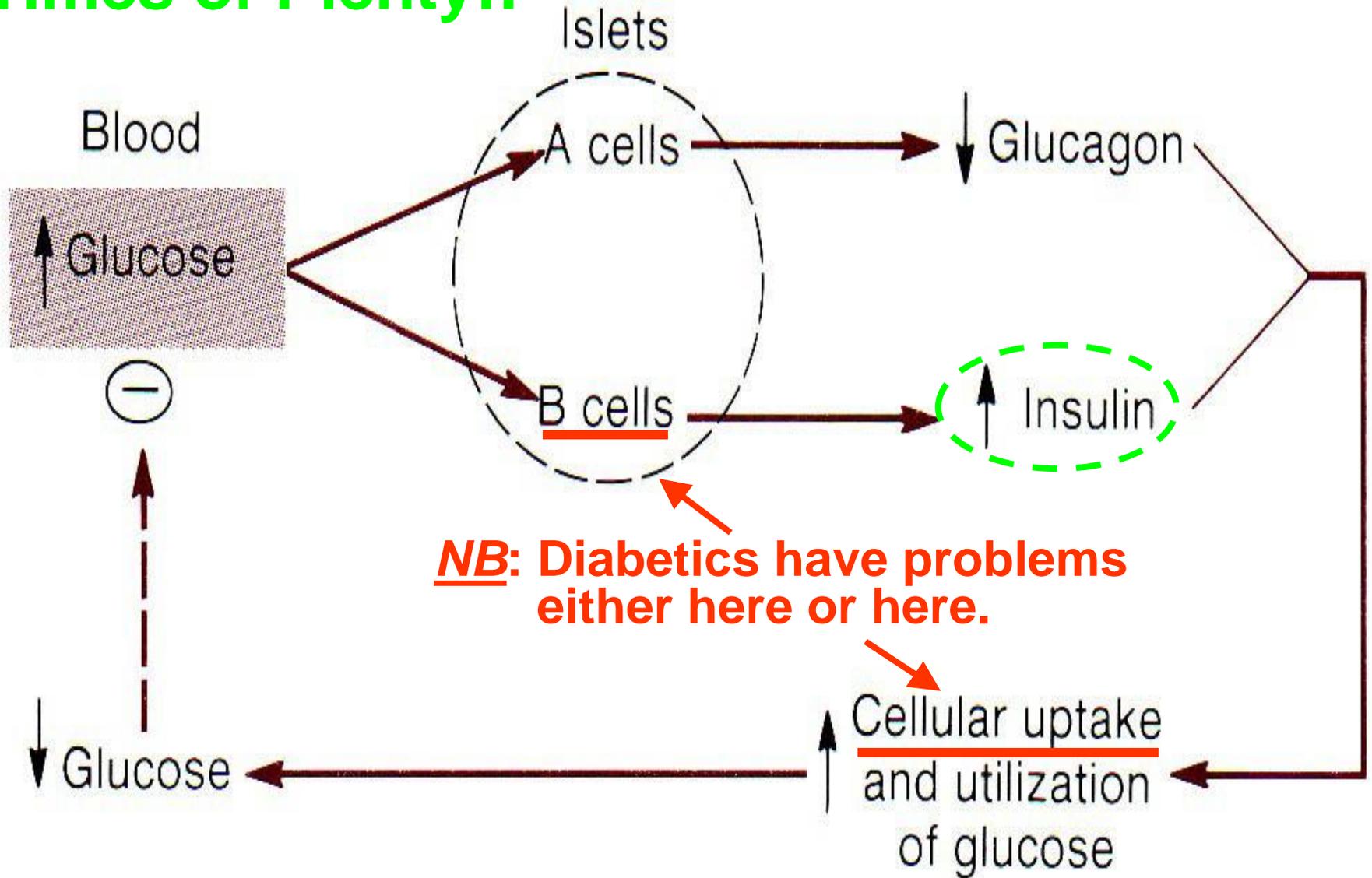


TABLE
4-7

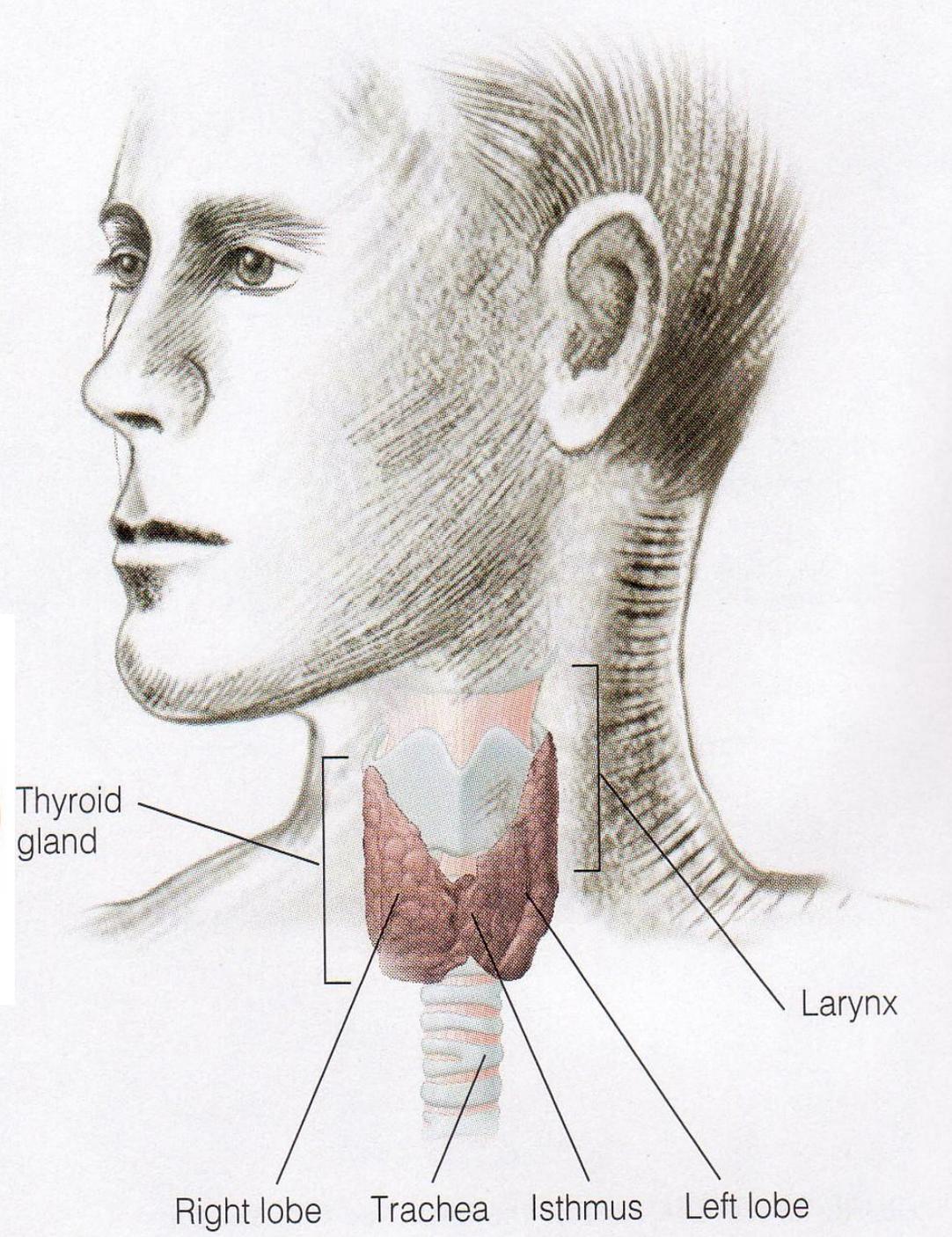
Warning Signs of Diabetes

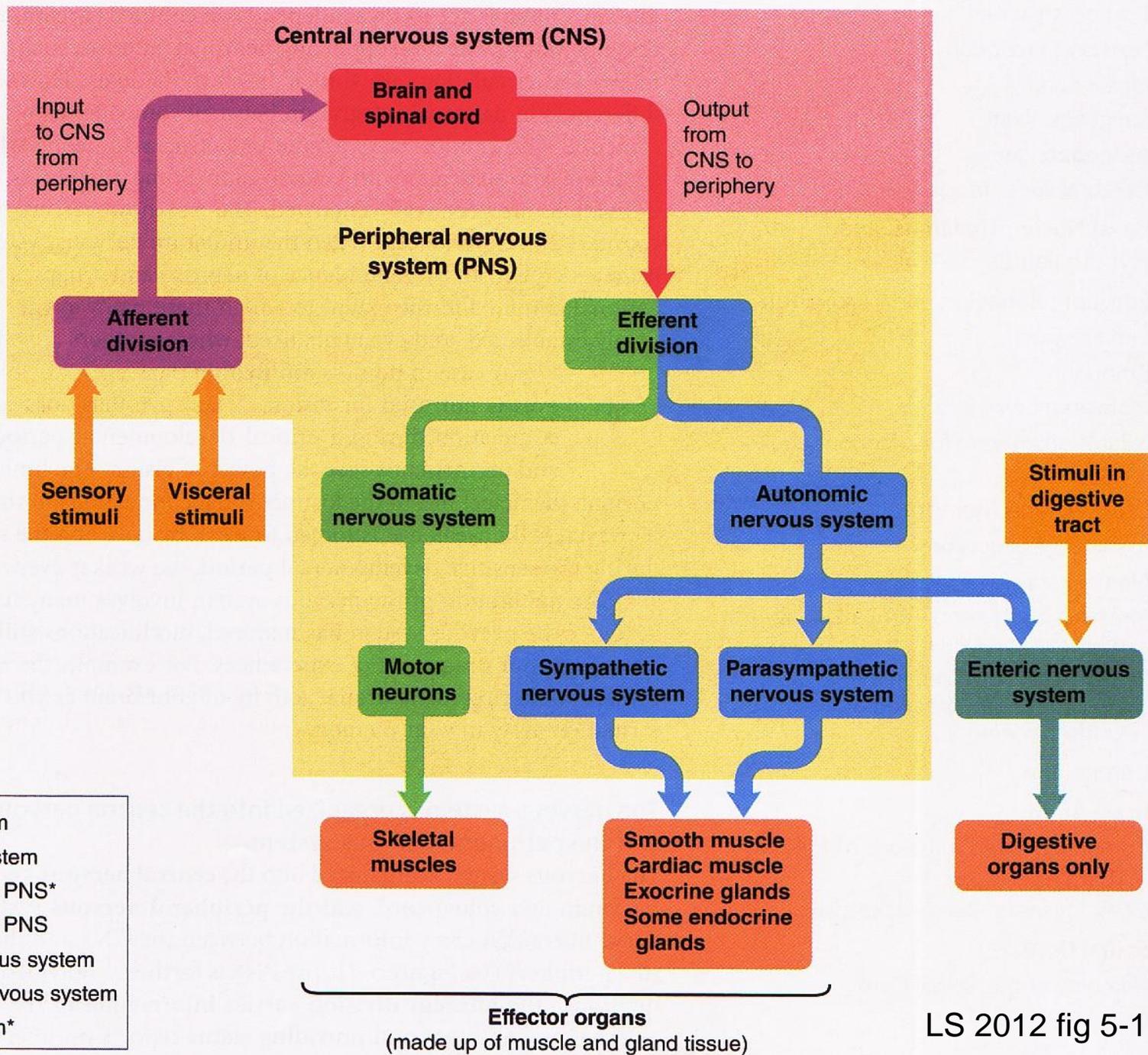
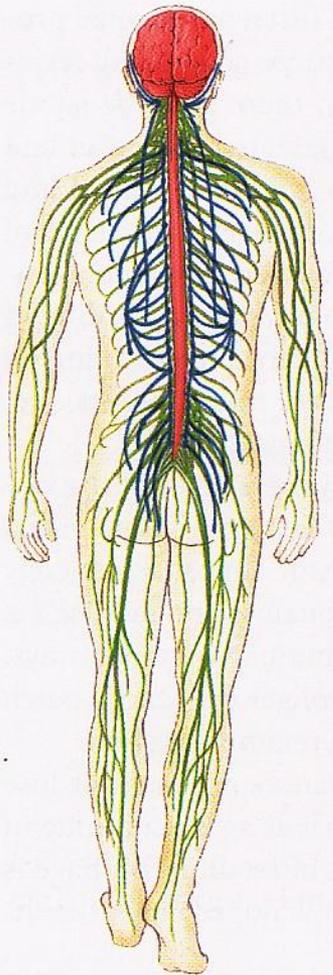
These signs appear reliably in type 1 diabetes and, often, in the later stages of type 2 diabetes.

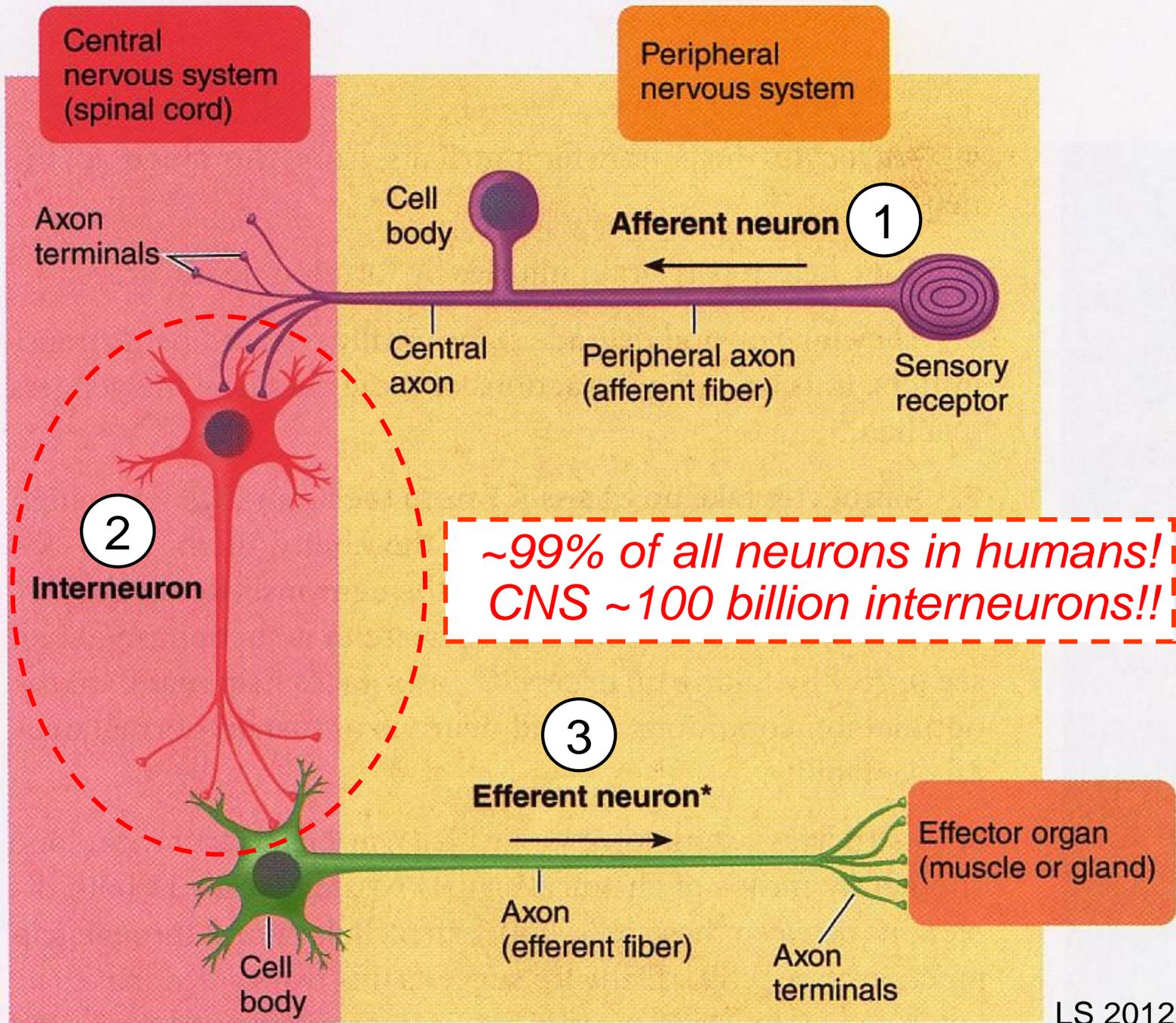
- Excessive urination and thirst
- Glucose in the urine
- Weight loss with nausea, easy tiring, weakness, or irritability
- Cravings for food, especially for sweets
- Frequent infections of the skin, gums, vagina, or urinary tract
- Vision disturbances; blurred vision
- Pain in the legs, feet, or fingers
- Slow healing of cuts and bruises
- Itching
- Drowsiness
- Abnormally high glucose in the blood

Like others, diabetics benefit from whole grains, vegetables, fruits, legumes & non-/low-fat milk products!









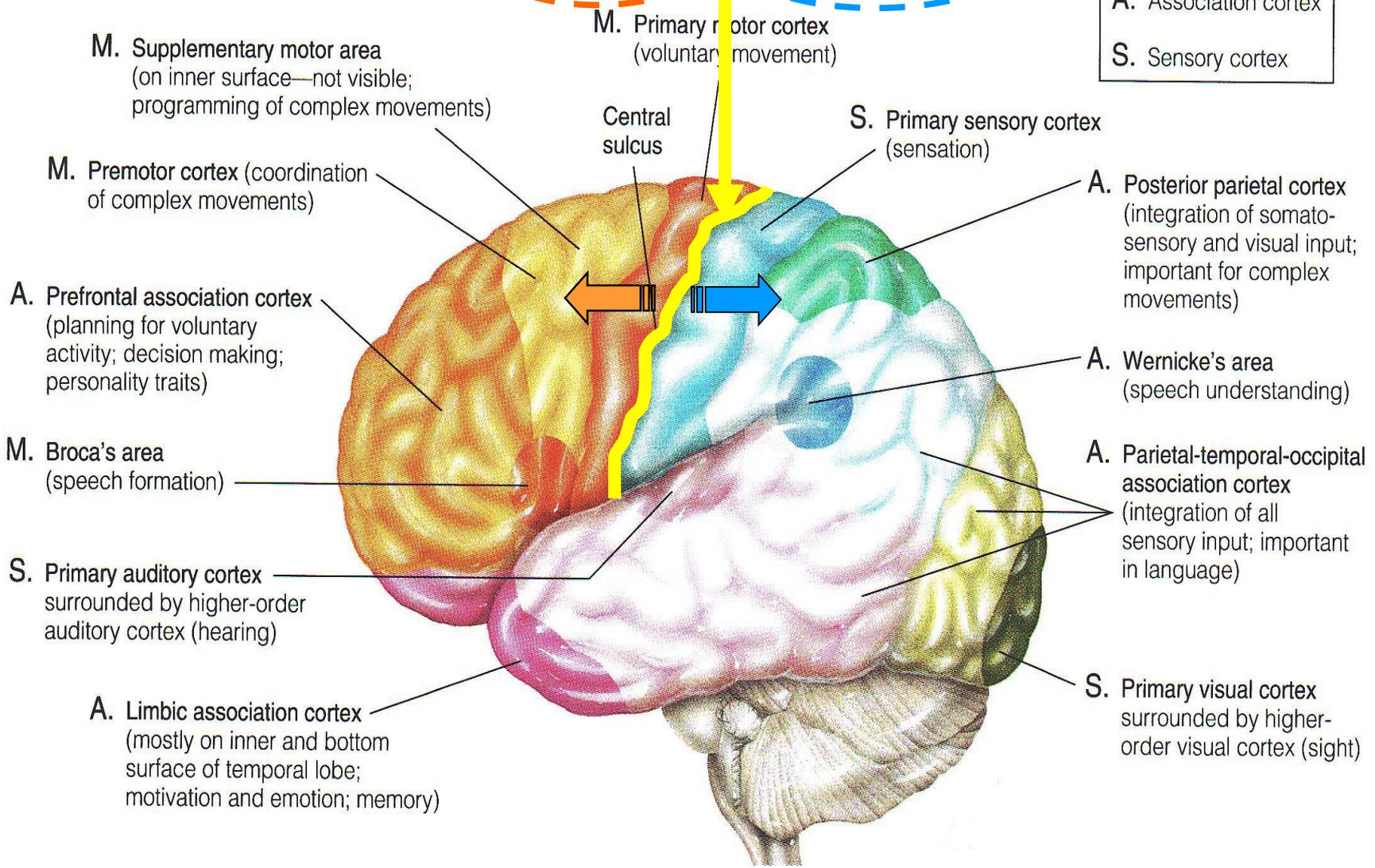


- I. Announcements Optional notebook check + Lab 6 tomorrow. Pulmonary Function Testing. Final exam > your Q on Wed. Q?
- II. Brain + Autonomic Nervous System Overview DC pp 71-77, LS pp 178 – 85, tab 7-1 p 183 + stories to remember **fight-or-flight!**
- III. Neuromuscular Connections LS ch 7 pp 186-92, DC pp 69-71
How does the signal cross the nerve-muscle gap? LS fig 7-5
 - A. Normal function? Ca²⁺ for bones!...but what else? LS p 190
 - B. What do black widow spider venom, botulism, curare & nerve gas have in common? Botox? LS p 189-91
- IV. Muscle Structure, Function & Adaptation LS ch 8, DC Module 12
 - A. Muscle types: cardiac, smooth, skeletal LS fig 8-1 p 194-6
 - B. How is skeletal muscle organized? LS fig 8-2, DC fig 12-2
 - C. What do thick filaments look like? LS fig 8-4, DC fig 12-4
 - D. How about thin filaments? LS fig 8-5
 - E. Banding pattern? LS fig 8-3, fig 8-7
 - F. How do muscles contract? LS fig 8-6, 8-10
 - G. What's a cross-bridge cycle? LS fig 8-11 +...
 - H. Summary of skeletal muscle contraction
 - I. Exercise adaptation variables: **mode, intensity, duration, frequency, distribution, individual & environmental char...?**
 - J. Endurance vs. strength training continuum? fiber types...





Key	
M.	Motor cortex
A.	Association cortex
S.	Sensory cortex





Helmets Cheap, Brains Expensive!! Use Your Head, Get a Helmet!!



<http://www-nrd.nhtsa.dot.gov/Pubs/812018.pdf>

<http://www.bhsi.org/stats.htm>

~ 500,000 bicyclists/yr visit emergency rooms

As of 2014, the population estimate of

State of Wyoming 584,153

Albany OR 51,980

Corvallis OR 54,953

Springfield OR 60,263



~ 26,000 traumatic brain injuries

743 of ~900 cyclist deaths, 2013 \equiv ~ 2% of all traffic fatalities

13% of deaths children \leq 14 yr, 87% σ

11% involved wrong-way riding!

Bicycle crashes & injuries are under reported,
since majority not serious enough for ER visits.

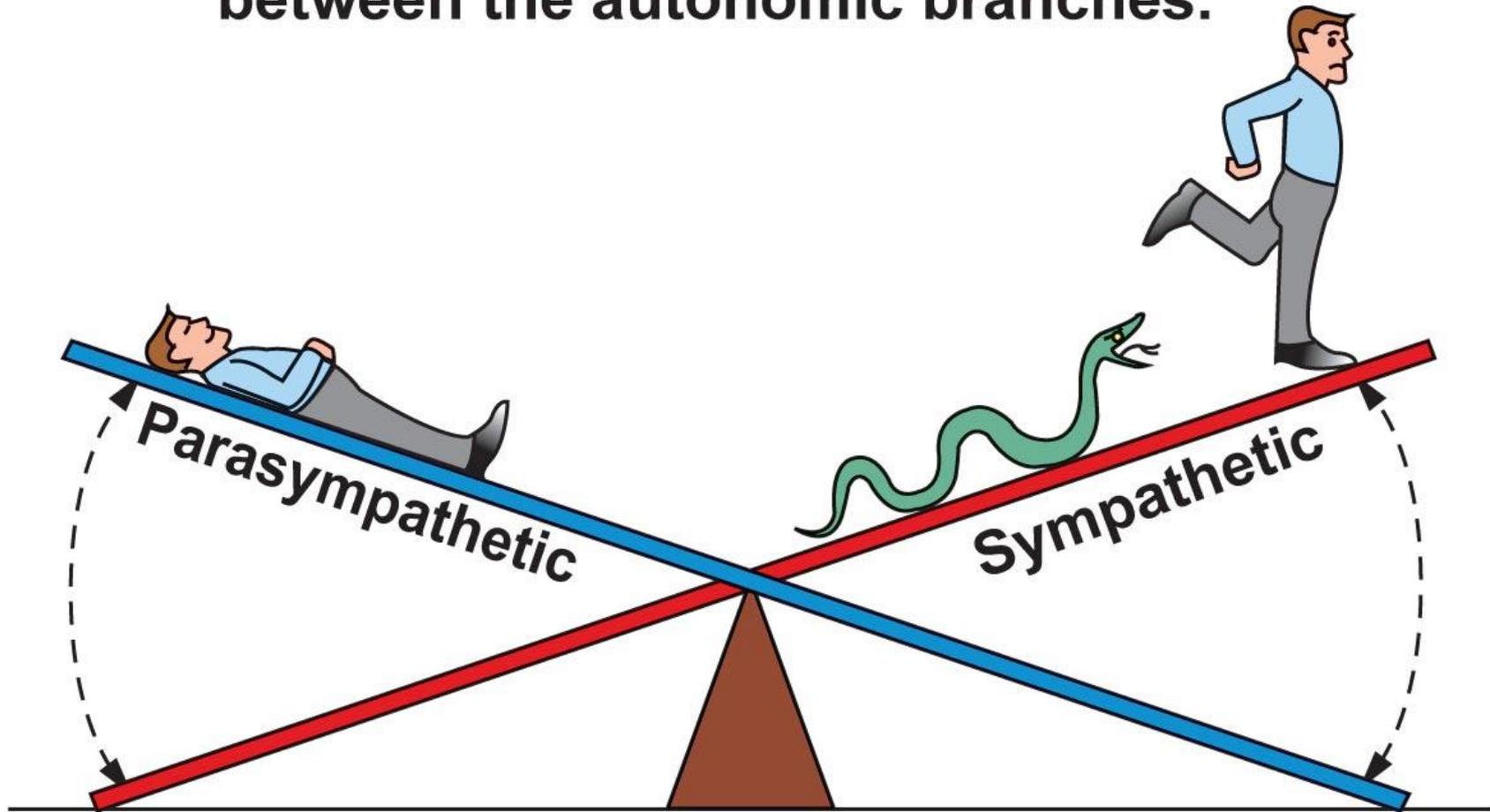
Helmets may reduce head & brain injury risk by 85%!

~\$2.3 billion/yr = indirect injury costs from not using helmets!

The "typical" bicyclist killed on our roads is a sober male over 16 riding without a helmet. He's hit by a car on a major road between intersections in an urban area on a summer evening. Please wear a helmet – it can make the difference between life and death.



Homeostasis is a dynamic balance between the autonomic branches.



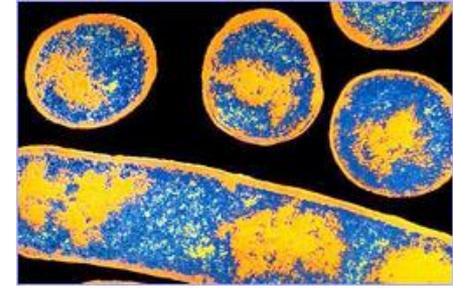
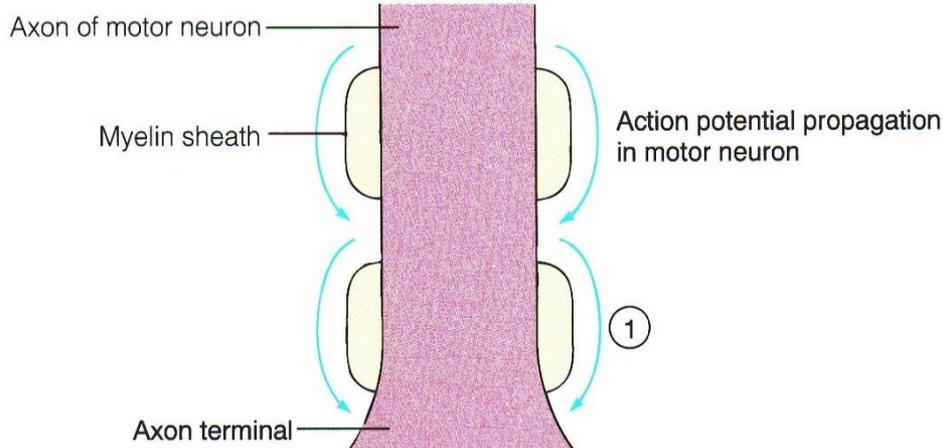
**Rest-and-digest:
Parasympathetic
activity dominates.**

**Fight-or-flight:
Sympathetic activity
dominates.**

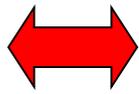
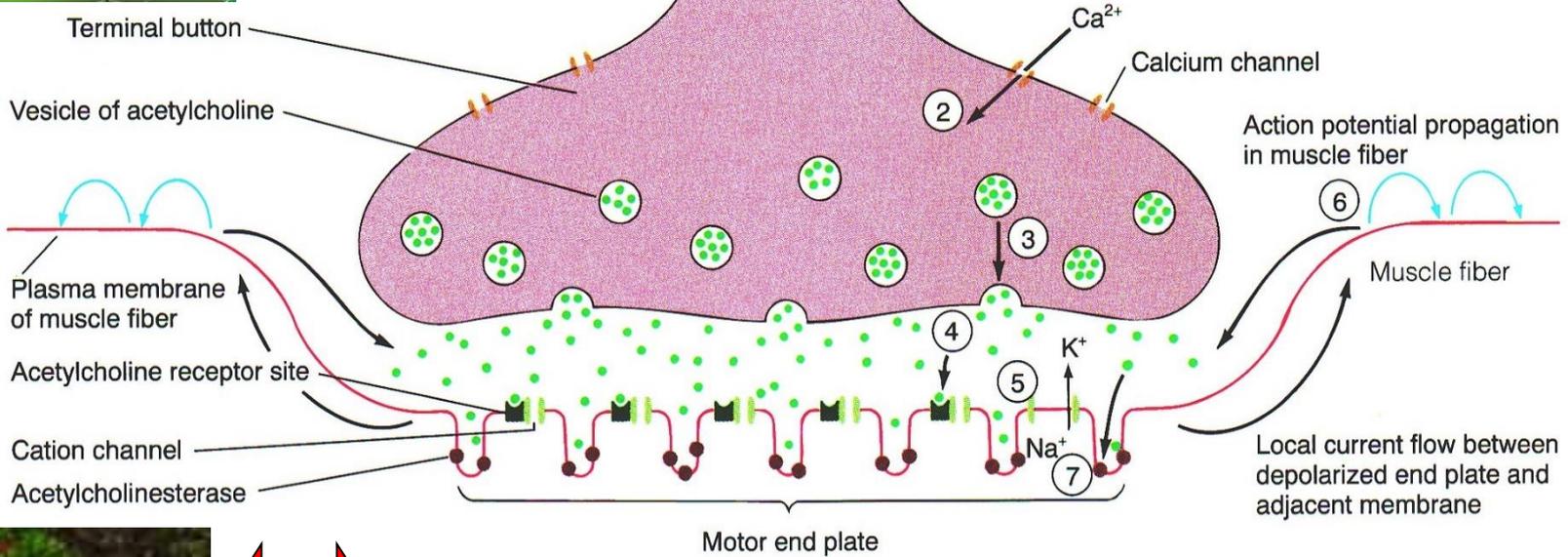
▲ Table 7-1 Effects of Autonomic Nervous System on Various Organs

Organ	Effect of Sympathetic Stimulation	Effect of Parasympathetic Stimulation
Heart	Increases heart rate and increases force of contraction of the whole heart	Decreases heart rate and decreases force of contraction of the atria only
Blood Vessels	Constricts	Dilates vessels supplying the penis and the clitoris only
Lungs	Dilates the bronchioles (airways)	Constricts the bronchioles
Digestive Tract	Decreases motility (movement) Contracts sphincters (to prevent forward movement of tract contents) Inhibits digestive secretions	Increases motility Relaxes sphincters (to permit forward movement of tract contents) Stimulates digestive secretions
Urinary Bladder	Relaxes	Contracts (emptying)
Eye	Dilates the pupil Adjusts the eye for far vision	Constricts the pupil Adjusts the eye for near vision
Liver (glycogen stores)	Glycogenolysis (glucose is released)	None
Adipose Cells (fat stores)	Lipolysis (fatty acids are released)	None
Exocrine Glands		
<i>Exocrine pancreas</i>	Inhibits pancreatic exocrine secretion	Stimulates pancreatic exocrine secretion (important for digestion)
<i>Sweat glands</i>	Stimulates secretion by sweat glands important in cooling the body	Stimulates secretion by specialized sweat glands in the armpits and genital area
<i>Salivary glands</i>	Stimulates a small volume of thick saliva rich in mucus	Stimulates a large volume of watery saliva rich in enzymes
Endocrine Glands		
<i>Adrenal medulla</i>	Stimulates epinephrine and norepinephrine secretion	None
<i>Endocrine pancreas</i>	Inhibits insulin secretion	Stimulates insulin secretion
Genitals	Controls ejaculation (males) and orgasm contractions (both sexes)	Controls erection (penis in males and clitoris in females)
Brain Activity	Increases alertness	None

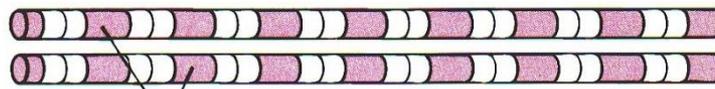
↑ 3



~~3~~



4

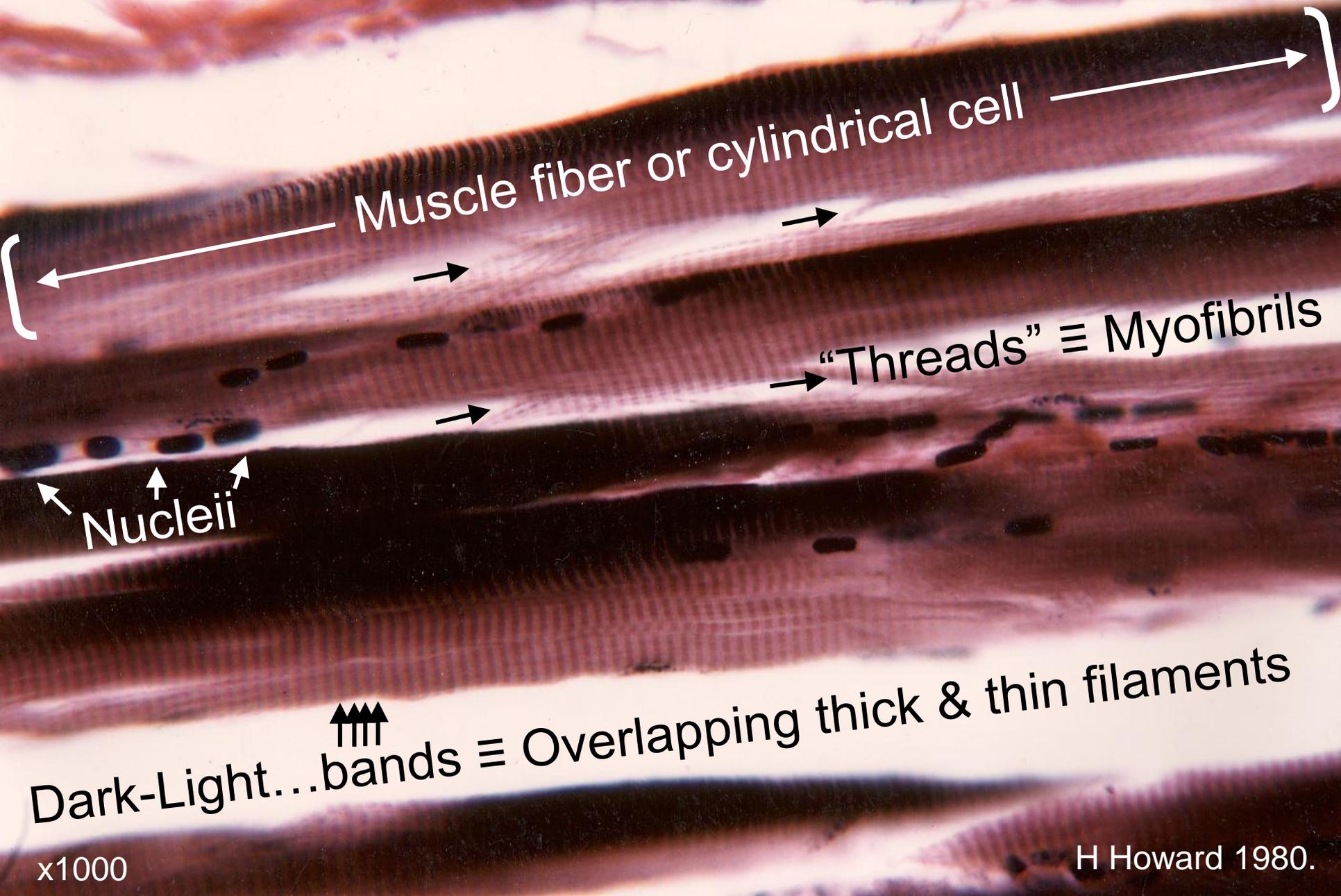


Contractile elements within muscle fiber

~~7~~



Skeletal Muscle Histology: Microscopic Anatomy



Muscle fiber or cylindrical cell

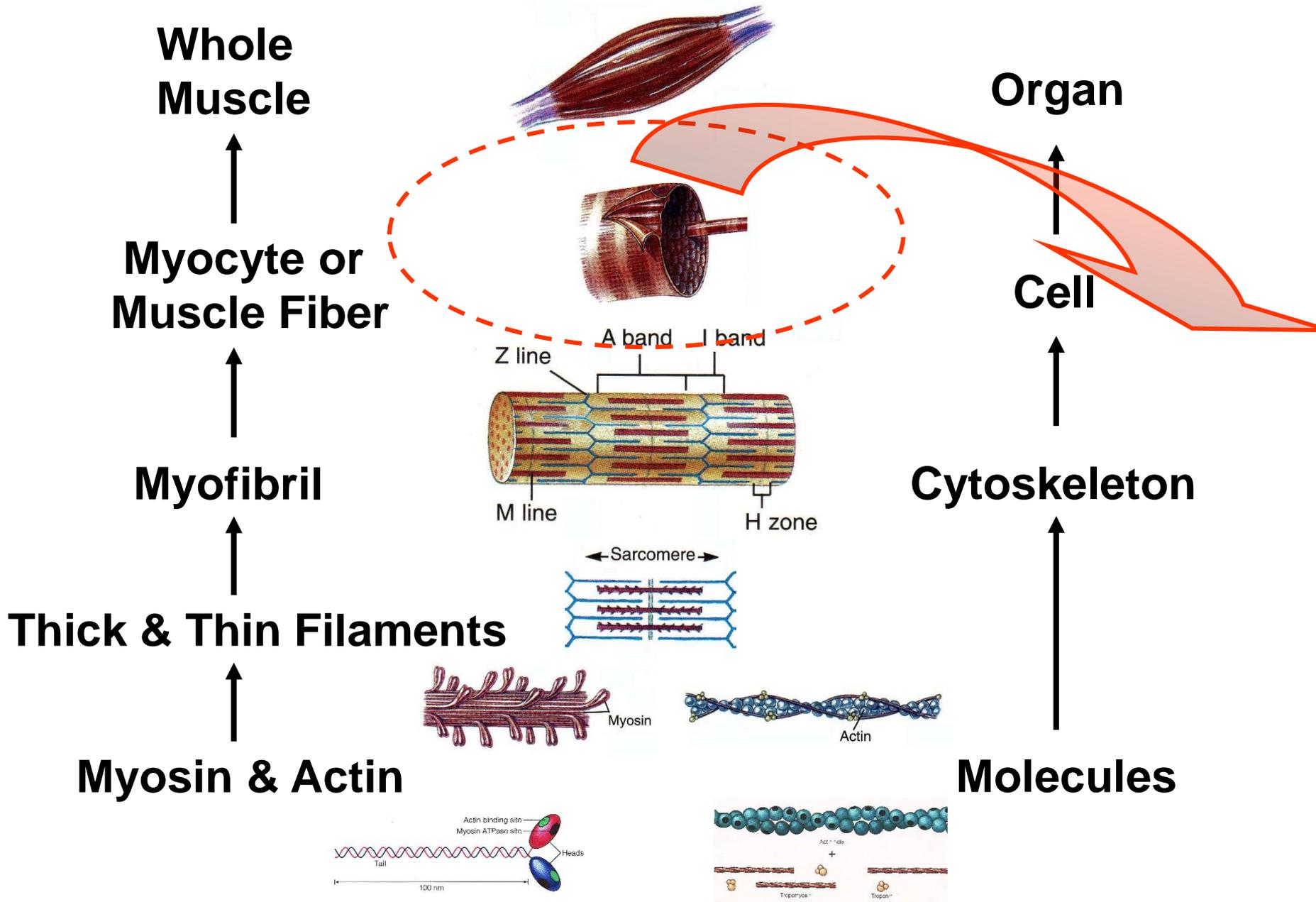
Nucleii

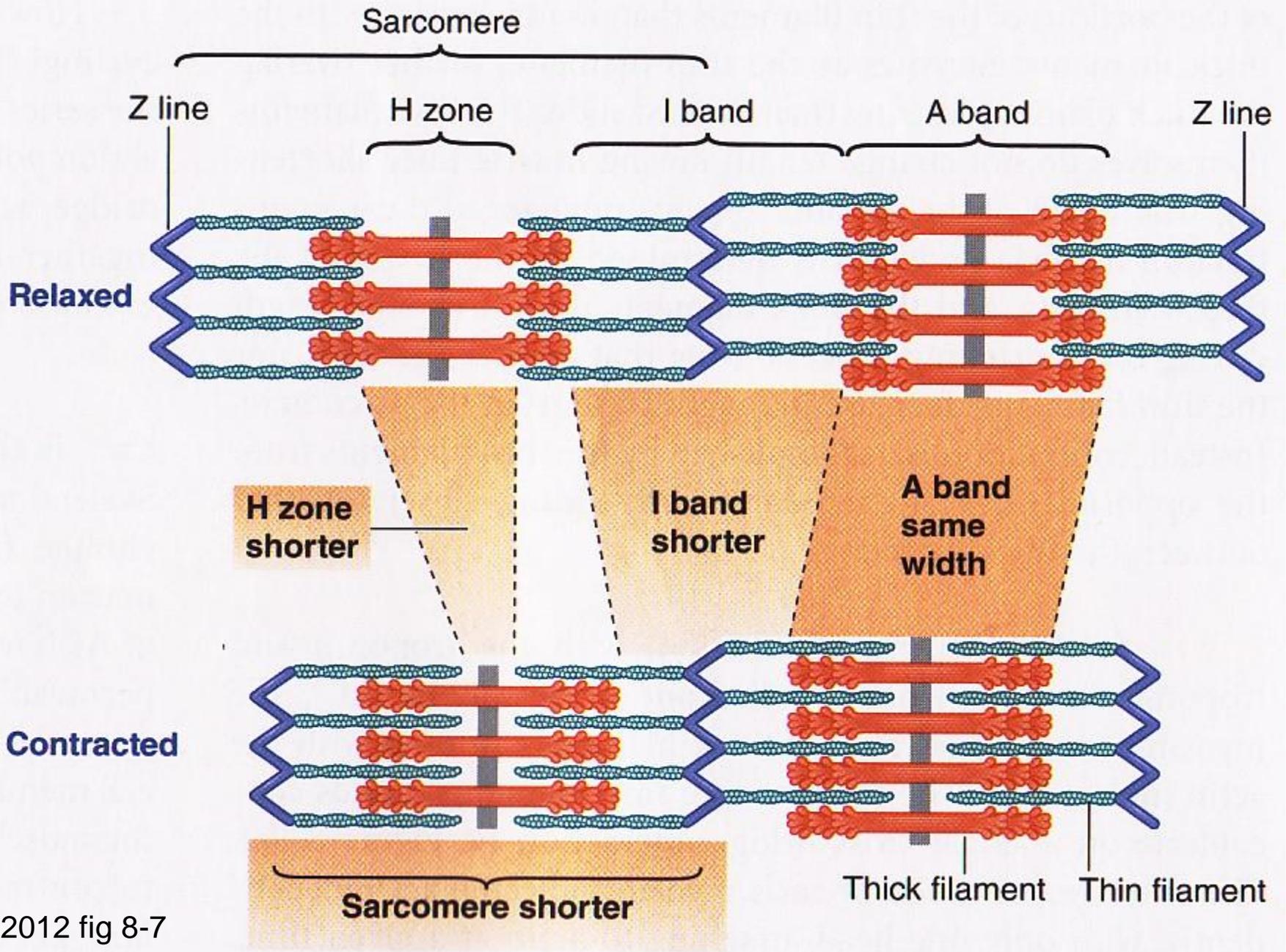
"Threads" ≡ Myofibrils

Dark-Light...bands ≡ Overlapping thick & thin filaments

x1000

H Howard 1980.



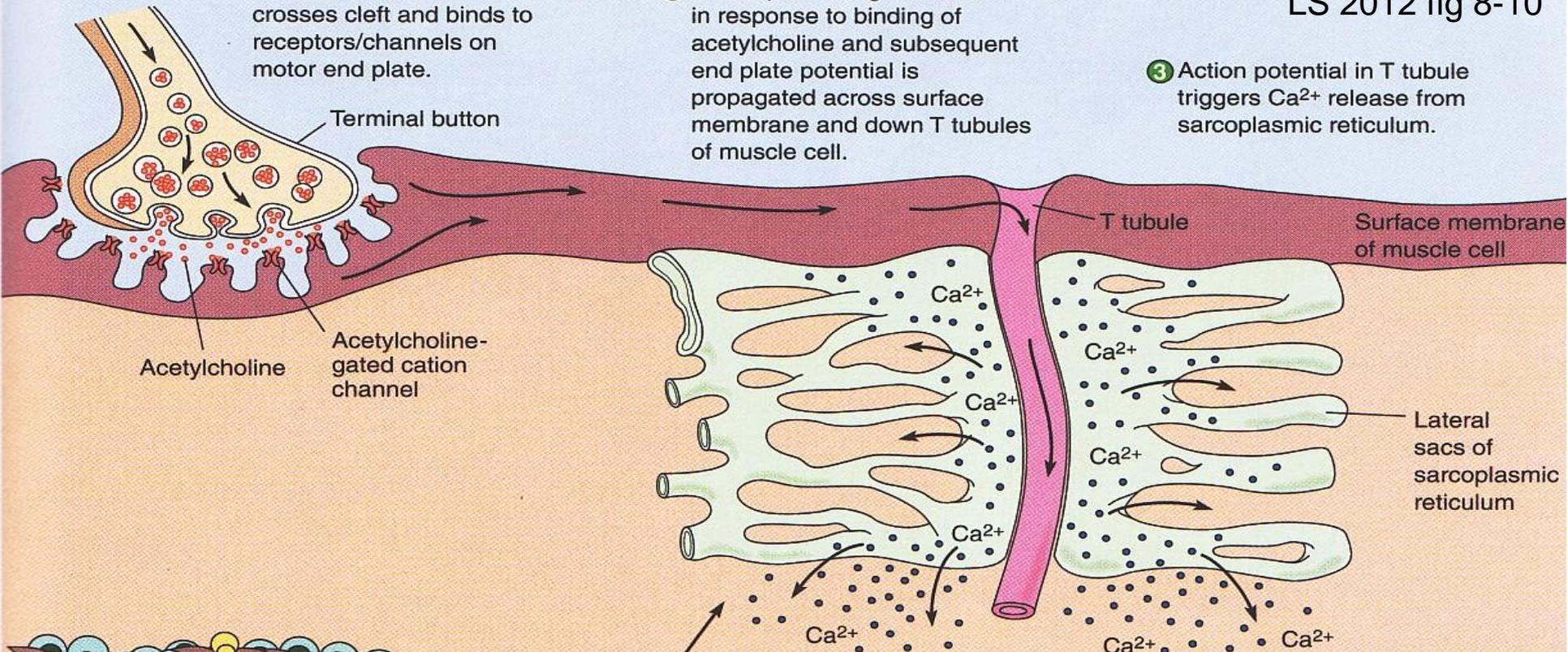


LS 2012 fig 8-7

1 Acetylcholine released by axon of motor neuron crosses cleft and binds to receptors/channels on motor end plate.

2 Action potential generated in response to binding of acetylcholine and subsequent end plate potential is propagated across surface membrane and down T tubules of muscle cell.

3 Action potential in T tubule triggers Ca^{2+} release from sarcoplasmic reticulum.



Terminal button
Acetylcholine
Acetylcholine-gated cation channel

T tubule
Surface membrane of muscle cell

Lateral sacs of sarcoplasmic reticulum

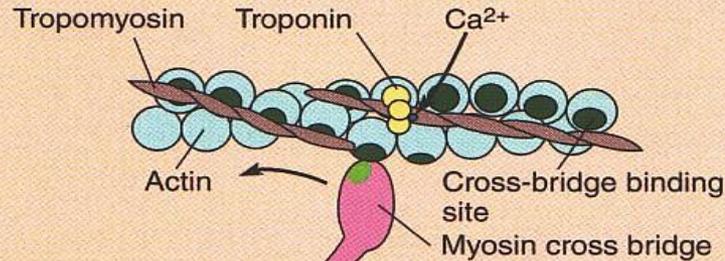
Ca^{2+}

7 With Ca^{2+} no longer bound to troponin, tropomyosin slips back to its blocking position over binding sites on actin; contraction ends; actin passively slides back to original resting position.

6 Ca^{2+} actively taken up by sarcoplasmic reticulum when there is no longer local action potential.

5 Myosin cross bridges attach to actin and bend, pulling actin filaments toward center of sarcomere; powered by energy provided by ATP.

4 Calcium ions released from lateral sacs bind to troponin on actin filaments; leads to tropomyosin being physically moved aside to uncover cross-bridge binding sites on actin.

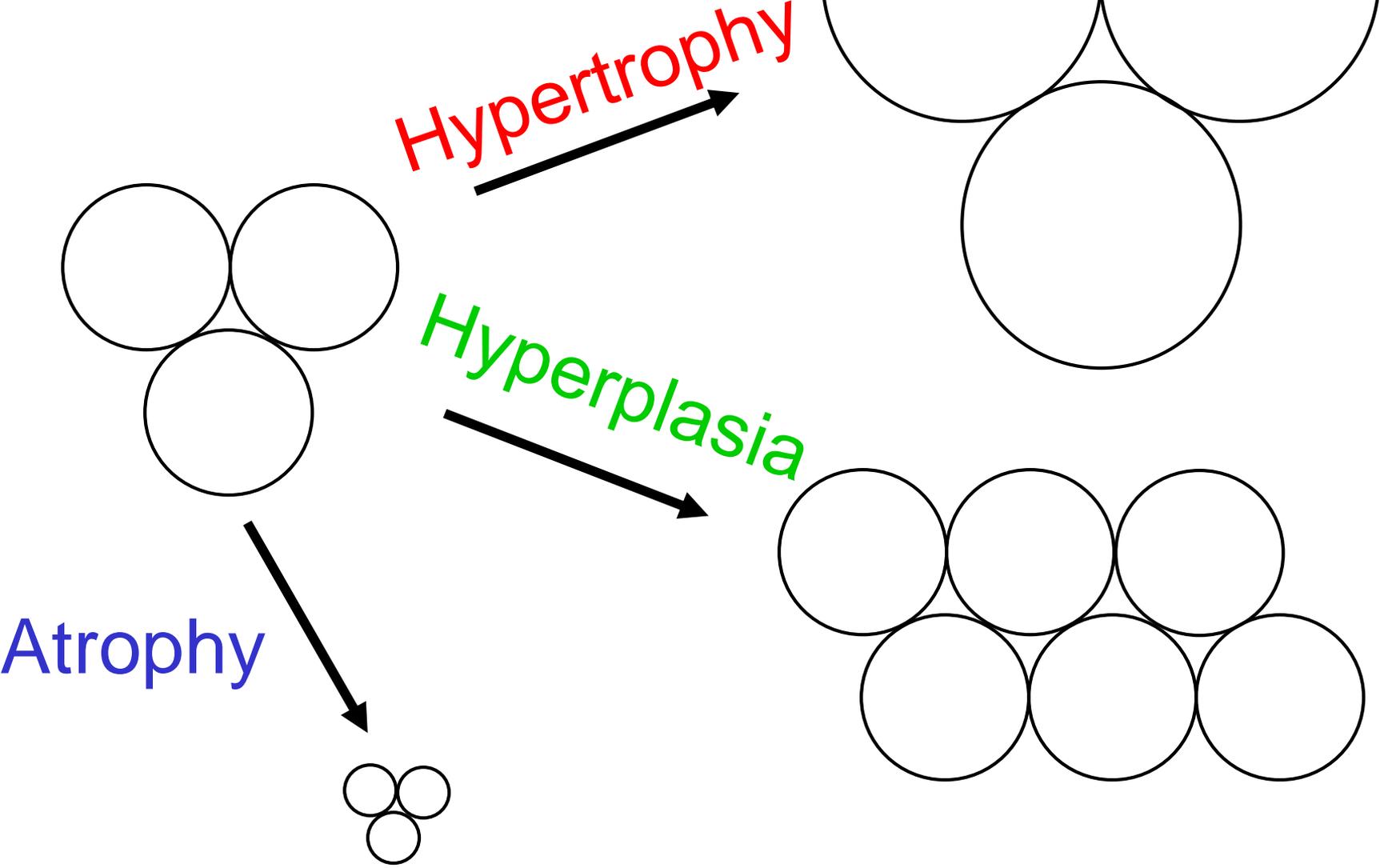


Tropomyosin Troponin

Actin Cross-bridge binding site Myosin cross bridge

Ca^{2+}

Skeletal Muscle



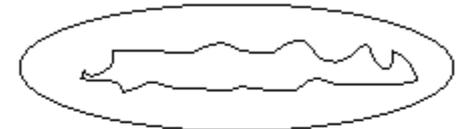
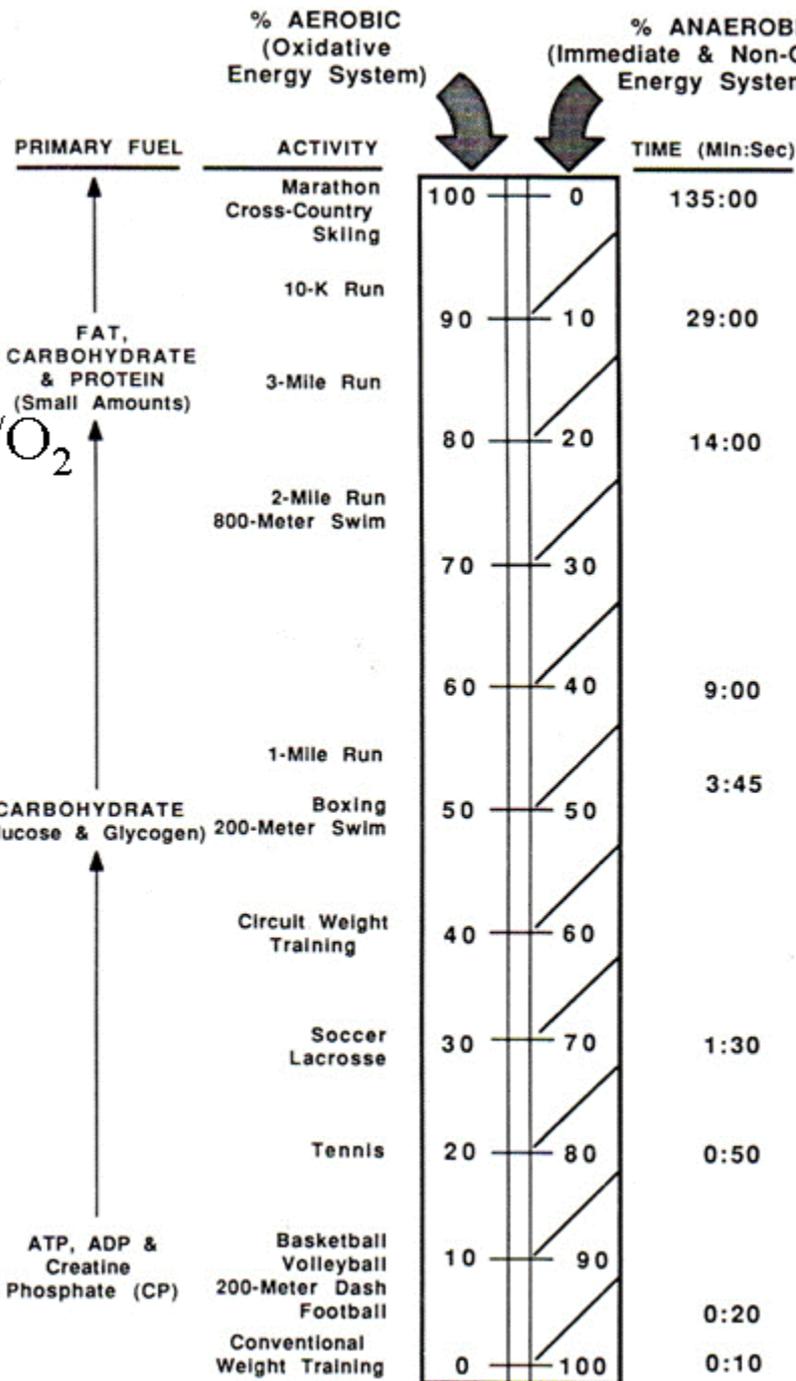
Characteristics of Skeletal Muscle Fibers

Characteristic	TYPE OF FIBER		
	Slow Oxidative (Type I)	Fast Oxidative (Type IIa)	Fast Glycolytic (Type IIb)
Myosin-ATPase Activity	Low	High	High
Speed of Contraction	Slow	Fast	Fast
Resistance to Fatigue	High	Intermediate	Low
Aerobic Capacity	High	High	Low
Anaerobic Capacity	Low	Intermediate	High
Mitochondria	Many	Many	Few
Capillaries	Many	Many	Few
Myoglobin Content	High	High	Low
Color of Fibers	Red	Red	White
Glycogen Content	Low	Intermediate	High



AEROBIC

w/O₂



MITOCHONDRIA

CYTOSOL

Glycolysis



Immediate/ATP-PC



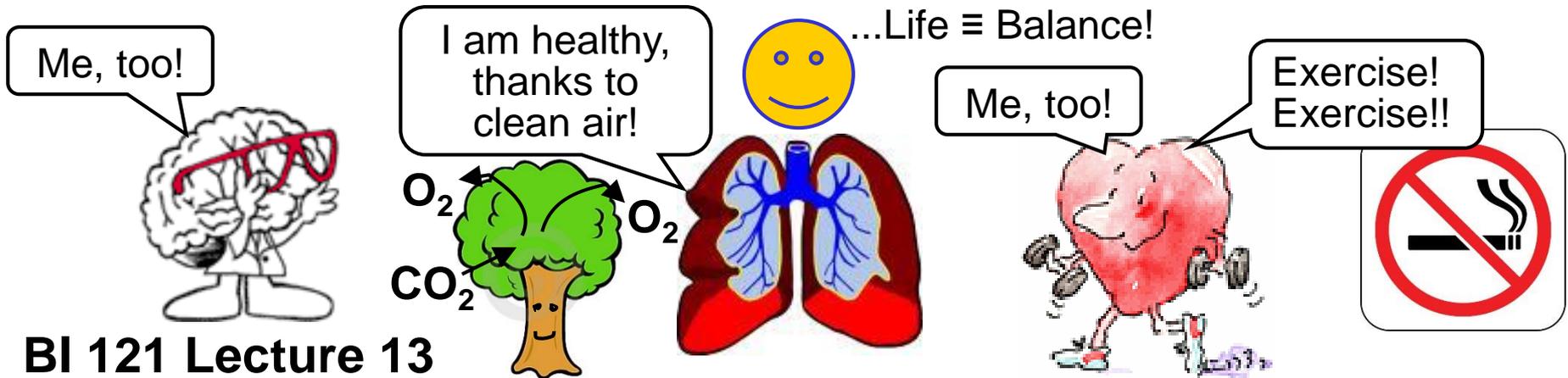
ANAEROBIC

Changes in Muscle Due to Strength Training

- ↑ Size of larger fast vs smaller slow fibers
- ↑ CP as well as creatine phosphokinase (CPK) which enhances short-term power output
- ↑ Key enzymes which help store and dissolve sugar including glycogen phosphorylase (GPP) & phosphofructokinase (PFK)
- ↓ Mitochondrial # relative to muscle tissue
- ↓ Vascularization relative to muscle tissue
- ↑ Splitting of fast fibers? Hyperplasia?
With growth hormone (GH), androgenic-anabolic steroids (AAS)?

Changes in Muscle Due to Endurance Training

- ↑ Mitochondria, # & size
- ↑ Mitochondrial (aerobic) enzymes including those specific for fat burning
- ↑ Vascularization of muscles (better blood flow)
- ↑ Stores of fat in muscles accompanied by
- ↓ Triglycerides/fats in bloodstream
- ↑ Enzymes: activation, transport, breakdown (β -oxidation) of fatty acids
- ↑ Myoglobin (enhances O₂ transport)
- ↑ Resting energy levels which inhibit sugar breakdown
- ↑ Aerobic capacity of all three fiber types.



BI 121 Lecture 13

I. Announcements Optional notebook check today. Discussion-Review followed by final exam tomorrow. Q?

II. Introduction to PFT Lab 6 Pulmonary Function Testing

III. Respiratory System LS ch 12, DC Module 7, SI Fox +...

A. Steps of respiration? External vs. cellular/internal?

LS fig 12-1 pp 345-7

B. Respiratory system anatomy LS fig 12-2 p347, DC, SI Fox +...

C. Histology LS fig 12-4 pp 347-9, DC

D. How do we breathe? LS fig12-12, fig12-25 pp 349-56, 373-8

E. Gas exchange LS fig 12-19 pp 362-5

F. Gas transport LS tab 12-3 pp 365-70

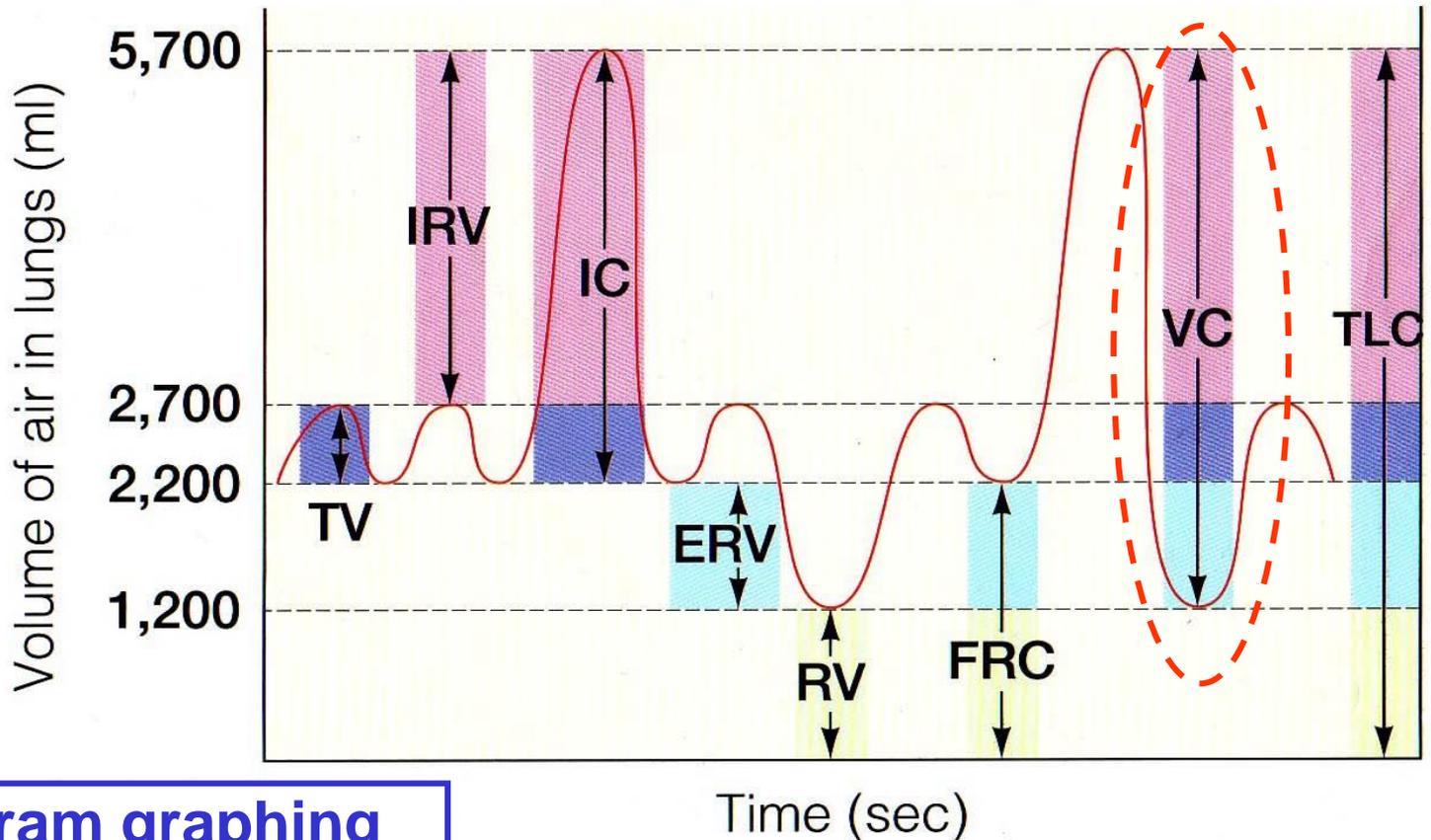
IV. Physiology of Cigarette Smoking

A. ANS, autonomic nerves & nicotine? Route of chemicals,...

B. Emphysema? 2nd-hand smoke?... p 356, 365

C. UO Smoke-Free since Fall 2012! Help is available!

Normal Spirogram of Healthy Young Adult Male



**Spirogram graphing
complete *PFT* from
computer simulation.**

- TV = Tidal volume (500 ml)
- IRV = Inspiratory reserve volume (3,000 ml)
- IC = Inspiratory capacity (3,500 ml)
- ERV = Expiratory reserve volume (1,000 ml)
- RV = Residual volume (1,200 ml)
- FRC = Functional residual capacity (2,200 ml)
- VC = Vital capacity (4,500 ml)
- TLC = Total lung capacity (5,700 ml)

Lombo's simplified steps!

1 Breathe in & out!



2 Cross membranes!



3 Move with blood!

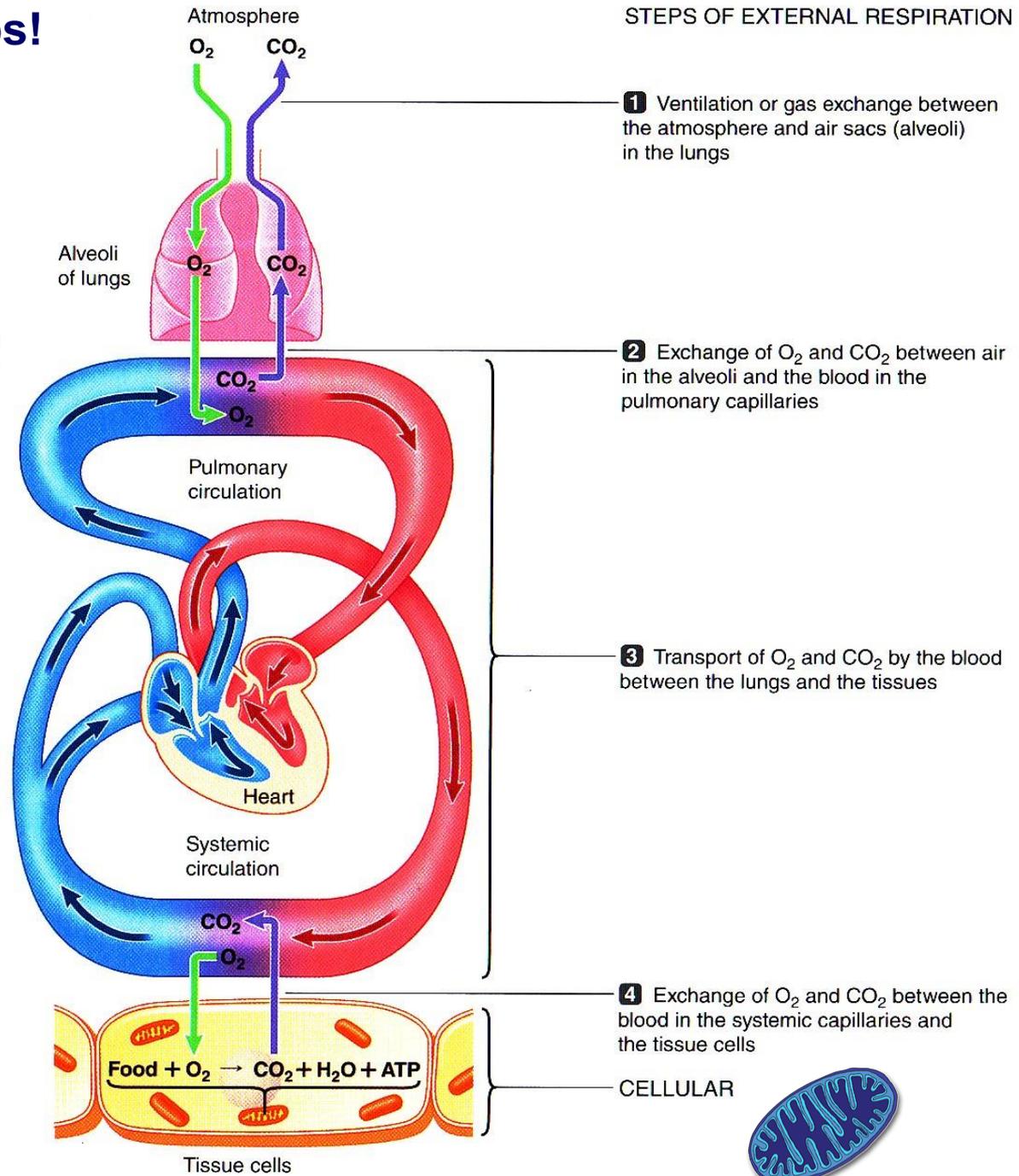
Go with the flow!



4 Cross membranes!

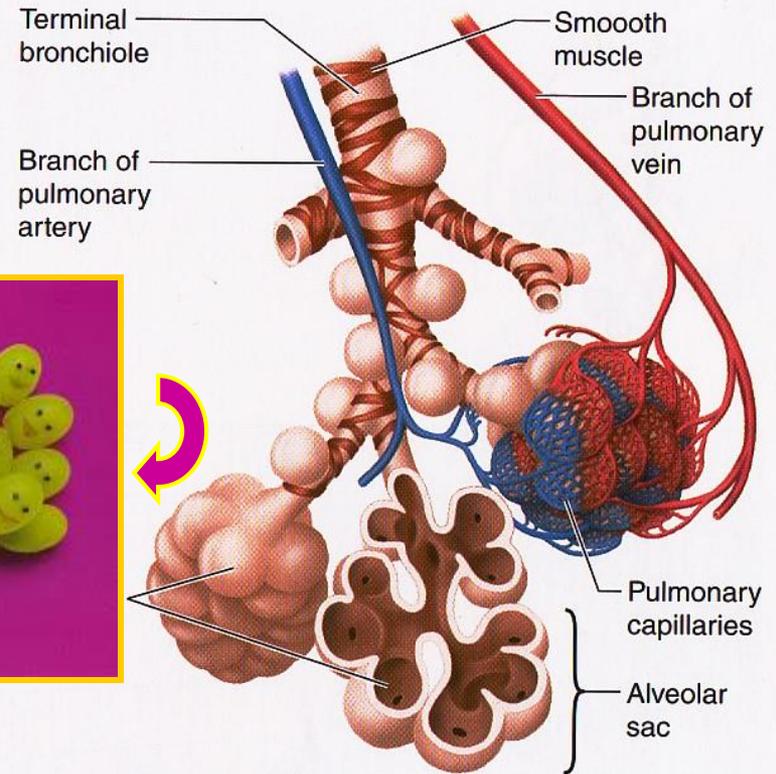
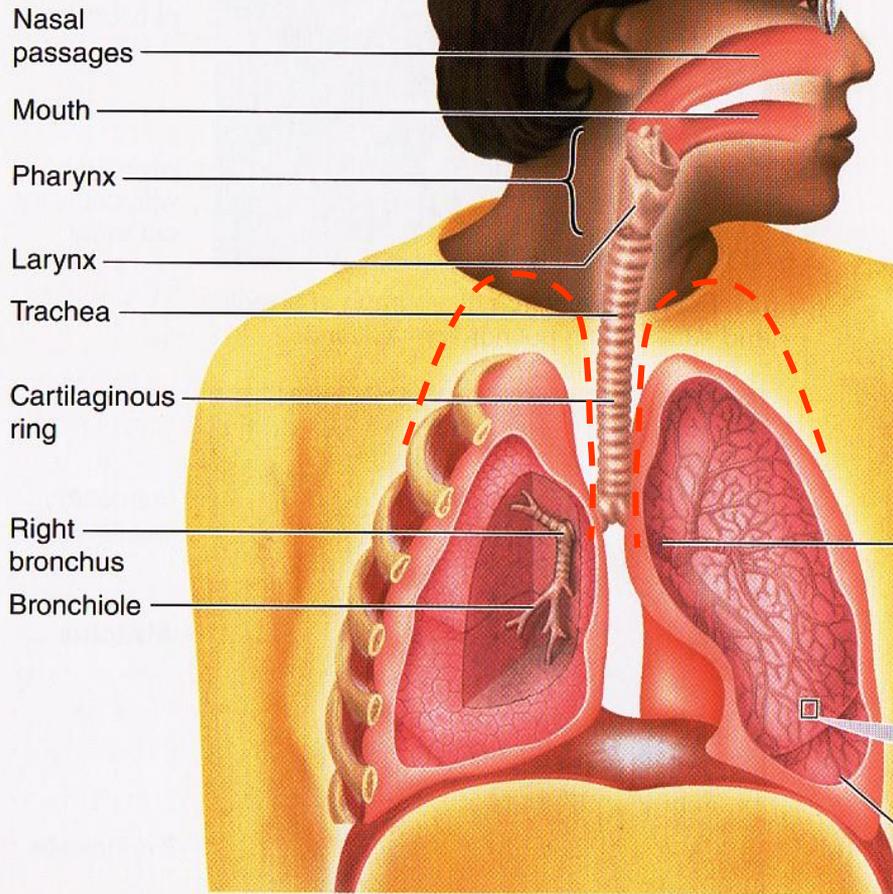


STEPS OF EXTERNAL RESPIRATION

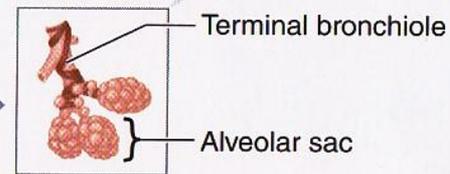


Respiratory System Anatomy

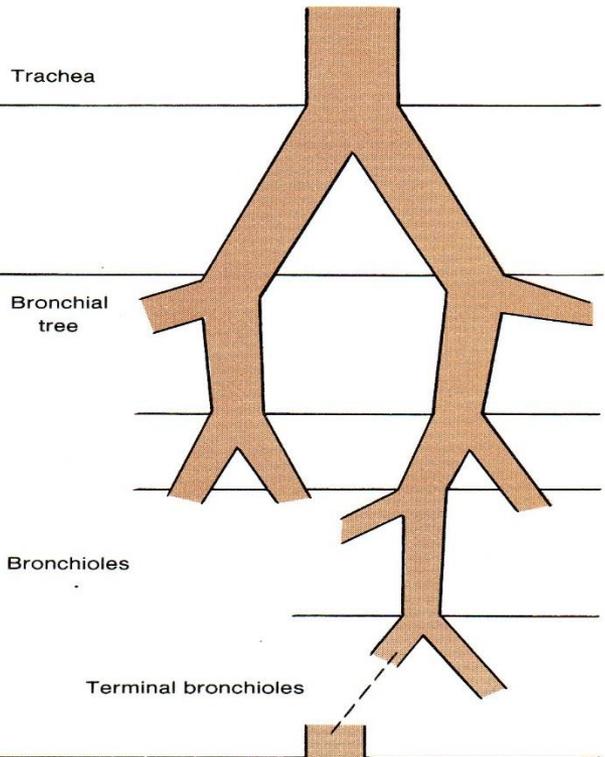
NB: In vivo,
Cupola or peak
of each lung
goes into neck
> clavicle line!



(b) Enlargement of alveoli (air sacs) at terminal ends of airways

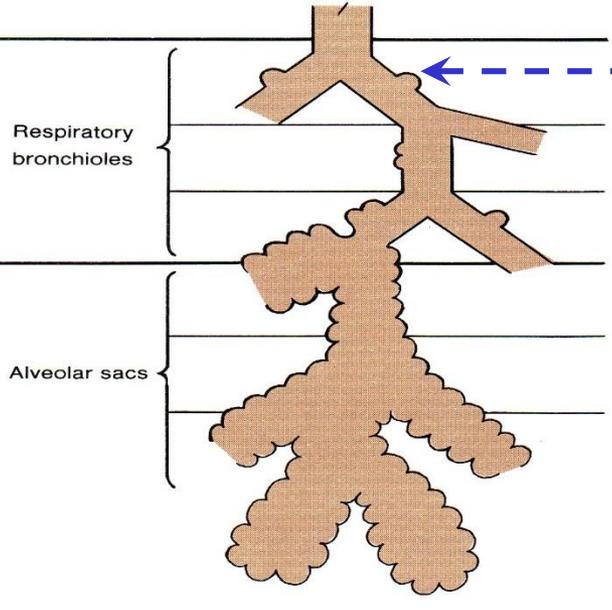


Conductive Zone



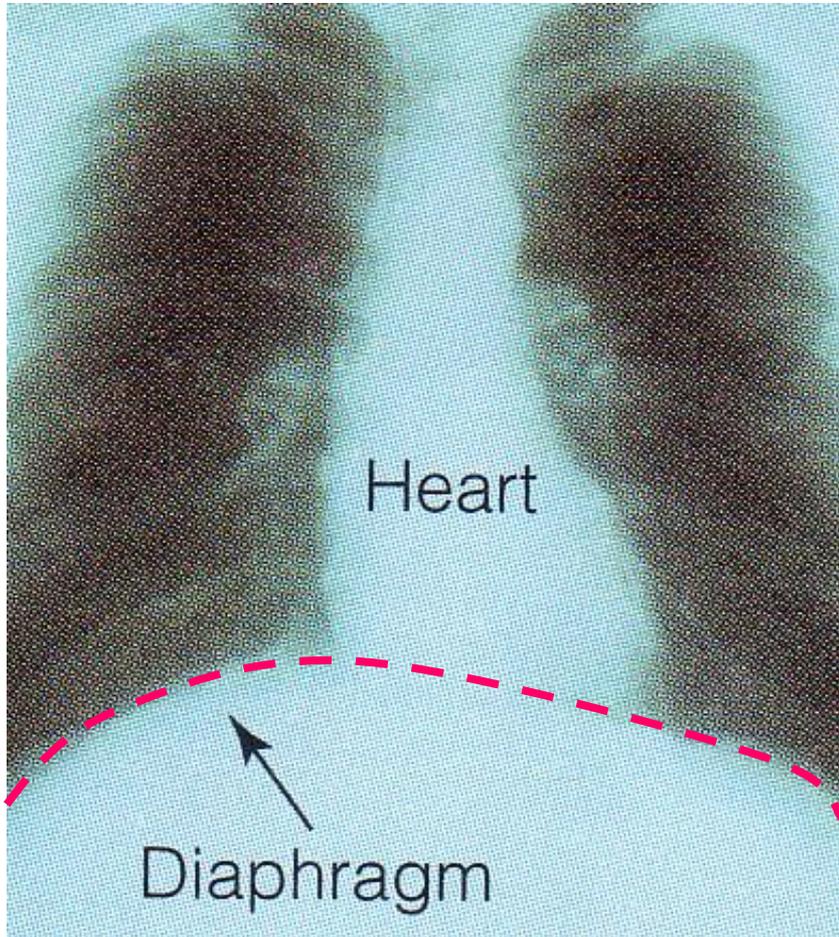
No Gas Exchange

Respiratory Zone



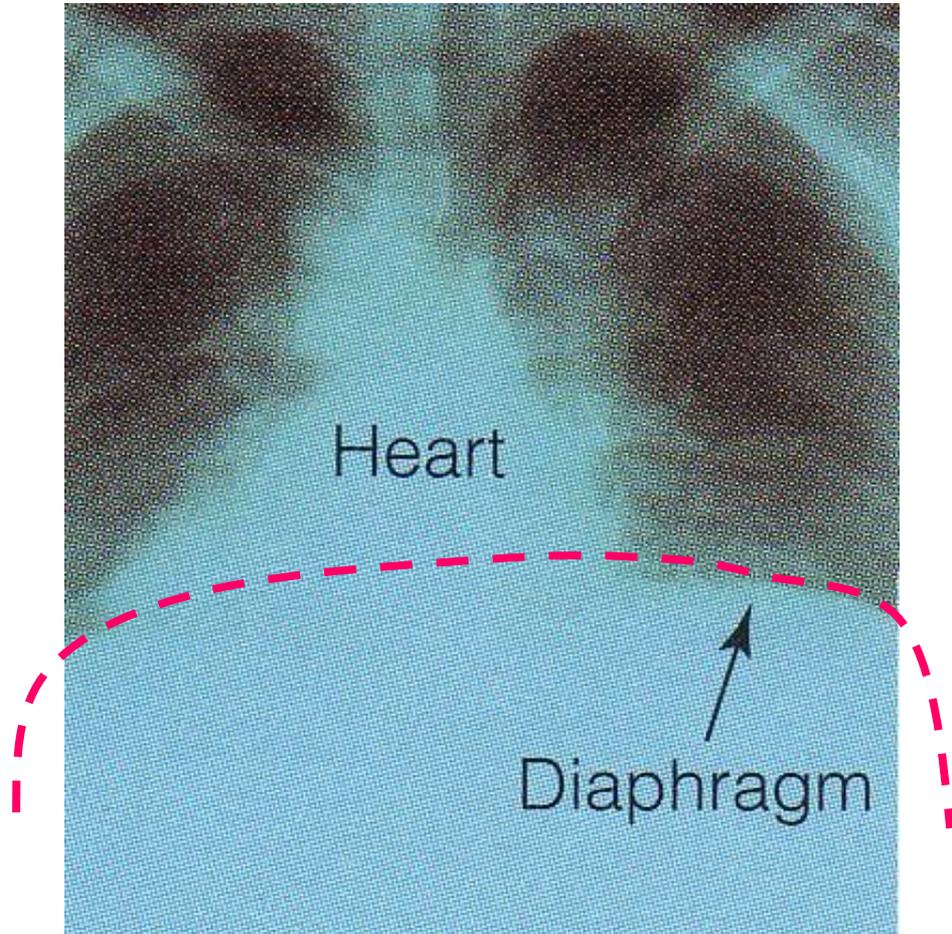
-1st alveolar outpouching!

Gas Exchange



Inhale (active)

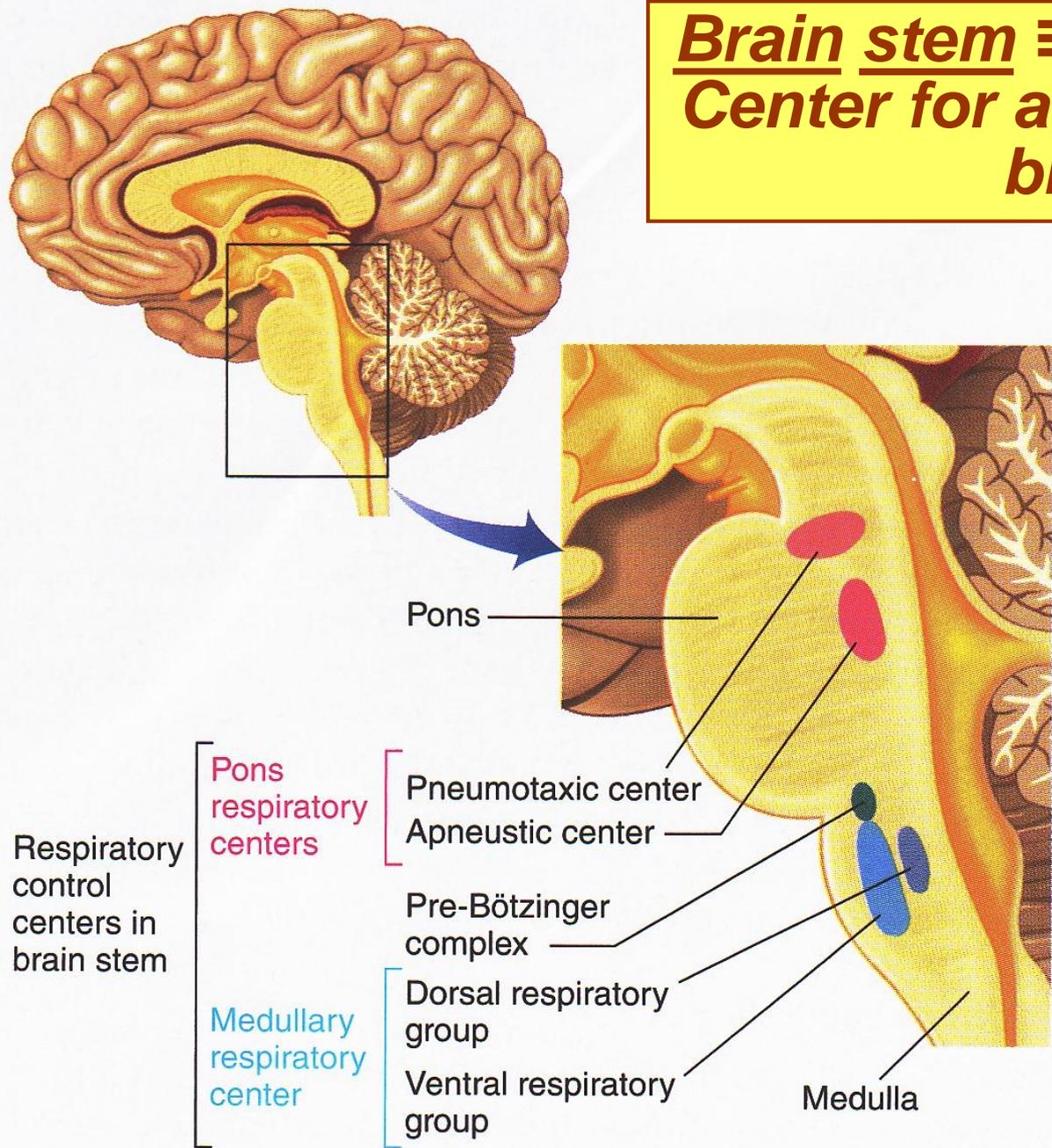
Contract & flatten diaphragm



Exhale (passive @ rest)

Relax & pouch up diaphragm!

Brain stem ≡ Control Center for automatic breathing!



Respiratory control centers in brain stem

Pons respiratory centers

Medullary respiratory center

Pneumotaxic center
Apneustic center

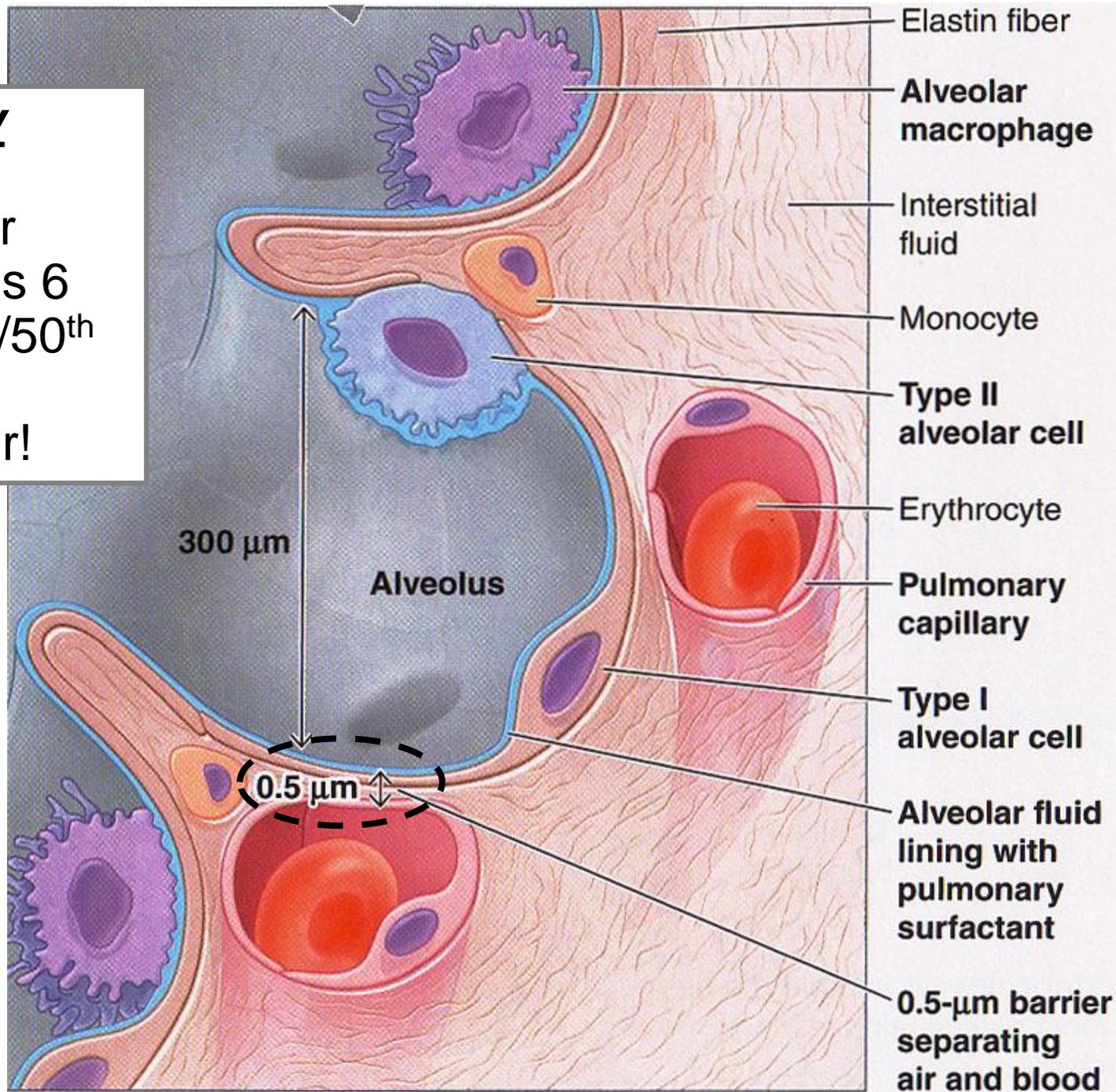
Pre-Bötzinger complex

Dorsal respiratory group
Ventral respiratory group

Medulla

Respiratory membrane

separates air from blood, is 6 layers, yet 1/50th thickness of tracing paper!



Gas Exchange

CO₂ LOW

O₂ HIGH

Across pulmonary capillaries:

O₂ partial pressure gradient from alveoli to blood = 60 mm Hg (100 → 40)

CO₂ partial pressure gradient from blood to alveoli = 6 mm Hg (46 → 40)

Across systemic capillaries:

O₂ partial pressure gradient from blood to tissue cell = 60 mm Hg (100 → 40)

CO₂ partial pressure gradient from tissue cell to blood = 6 mm Hg (46 → 40)

Numbers are mm Hg pressure.

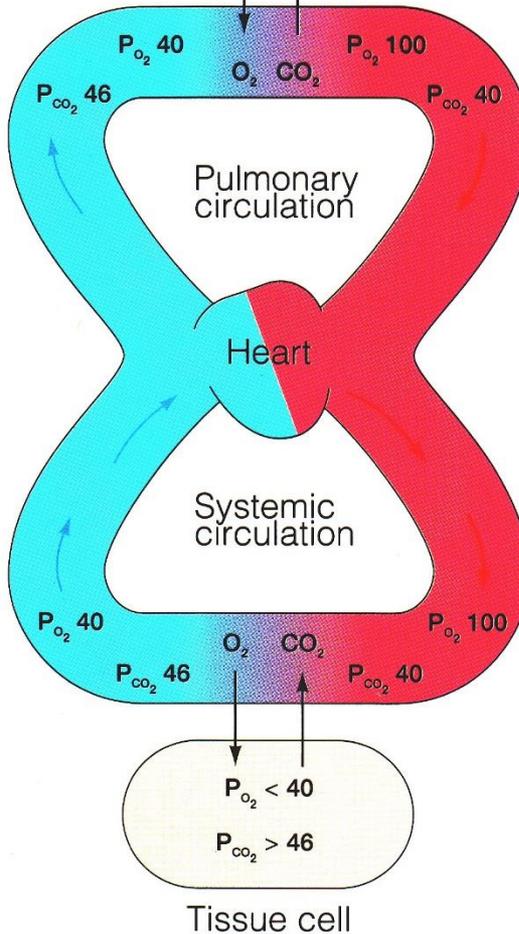
Inspired air

P_{O₂} 160

P_{CO₂} 0.3

P_{O₂} 100 P_{CO₂} 40

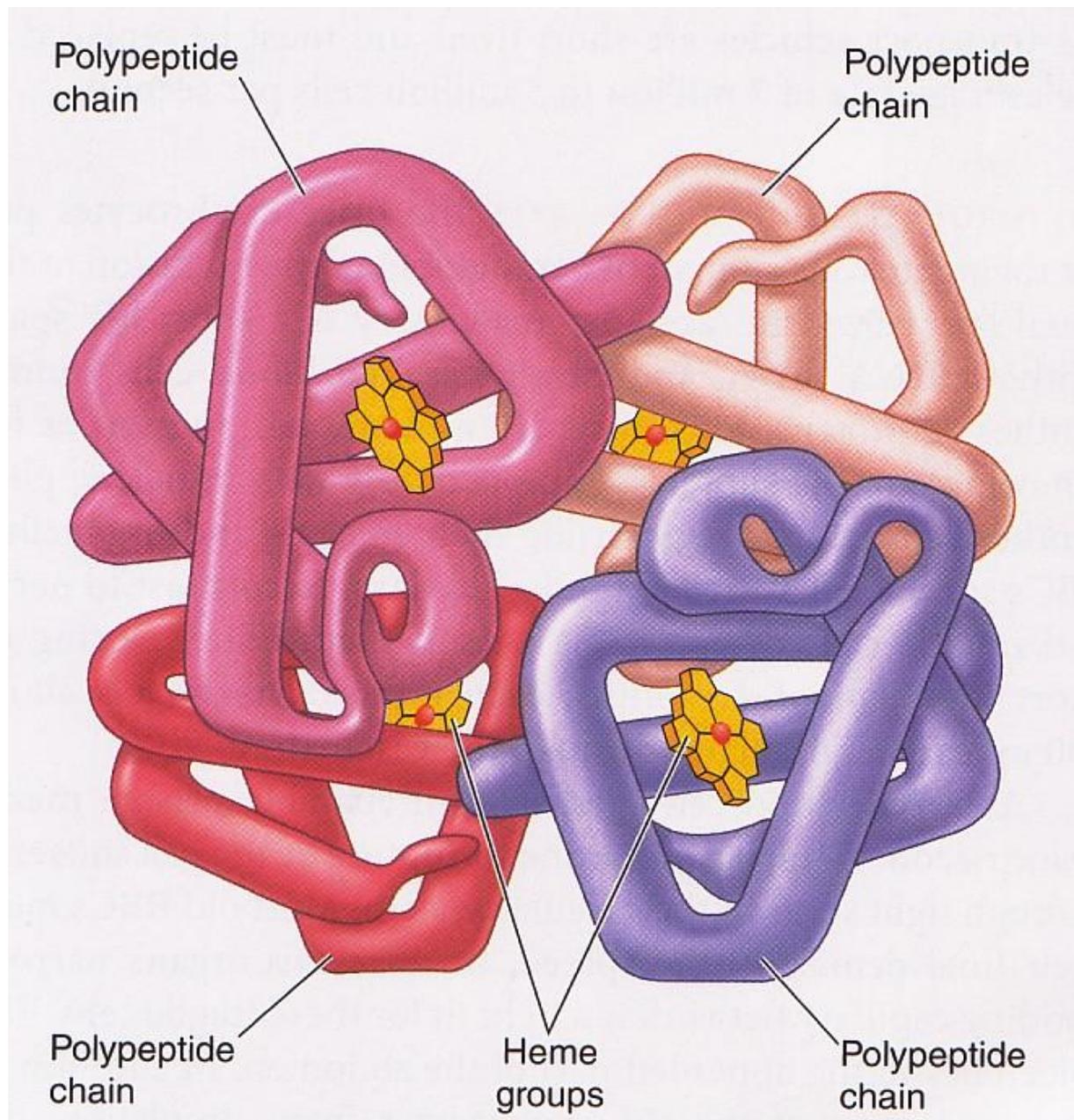
Alveolus



CO₂ HIGH

O₂ LOW

O₂ is carried mainly by red blood cell hemoglobin!

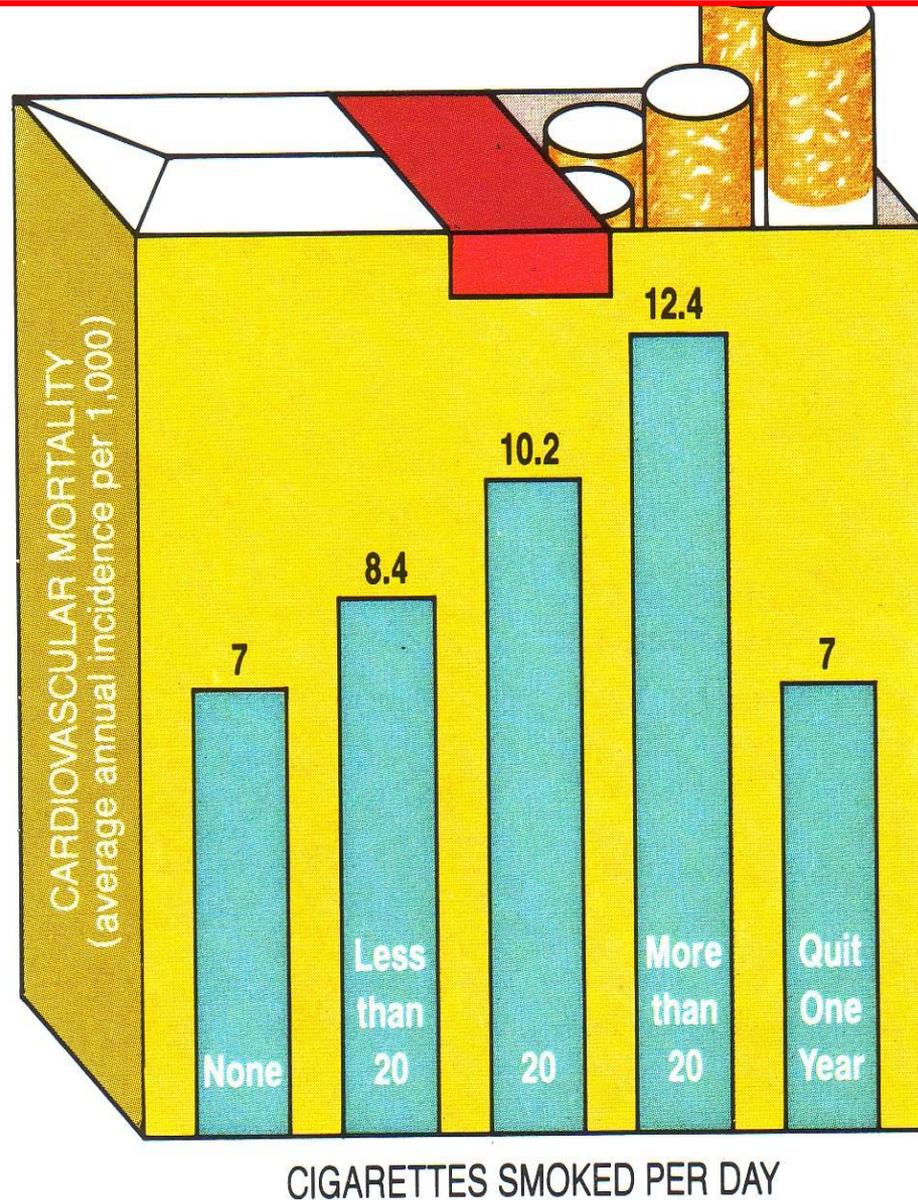


American Cancer Society Great American Smoke Out!

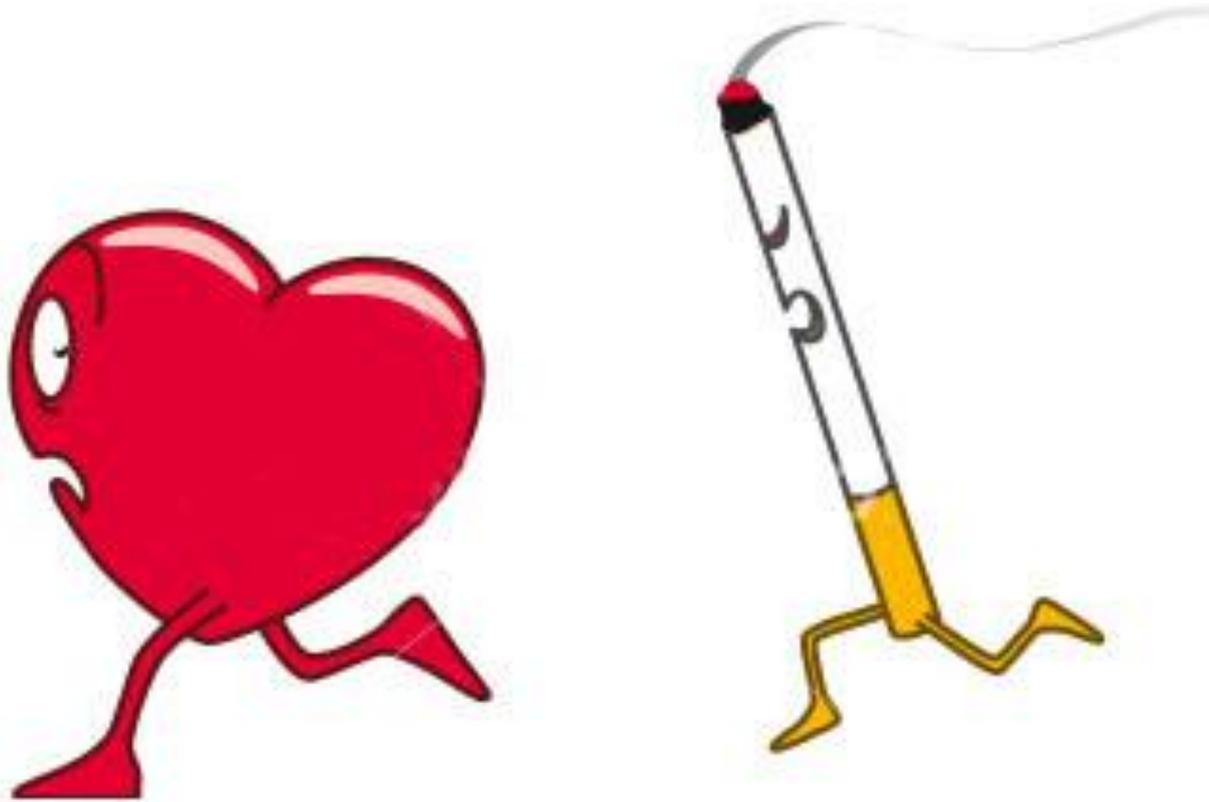


**[http://www.cancer.org/healthy/stayawayfromtobacco/
greatamericansmokeout/](http://www.cancer.org/healthy/stayawayfromtobacco/greatamericansmokeout/)**

Cigarette Smoking: #1 Preventable Cause of Premature Death in the US



***Not only the Lungs, but the Heart, Brain & 100s
of Other Tissues & Organs Adversely Affected!***

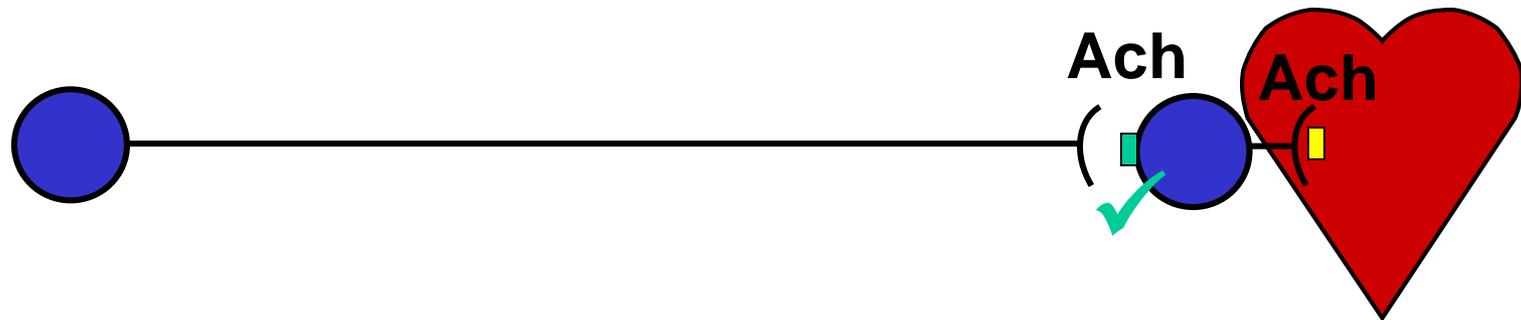


Tobacco smoke = Deadly mix of > 7000 chemicals!

[http://www.cdc.gov/tobacco/data_statistics/sgr/
50th-anniversary/index.htm#fact-sheets](http://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/index.htm#fact-sheets)

[http://www.cdc.gov/tobacco/data_statistics/sgr/
2010/consumer_booklet/chemicals_smoke/](http://www.cdc.gov/tobacco/data_statistics/sgr/2010/consumer_booklet/chemicals_smoke/)

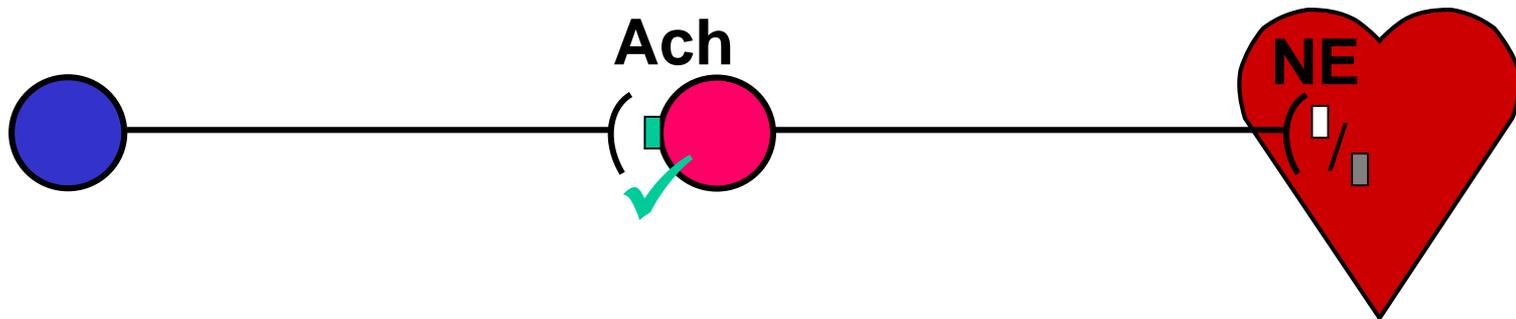
Parasympathetic



Ach = Acetylcholine

- = Nicotinic Receptor
- = Muscarinic Receptor

Sympathetic



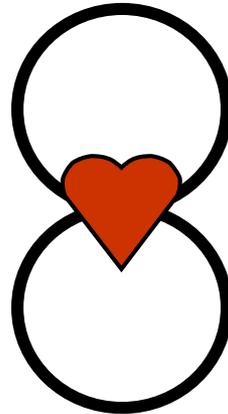
NE = Norepinephrine

- = α Receptor (α_1 , α_2)
- = β Receptor (β_1 , β_2)

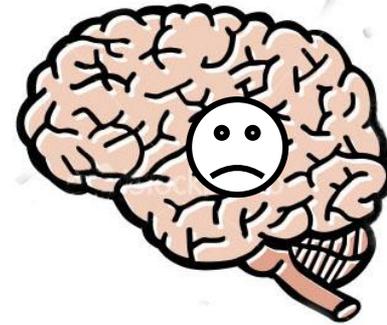
Cigarettes ≡ Patient-Assisted Drug-Delivery System Inhaling Bypasses the Systemic Circulation & Is Powerfully Reinforcinging!



Pulmonary

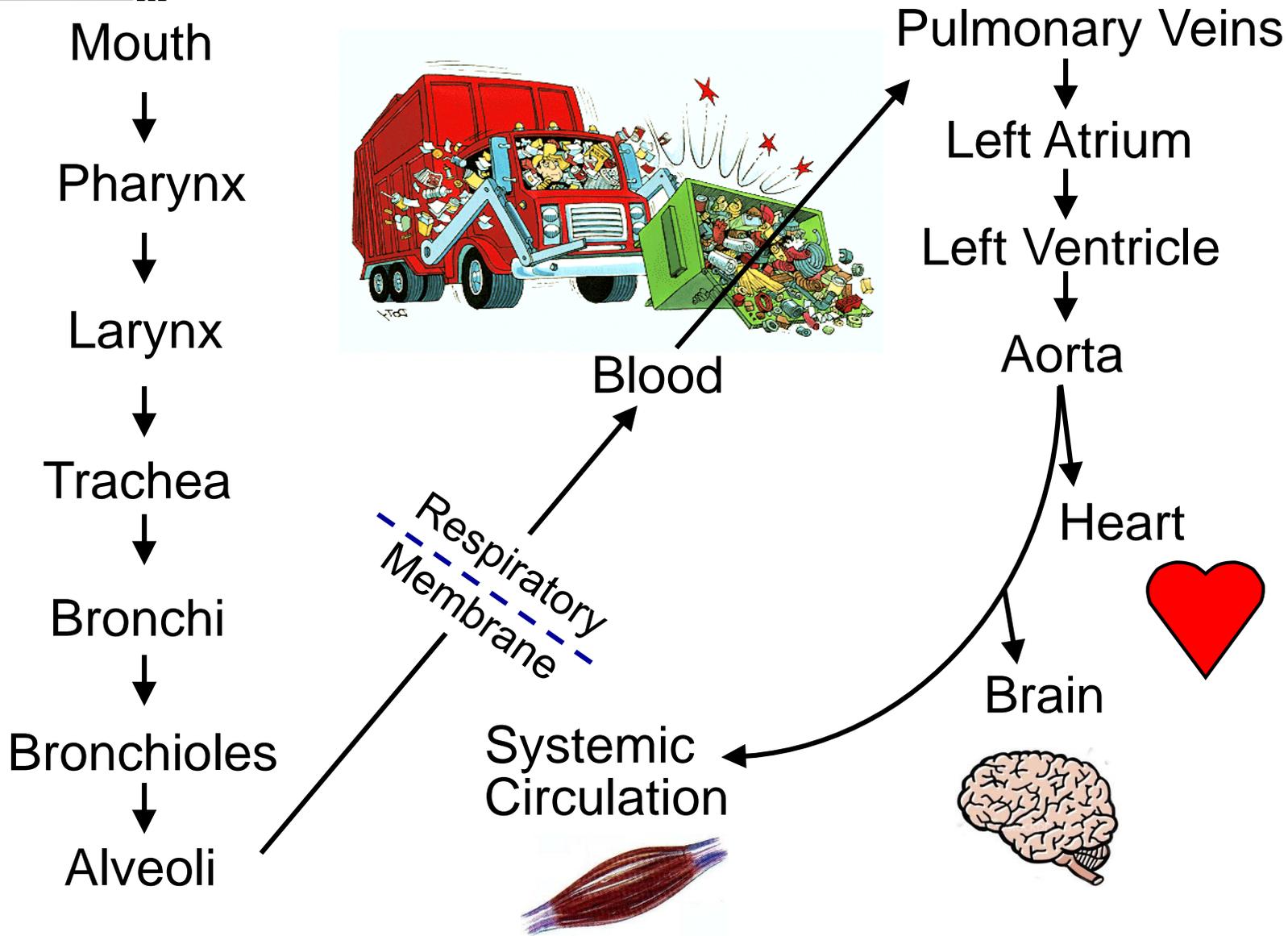


Systemic



Tracing the Route of Cigarette Smoke

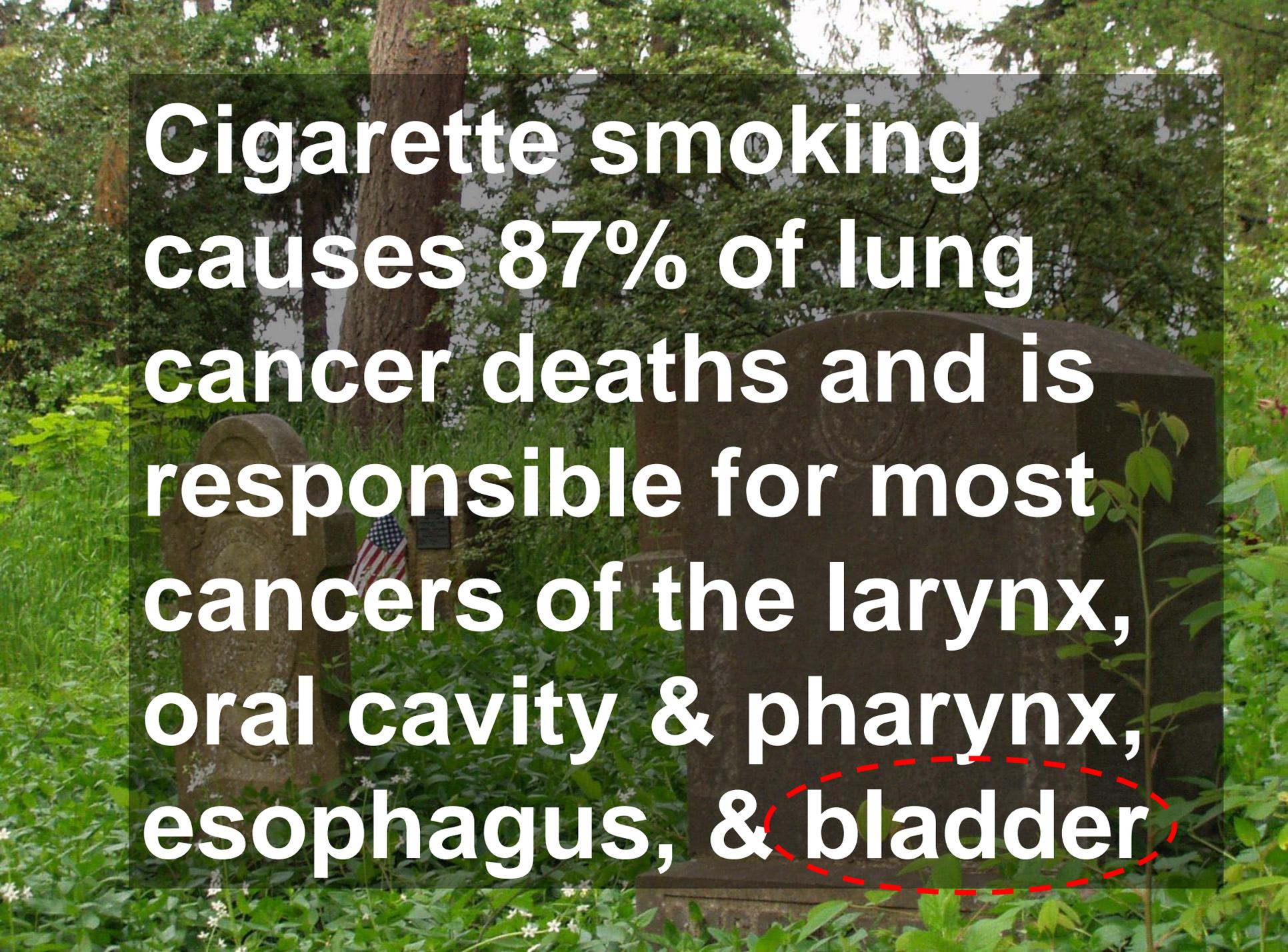
Puff to Brain Time 5 to 8 seconds!!



Keep it Basic?

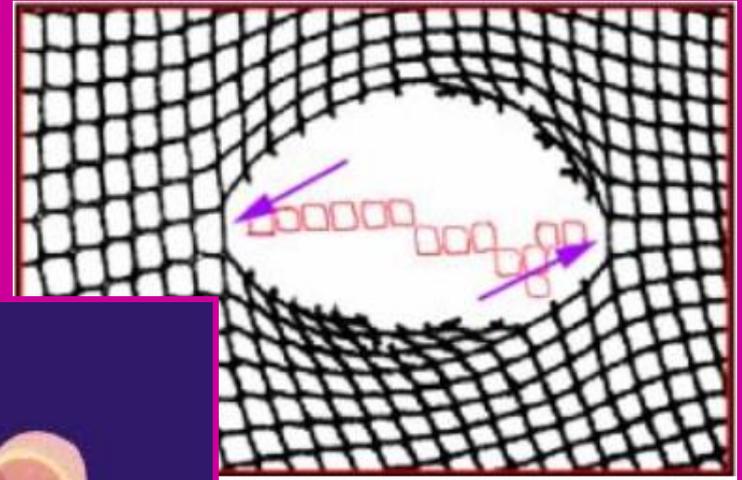
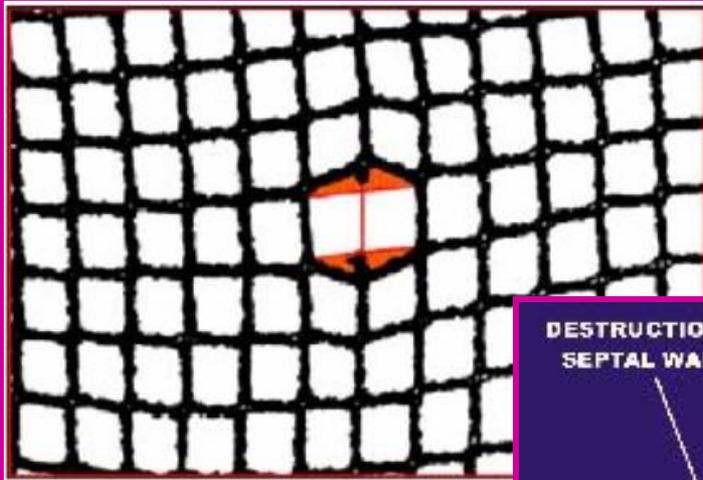
Cigarette smoking is the most important preventable cause of premature death in the U.S. accounting for 443,000 annual deaths.

http://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/tobacco_related_mortality/#cigs

A photograph of a cemetery with several tombstones and lush green trees in the background. A semi-transparent grey text box is overlaid on the image, containing white text. The word 'bladder' in the text is circled with a red dashed line.

Cigarette smoking causes 87% of lung cancer deaths and is responsible for most cancers of the larynx, oral cavity & pharynx, esophagus, & bladder

Emphysema ≡ Corrosion of Alveolar Walls with ↓ SA & Labored Breathing



Why you have to tell your gynecologist you smoke. Even if it's only at parties.

©AMP 2008 03/11/08



You figure an occasional cigarette can't hurt, and you really don't want to listen to the "stop smoking" lecture from your doctor. But if you want any type of hormonal birth control, smoking is a vitally important issue.

Hormonal birth control is a prescription drug, and while the risks are rare, they can be serious, and smoking, even a little, increases the risks, especially if you're over 35.

Risks include blood clots, stroke, and heart attack. If you have a history of these conditions or certain cancers, you shouldn't use hormonal birth control.

Of course, you should tell your healthcare professional if you could be pregnant, and because hormonal birth control doesn't protect against HIV or sexually transmitted diseases, learn how to stay safe and healthy.

Hormonal birth control has been used safely by millions of women for 45 years, and is 99% effective when used correctly.

It could be a good choice for you. To find out, talk to your healthcare professional. And to help you get started, there's a list of questions to ask at: www.orthowomenshealth.com



Be smart about your body.
Be smart about your birth control.

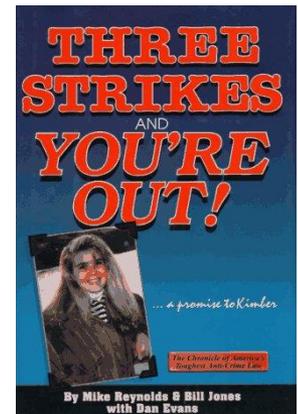
On the Pill & Smoke?

Increased Risk of:

1. Blood Clots

2. Heart Attack

3. Strokes!



**Breathing 2nd-hand
smoke for as little as
1/2 hr activates
platelets almost as
much as if you were a
pack-a-day smoker**

2nd-hand smoke is the 3rd leading preventable cause of death in the US!

A photograph of a man in a tuxedo with a cigarette in his mouth, looking at a woman. The text "Mind if I smoke?" is overlaid on the image.

"Mind if I smoke?"

"Care if I die?"

Each year ~45,000 Americans die due to 2nd-hand smoke exposure!

News: Health, Toxicology, Pollution

Health risks of e-cigarettes emerge

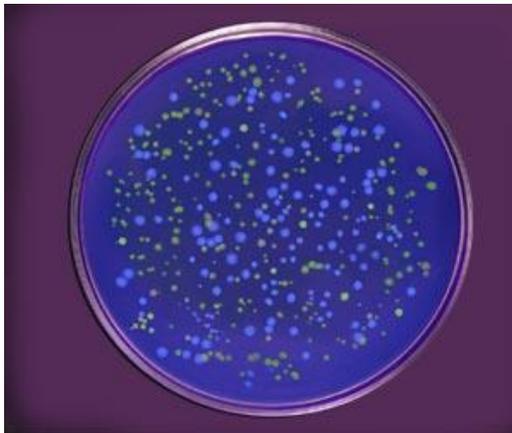
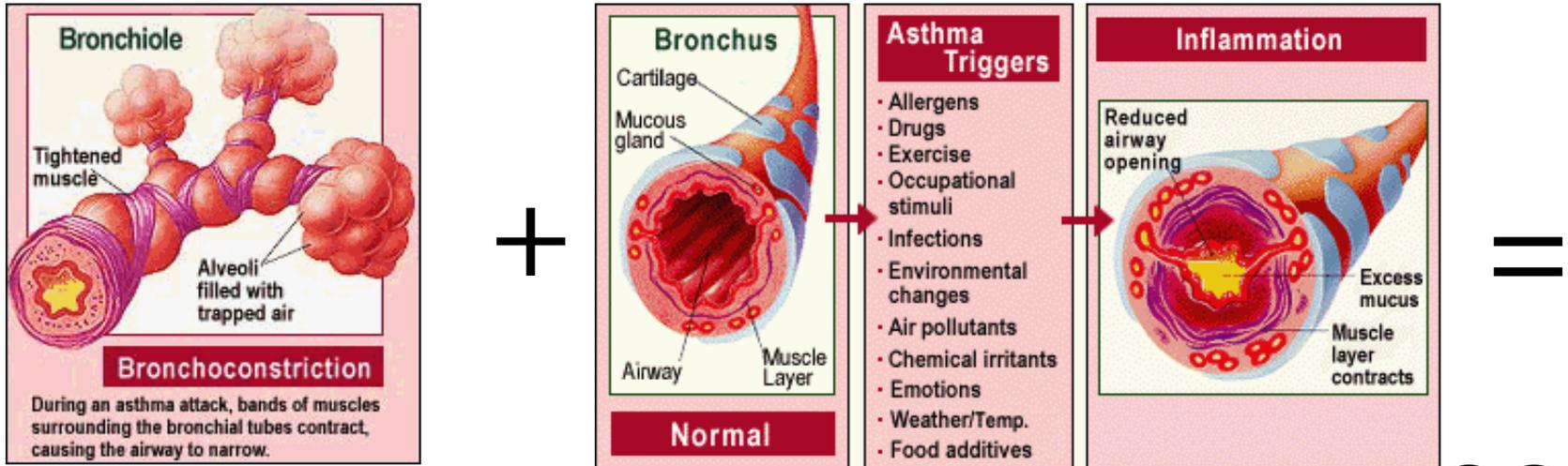
Vaping pollutes lungs with toxic chemicals and may even make antibiotic-resistant bacteria harder to kill

By JANET RALOFF 4:31PM, JUNE 3, 2014

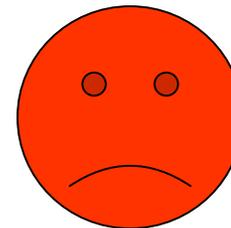


<https://www.sciencenews.org/article/health-risks-e-cigarettes-emerge>

SMOKING ≡ ASTHMA?



**Petri-dish
Effect**



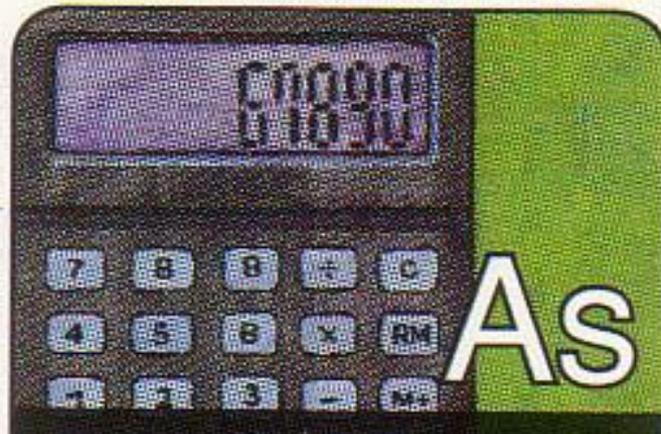
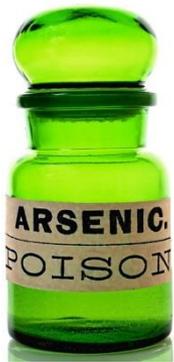
Ugh!!
Cough!
Cough!!



freebase nicotine!!

Ammonia converts nicotine, the addictive agent in tobacco, into a more volatile form, Pan-kow said. "Ammonia is the thing that helps tobacco companies hook the smoker by providing a means of delivering the nicotine."

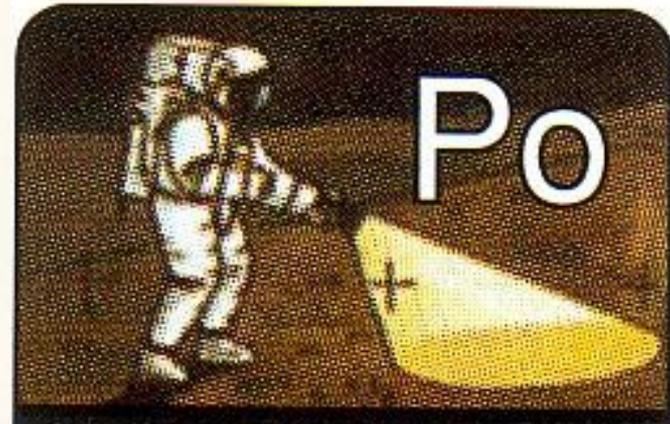
Last October a former tobacco industry employee revealed that secret industry documents indicated that ammonia was added to tobacco to double the impact of nicotine. The Oregon Graduate Institute study confirms the contention that



As

Arsenic 33

- o Shotgun pellets
- + Metal for mirrors
- v Glass, lasers
- v **Light emitting diodes=LED**
- x 74.9216



Po

Polonium 84

- o **Nuclear batteries**
- o Neutron source
- o Antistatic agents
- o Film cleaner
- x (209)



Nicotine Addiction & Help Quitting Smoking

[http://www.cancer.org/healthy/stayawayfromtobacco/guide
toquittingsmoking/guide-to- quitting-smoking-help-phys-nrt](http://www.cancer.org/healthy/stayawayfromtobacco/guide-toquittingsmoking/guide-to- quitting-smoking-help-phys-nrt)

2nd-Hand Smoke or ETS & 3rd-Hand Smoke?

[http://www.cancer.org/cancer/cancercauses/tobaccocancer/
secondhand-smoke](http://www.cancer.org/cancer/cancercauses/tobaccocancer/secondhand-smoke)

2nd-Hand Smoke Addictive?

[http://www.ncbi.nlm.nih.gov/pubmed?term=2nd%20hand
%20smoke%20addictive](http://www.ncbi.nlm.nih.gov/pubmed?term=2nd%20hand
%20smoke%20addictive)

<http://www.ncbi.nlm.nih.gov/pubmed/20211642>

<http://www.ncbi.nlm.nih.gov/pubmed/19936715>

<http://www.ncbi.nlm.nih.gov/pubmed/21840504>