



Exam II Review Slides



Exam II!
Whee!



We survived the exam! Happy Halloween!!
Remember nutrient p & have safe fun!

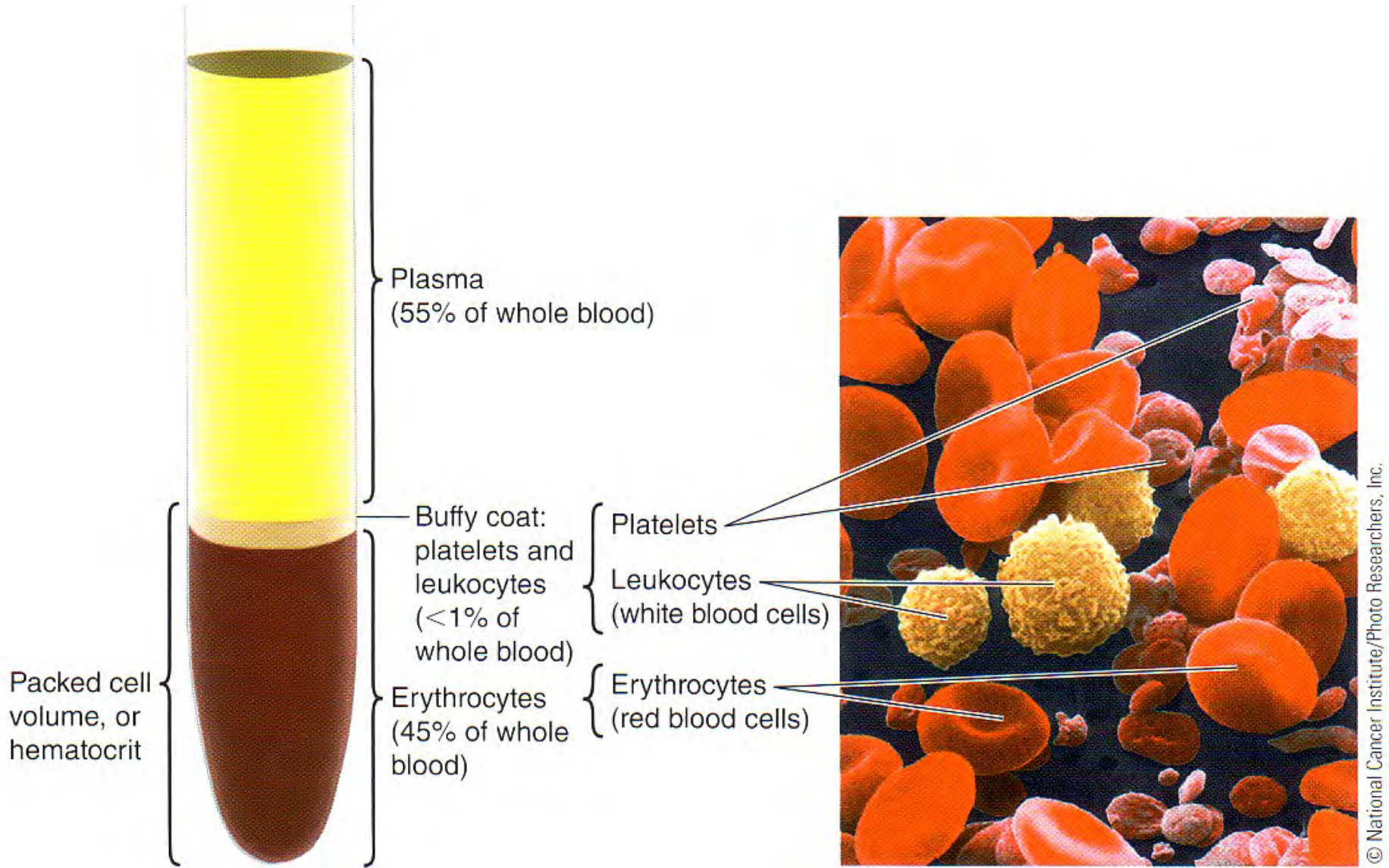


- I. Announcements**: No lab today! Break for exam week!
Next R Blood Chemistry. Thanks sincerely for helping us optimize safety by reading $\geq 2x$ Lab 5, LM pp 5-1 to 5-6.
- II. Blood Form & Function** LS ch 11, DC Module 5 pp 35-9
 - A. Formed vs Nonformed/cells vs plasma fig+tab 11-1
Cell origin - bone marrow. What's in plasma? p 316
 - B. Red blood cells/erythrocytes: O₂ carrying pp 317-8
Normal flexible vs fragile sickle cell fig 11-5 p 320
 - C. White blood cells/leukocytes: defense/immunity
differential + general functions pp 326-30 fig 11-1
 - D. Platelets/thrombocytes: clotting pp 321-2 fig 11-6
- III. Blood Chemistry Lab: Basics** LM + LS ch 11 & 17
 - A. What's blood typing? ABo System ch 11 LS pp 341- 4
Rhesus factor? Erythroblastosis fetalis? LS p 343
 - B. *Physiology in the News*: Eat right for your type?
 - C. What's blood glucose? Diabetes? LS ch 17 pp 560- 73
 - D. Questions about blood chem lab?
- IV. Exam Comments + Return**

Ghost, marshmallow
or white blood cell?



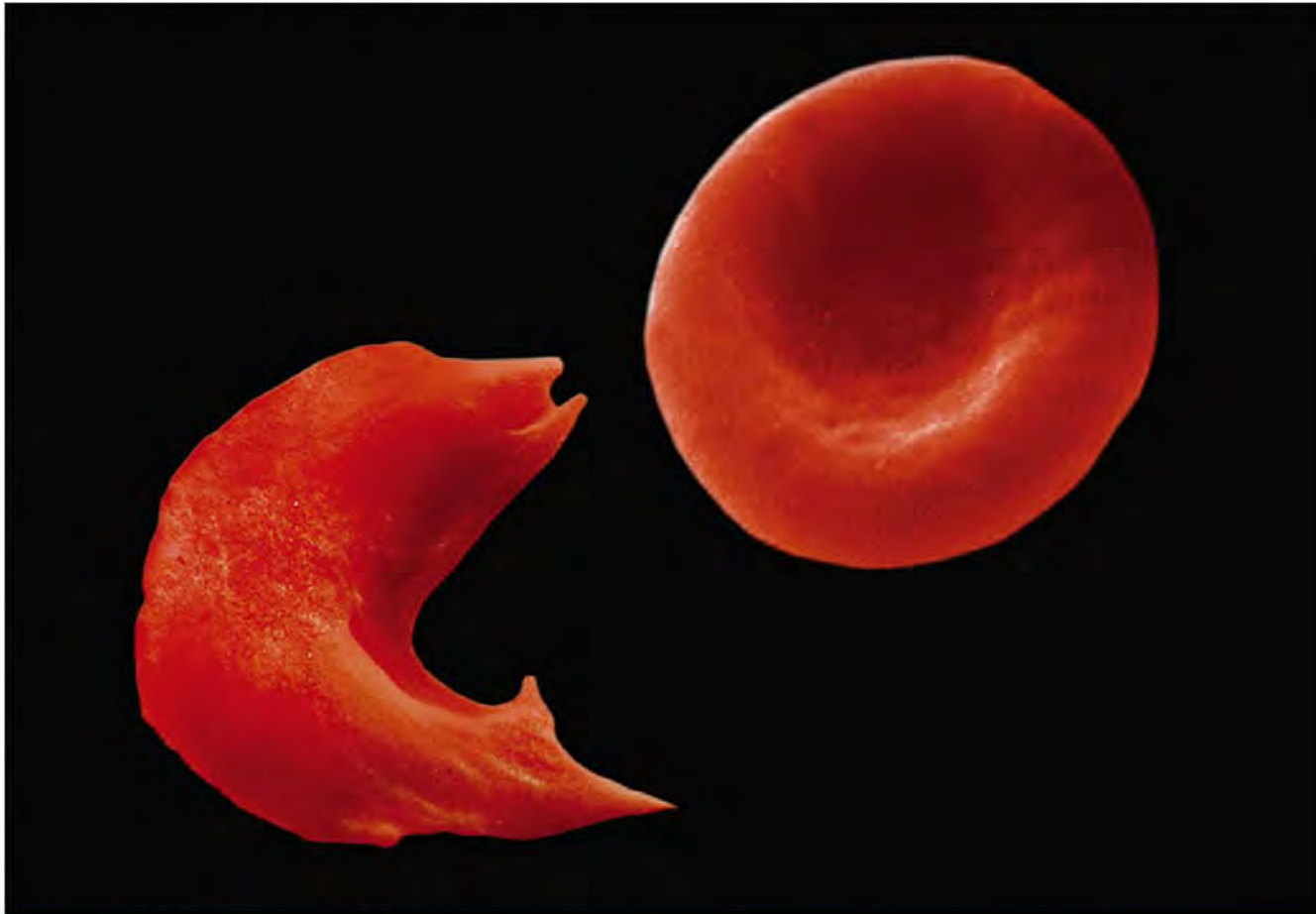
What's in Blood? Plasma & Blood Cells



Sickle-shaped blood cells

Normal red blood cells

© Dr. Stanley Flegler/Visuals Unlimited



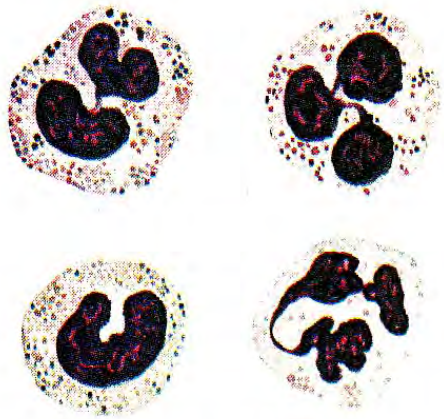
What a difference one amino acid can make!

Amino acid sequence of normal hemoglobin:

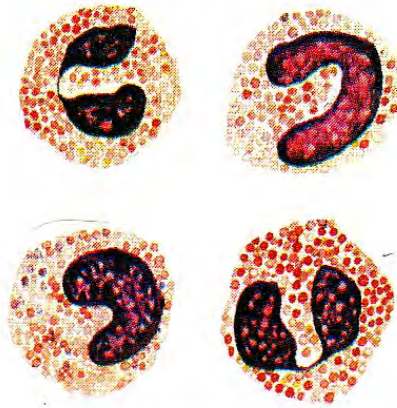
Val — His — Leu — Thr — Pro — Glu — Glu

Amino acid sequence of sickle-cell hemoglobin:

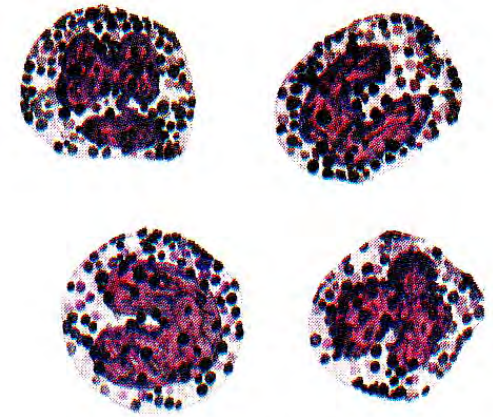
Val — His — Leu — Thr — Pro — Val — Glu



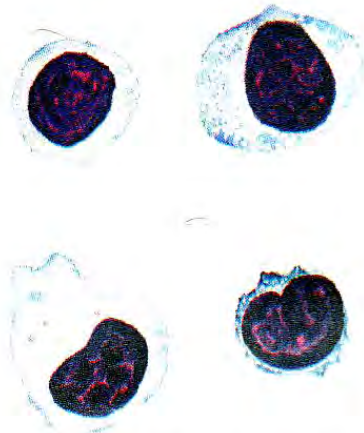
NEUTROPHILS



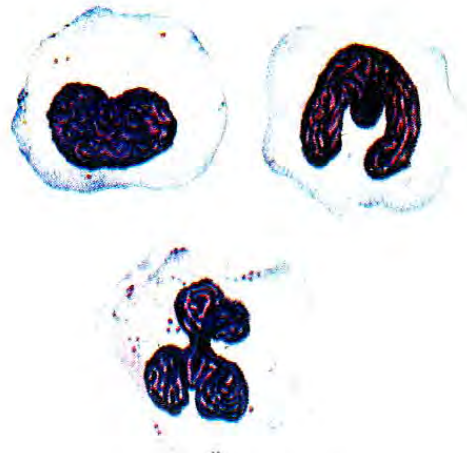
EOSINOPHILS



BASOPHILS



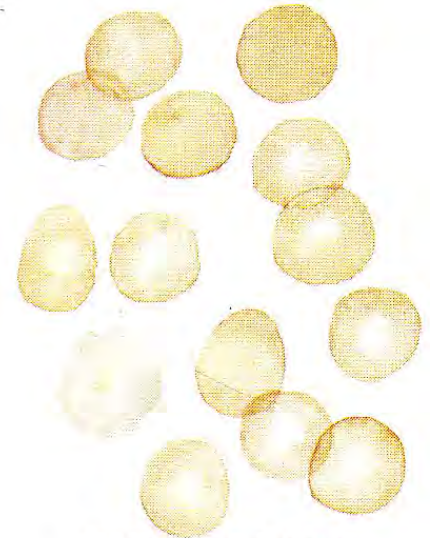
LYMPHOCYTES



MONOCYTES



PLATELETS

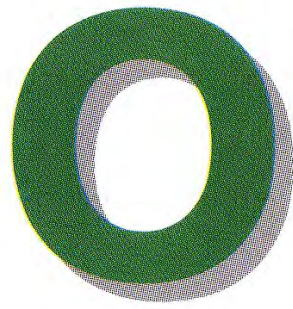


ERYTHROCYTES

AB



A & B Antigens
(Agglutinogens)



No Antigens
(Agglutinogens)

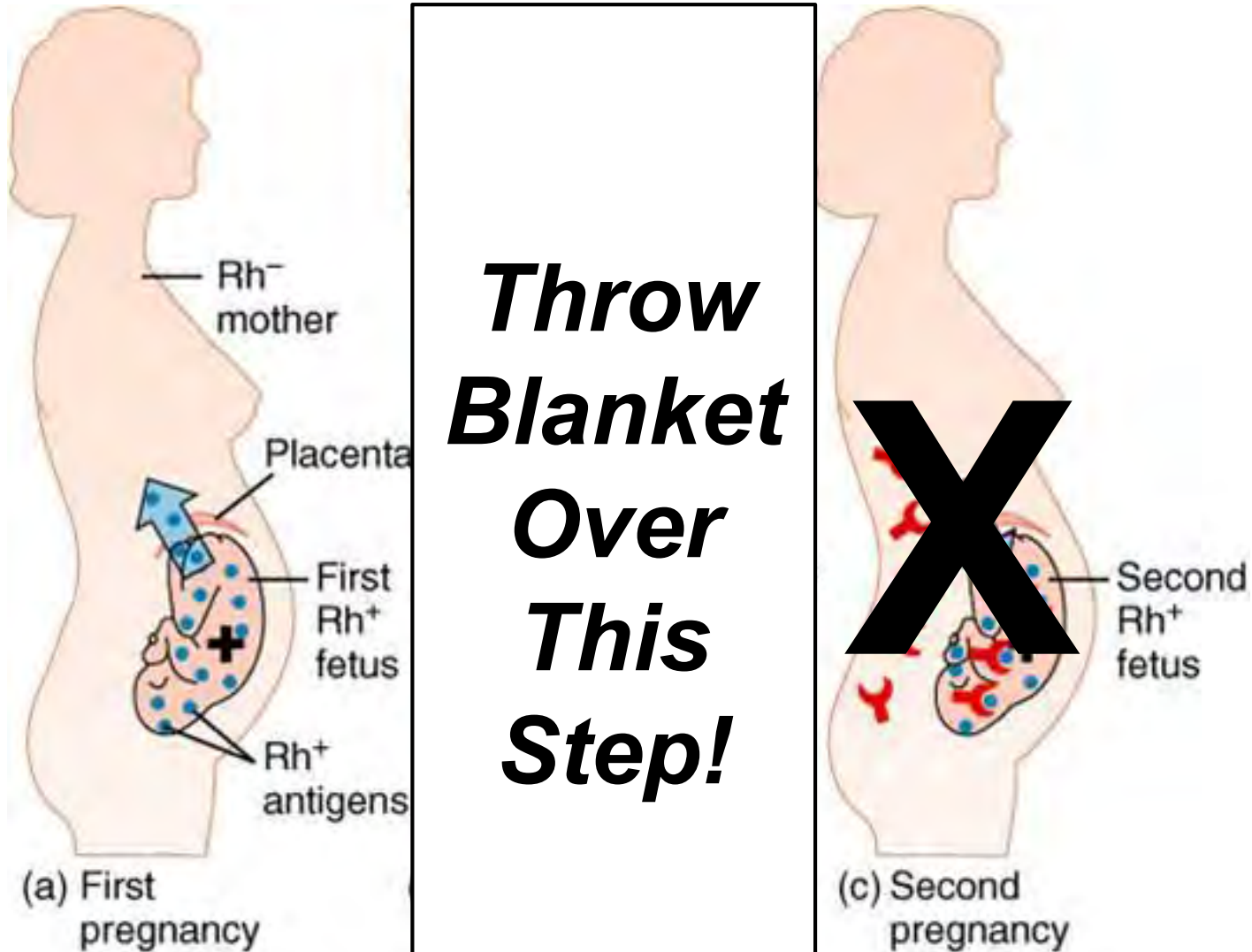
BI 121 Lecture 10



...This Thursday more fun & data about me! Heck yeah!!

- I. Announcements** To make Lab 5 educational, fun & safe for all, **please read pp 5-1 thru 5-6 in LM twice before Thursday!** Remaining exams & notebooks returned > lecture. Key posted in glass box in Huestis near 120 HUE. Estimate grade? Q?
- II. Blood Chemistry Connections** LS ch 11 p 303, ch 17 pp 525-36
Erythroblastosis fetalis, diabetes, insulin, glucagon
- III. Endocrinology Overview** LS ch 17, DC Module 13, SI Fox+
 - A. Vignette: Cushing's syndrome** LS fig 17-20 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 see-saw!) 2. Thyroid 3. Adrenals**

Erythroblastosis Fetalis or Hemolytic Disease of the Unborn/Newborn

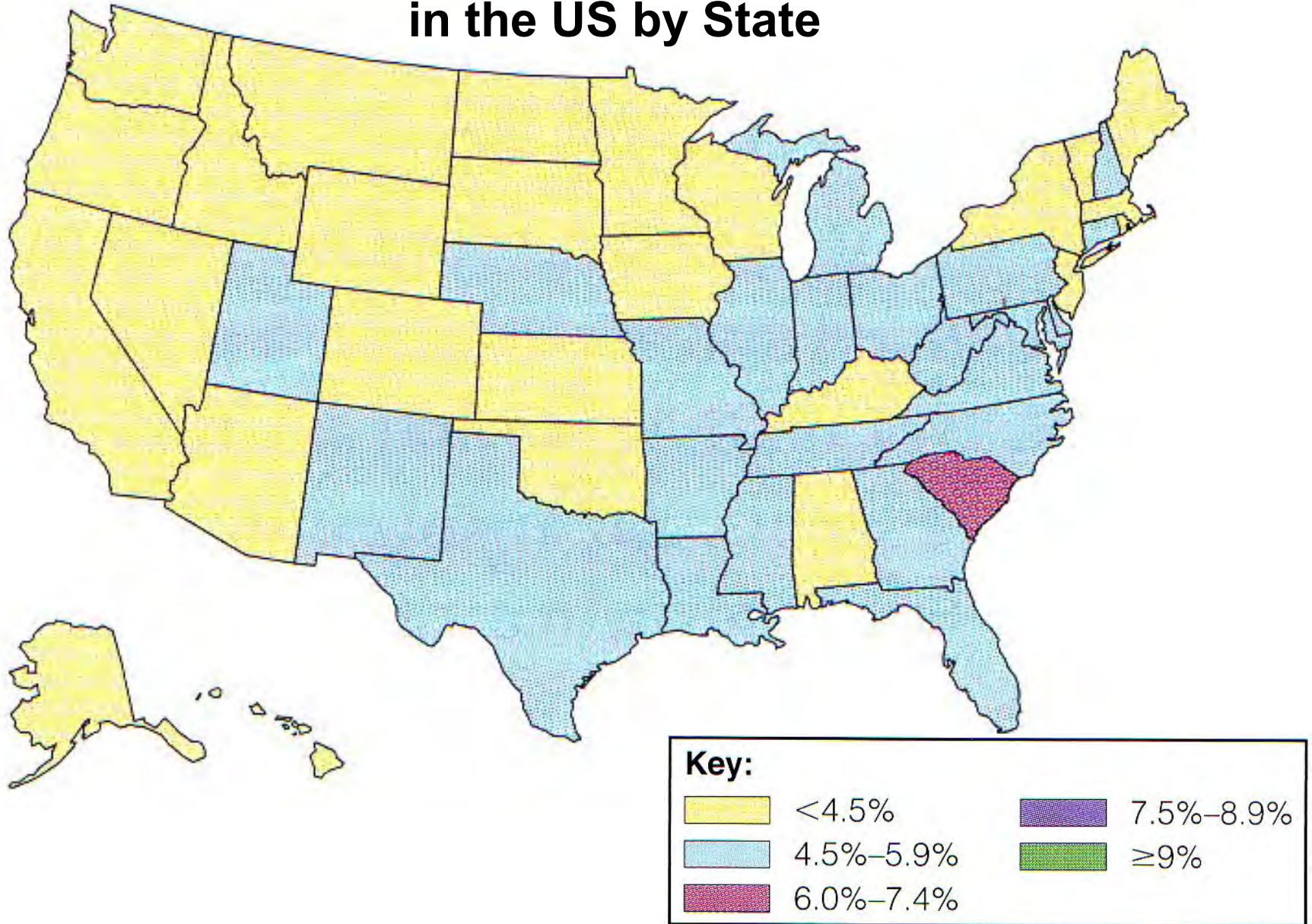


**Inject Mom with RhoGam \leq 48-72 hr
> each Rh+ Pregnancy**



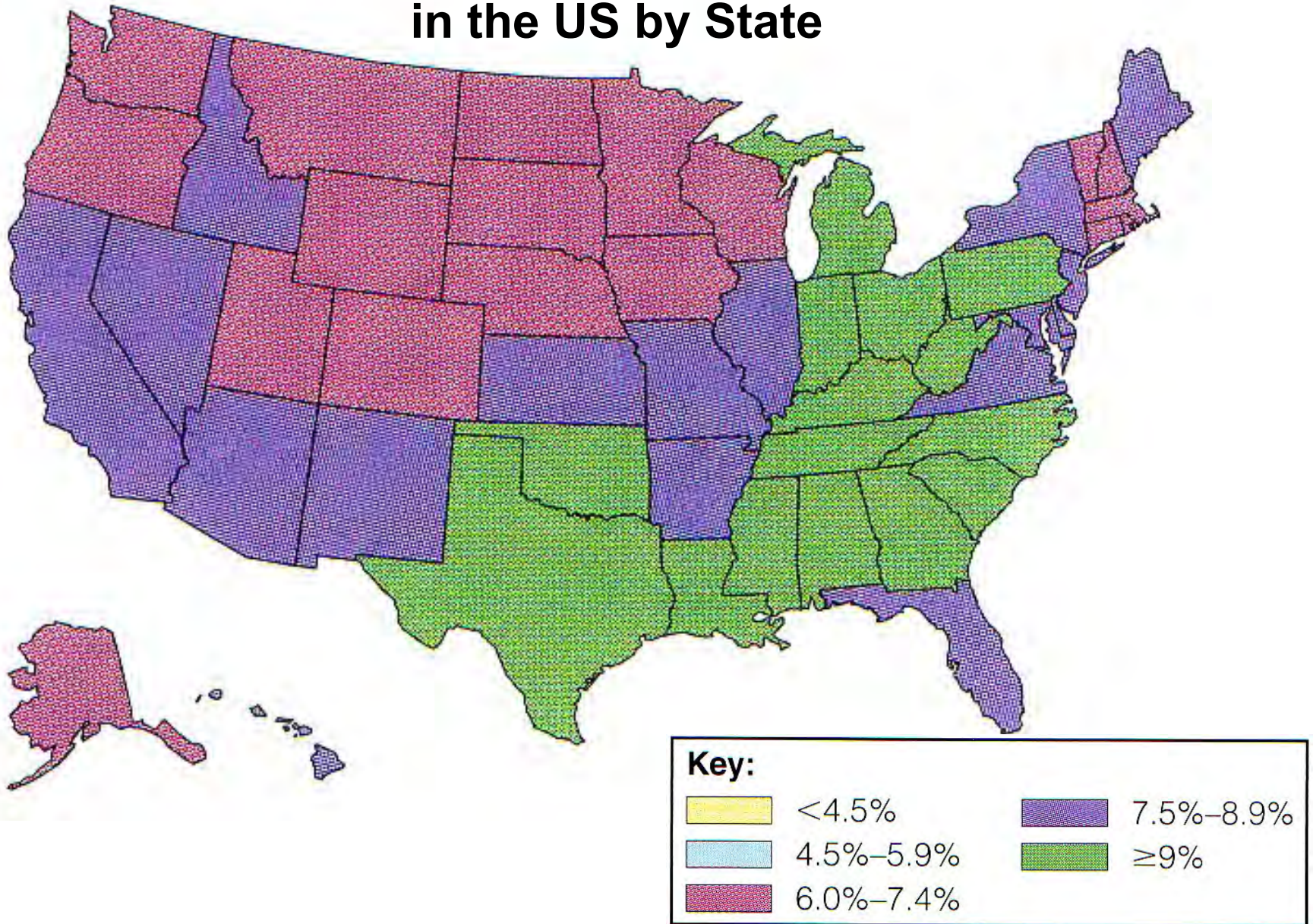
**The Blanket is RhoGam → Masks
the Mom's Immune System!**

1994 Diabetes Prevalence in the US by State



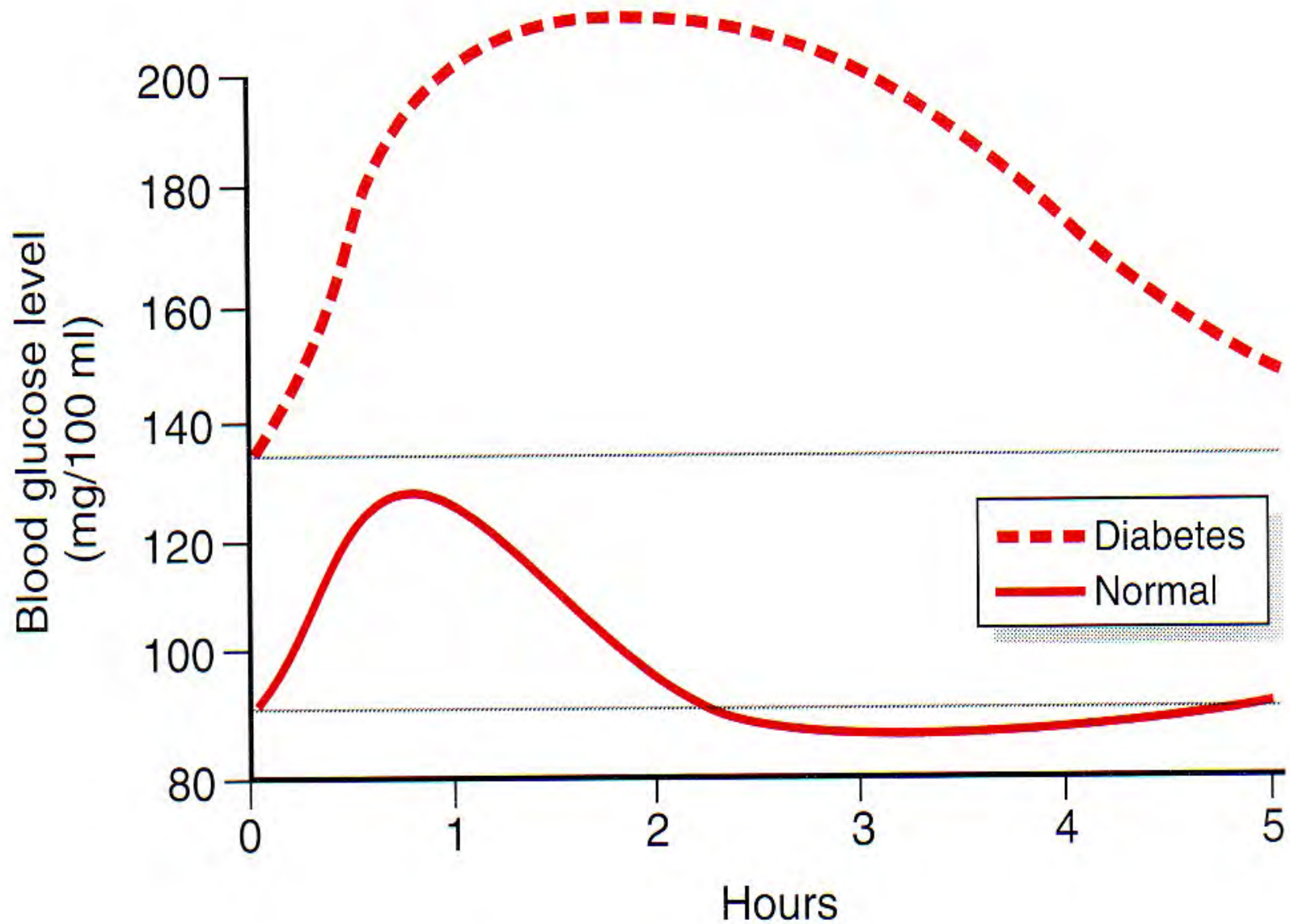
Source: Centers for Disease Control, Division of Diabetes Translation,
<http://www.cdc.gov/diabetes/statistics>, S&W 2014 fig 4-15 p139A.

2010 Diabetes Prevalence in the US by State

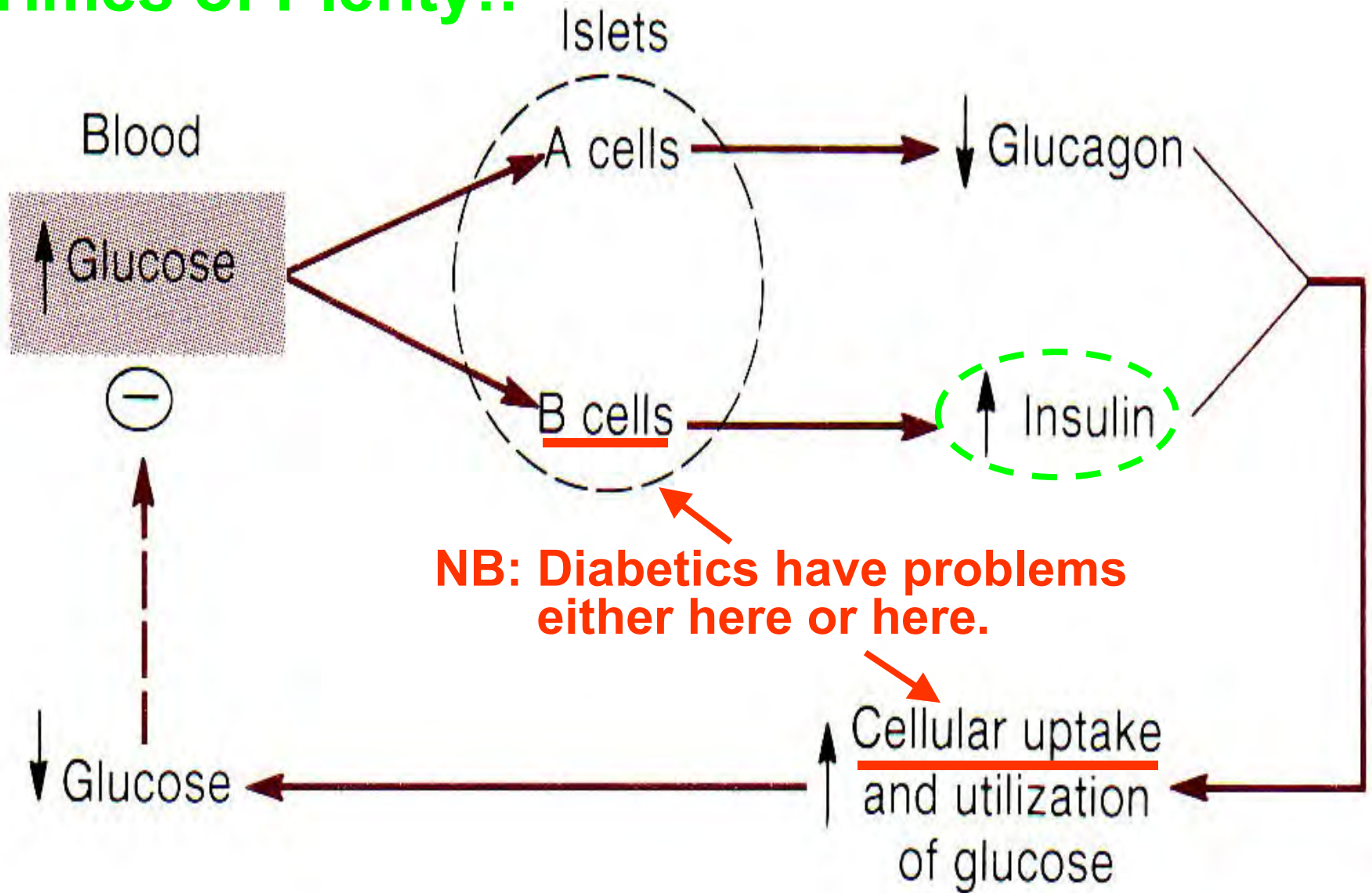


Source: Centers for Disease Control, Division of Diabetes Translation,
<http://www.cdc.gov/diabetes/statistics>, S&W 2014 fig 4-15 p139B.

Diabetic & Normal Response to Glucose Load



Times of Plenty!!



NB: Diabetics have problems either here or here.

Type 1 and Type 2 Diabetes Compared

	Type 1	Type 2
Percentage of cases	5–10%	90–95%
Age of onset	<30 years	>40 years ^a
Associated characteristics	Autoimmune diseases, viral infections, inherited factors	Obesity, aging, inherited factors
Primary problems	Destruction of pancreatic beta cells; insulin deficiency	Insulin resistance, insulin deficiency (relative to needs)
Insulin secretion	Little or none	Varies; may be normal, increased, or decreased
Requires insulin	Always	Sometimes
Older names	Juvenile-onset diabetes Insulin-dependent diabetes mellitus (IDDM)	Adult-onset diabetes Noninsulin-dependent diabetes mellitus (NIDDM)

Table 4–9

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

Diabetics must constantly juggle diet, exercise & medication to control blood glucose!



Medication

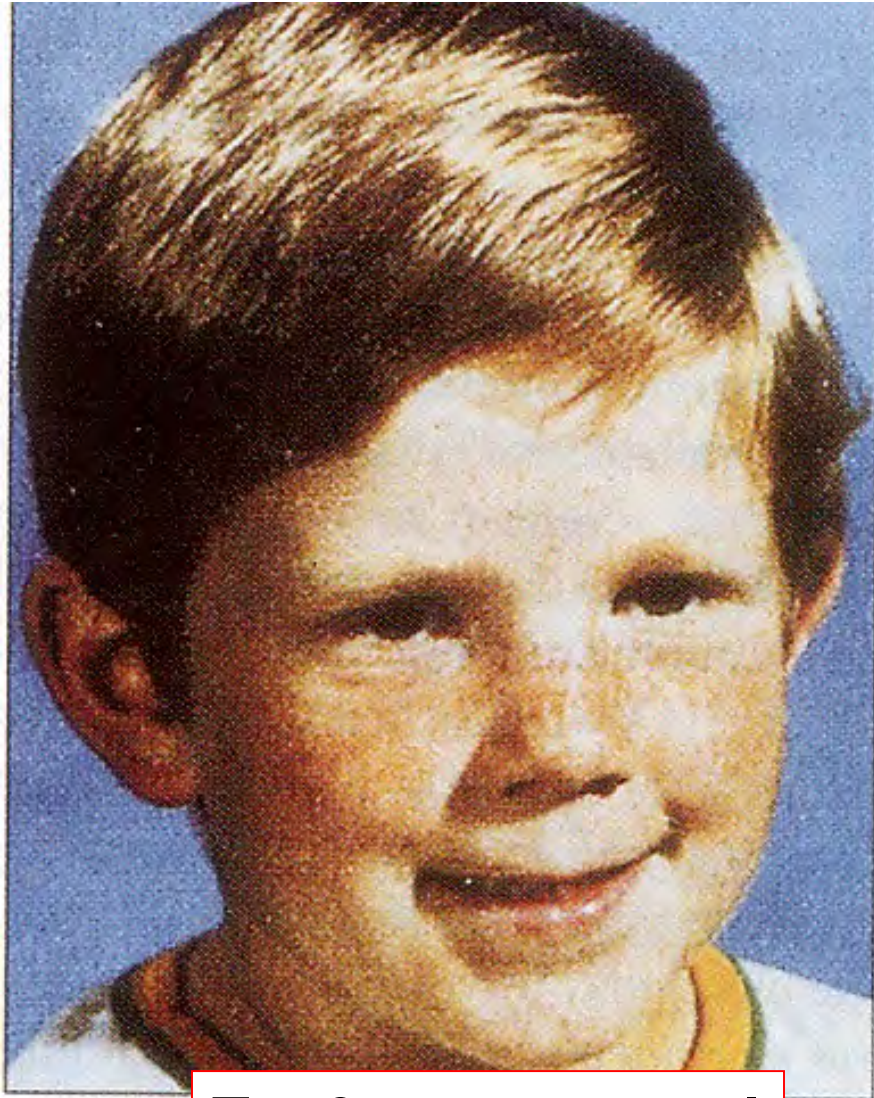
Diet

Exercise

***Exercise is a must based on
its insulin-like effect!***



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



T = 0, near normal

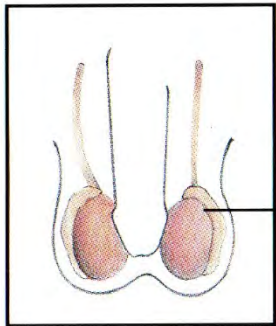


T = 4 months later

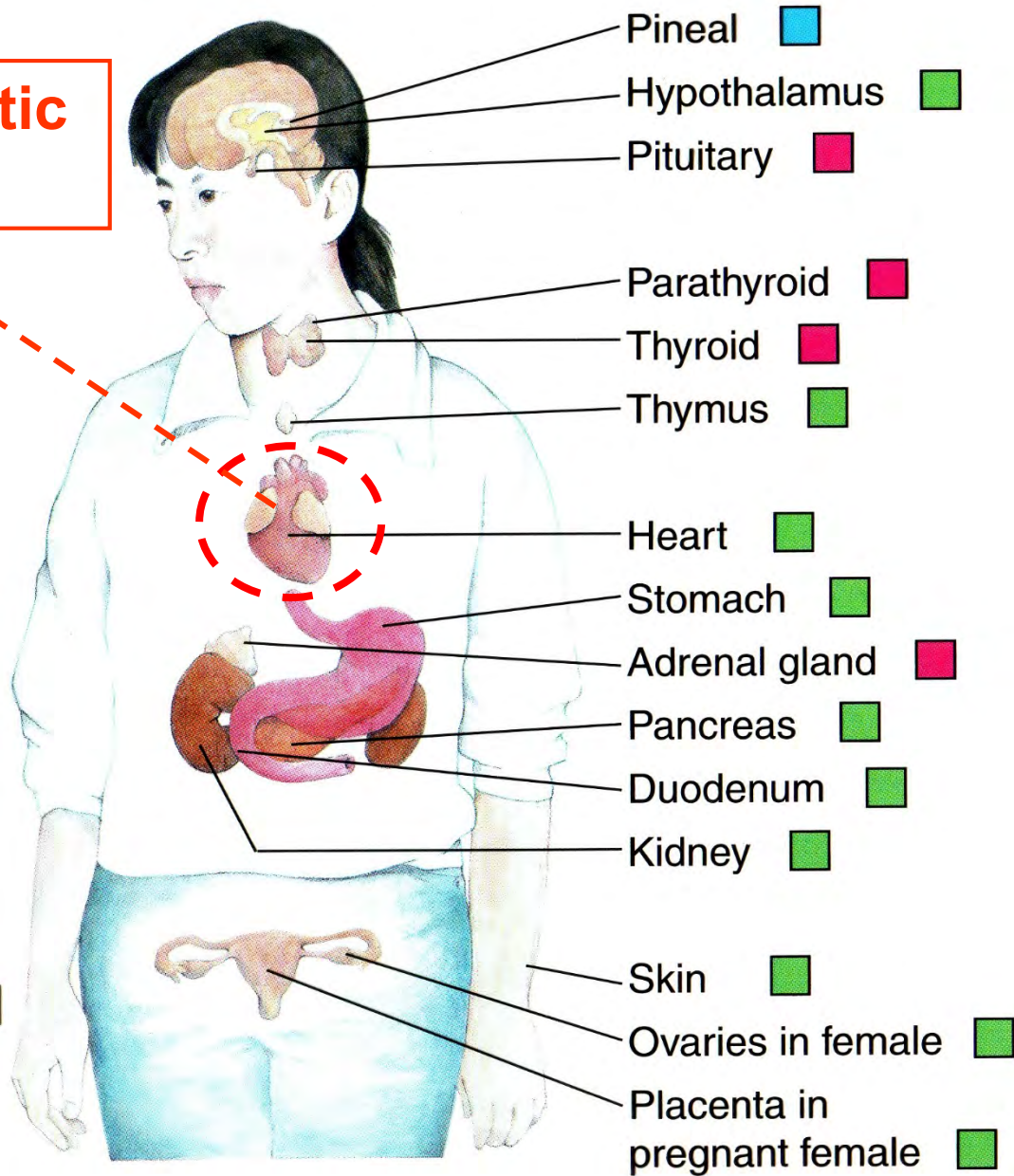
Endocrine System

ANP = Atrial Natriuretic Polypeptide

- Solely endocrine function
- Mixed function
- Complete function uncertain



Testes in male ■



Personal data I can
use for a lifetime!!



Heck yeah!

BI 121 Lecture 11

- I. *Announcements*** Blood Chem Lab today! Fun day!
Personal data!!! If you haven't already done so, please review Lab 5 in LM, in e-mail. Thanks sincerely!
Lab Manual & Exam I Remaining Returns. Q from last t?
- II. *Physiology in Hollywood News?*** Type I vs Type II diabetes
- III. *Safety & Techniques Review for Blood Chem Lab*** Q?
- IV. *Endocrine Connections*** LS ch 17, DC Module 13, SI Fox +...
 - A. What's an endocrine? + classes ~ LS pp 495 - 6**
 - B. Hypothalamus (Master) – Pituitary (Slave!)
DC pp 104-6 + LS pp 499-506**
 - C. Posterior pituitary storage site DC p 108, LS fig 17-4 p 502**
 - D. Anterior pituitary hormones DC pp 105-7, LS pp 502-6**
 - E. Endocrine feedback + reflexes LS p 540 fig 17-7**
 - F. GH: Body builder's dream? Fountain of youth?
LS pp 506-10, fig 17-10, 17-11**
 - G. Peripheral endocrine organs DC pp 109-13, LS pp 513-36**
 - 1. Pancreas 2. Thyroid 3. Adrenals**

Glucose:
Sugar in blood



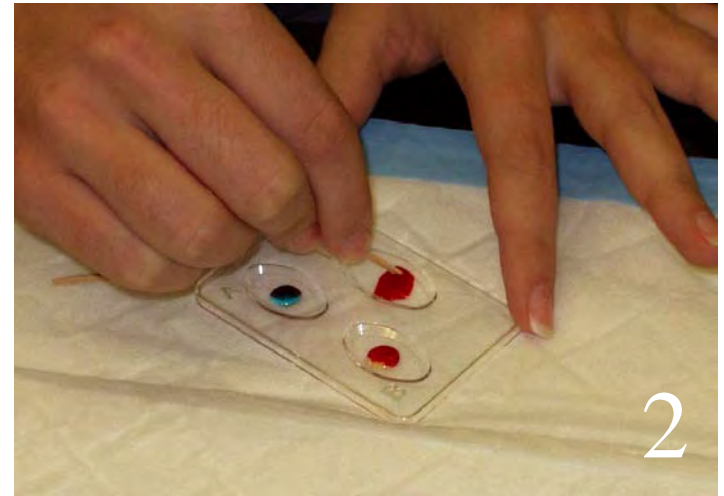
Record in
Notebook
w/dominant
hand!

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

BLOOD TYPING



ADD ANTISERA



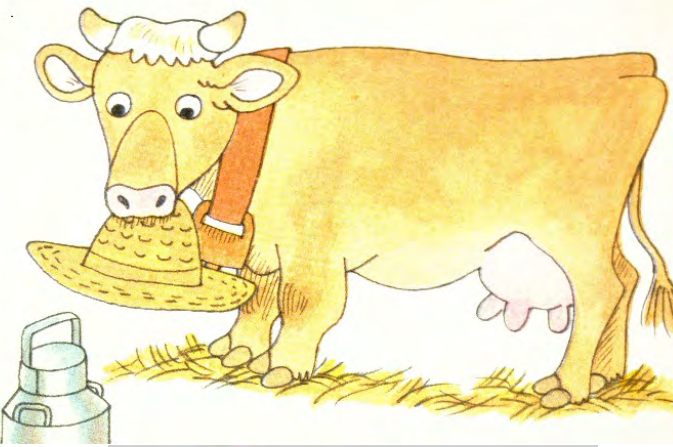
MIX W/TOOTHPICKS



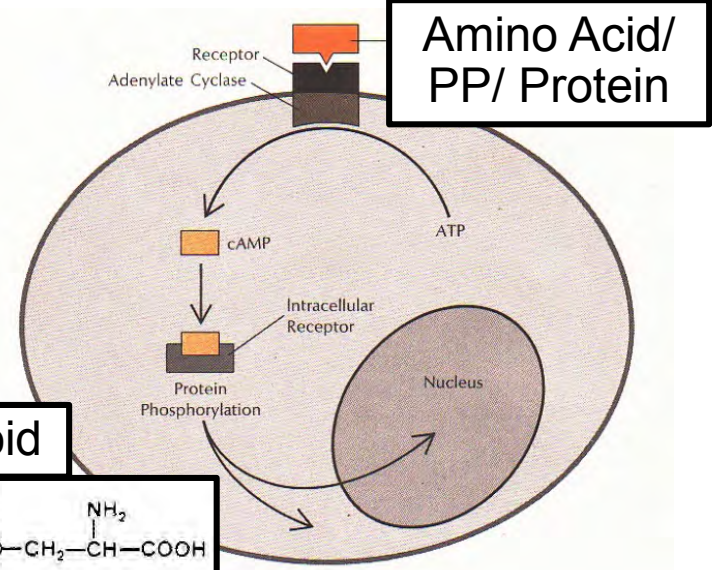
READ & RECORD!!

Hormone/Endocrine Classifications?

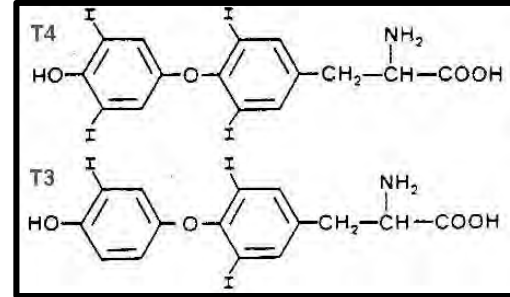
Exogenous



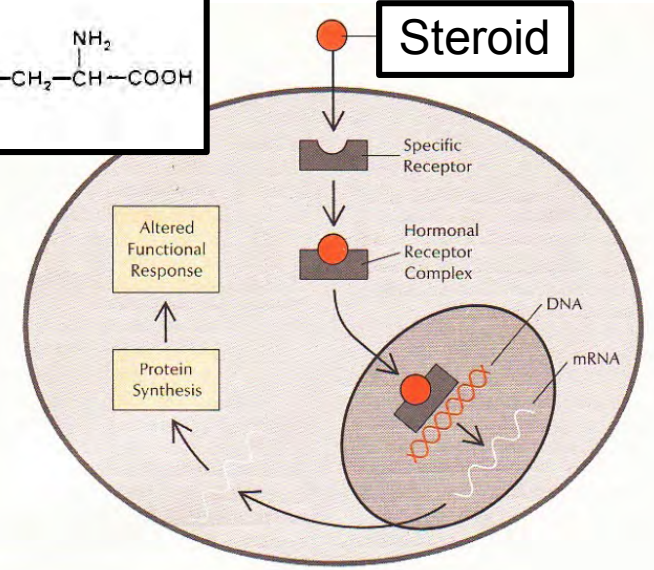
Endogenous



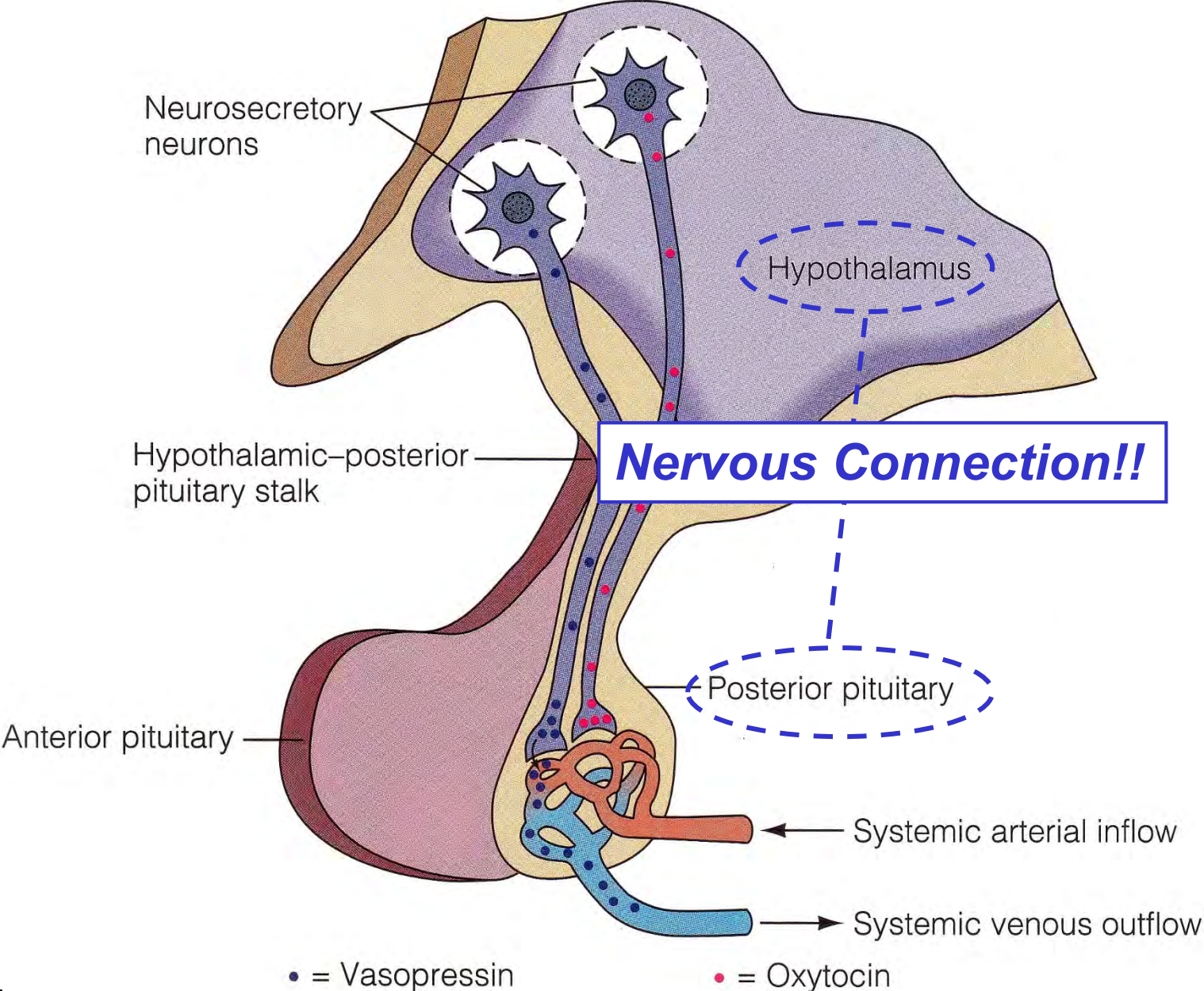
Thyroid



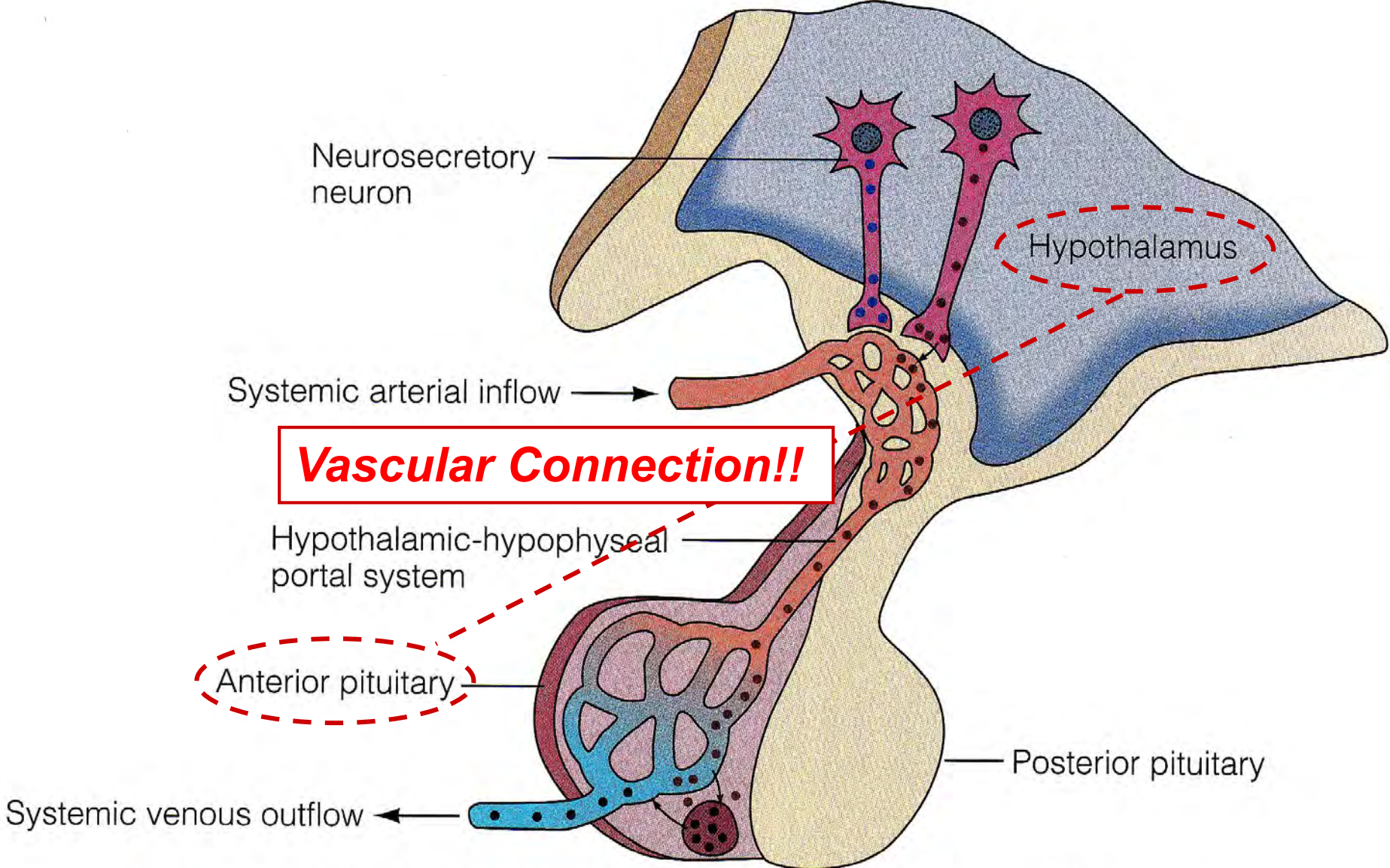
Steroid



Hypothalamus-Posterior Pituitary Nervous Connection!



Hypothalamus-Anterior Pituitary Vascular Connection!



Vascular Connection!!

• = Hypophysiotropic hormones

• = Anterior pituitary hormone

Hypothalamus talks to Anterior Pituitary by way of RH & RIH!

Neurosecretory neuron

Hypothalamus

Systemic arterial inflow

Hypothalamic-hypophyseal portal system

RH + or RIH -

Pituitary Nourishing or Growth Hormones

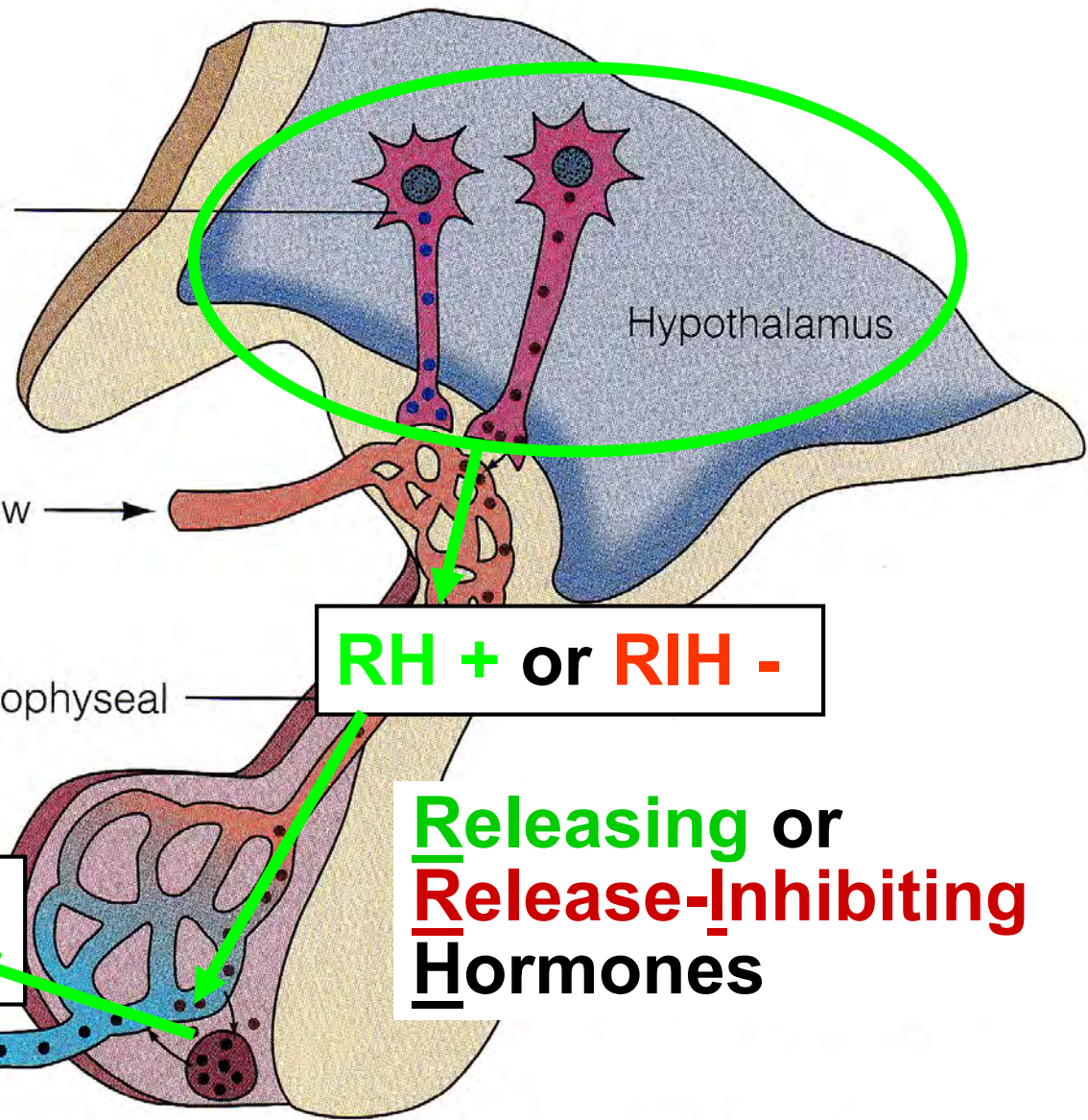
Releasing or Release-Inhibiting Hormones

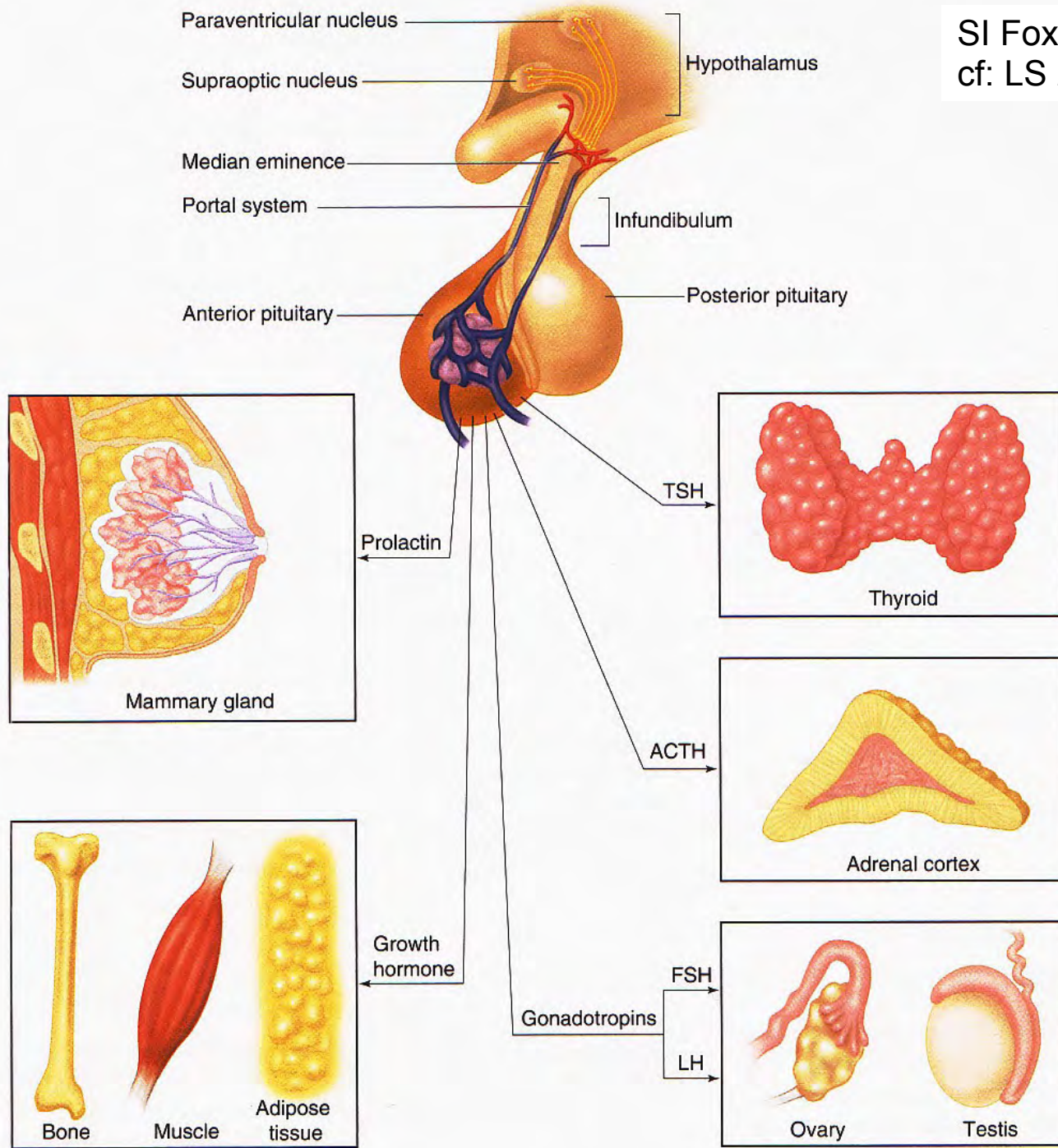
Systemic venous outflow

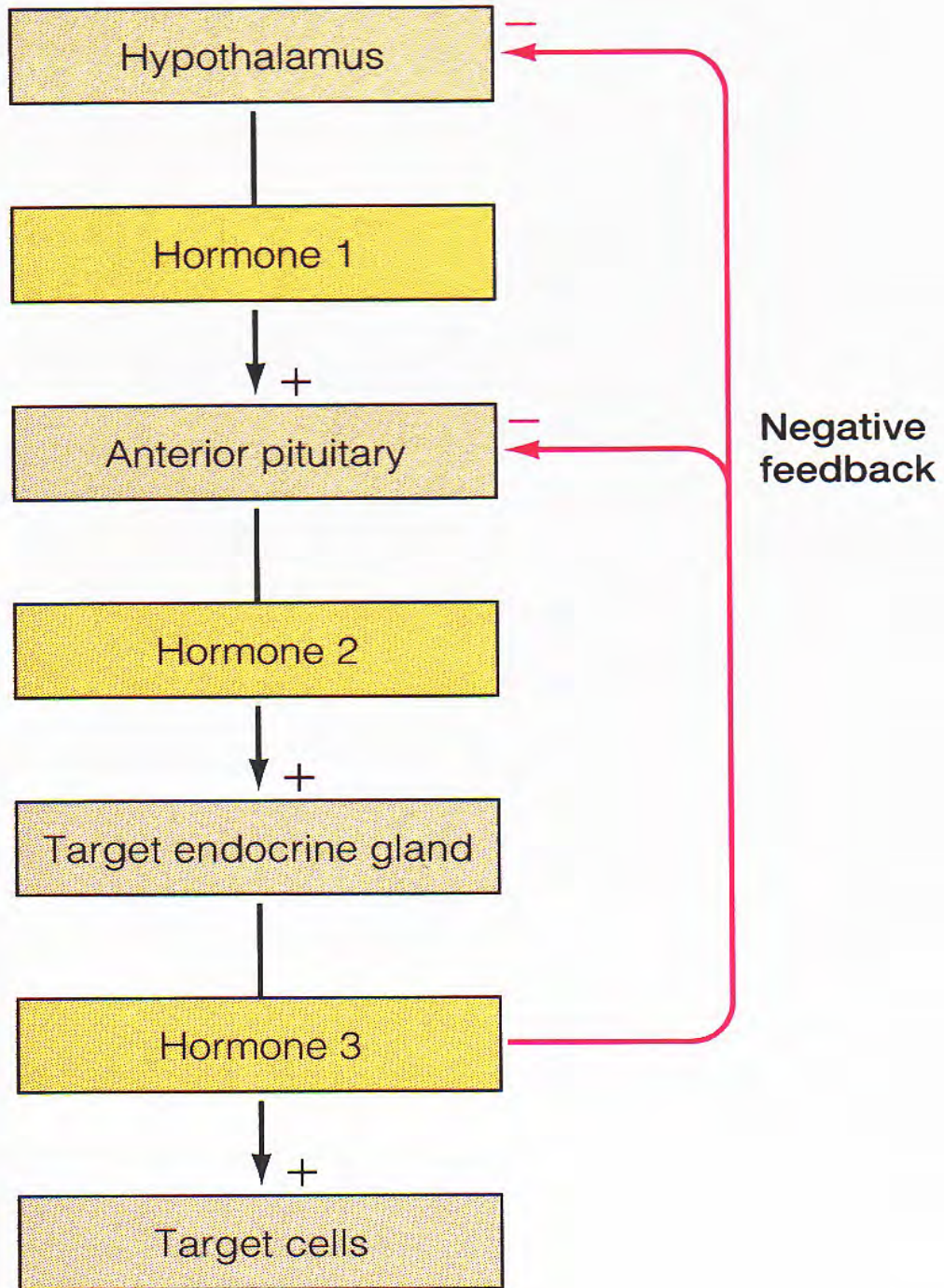
• • = Hypophysiotropic hormones

• = Anterior pituitary hormone

Hypophysis ≡ Pituitary







GH/STH Effects: Insulin Resistance/Type II Diabetes?

↑ Amino Acid uptake & Protein synthesis

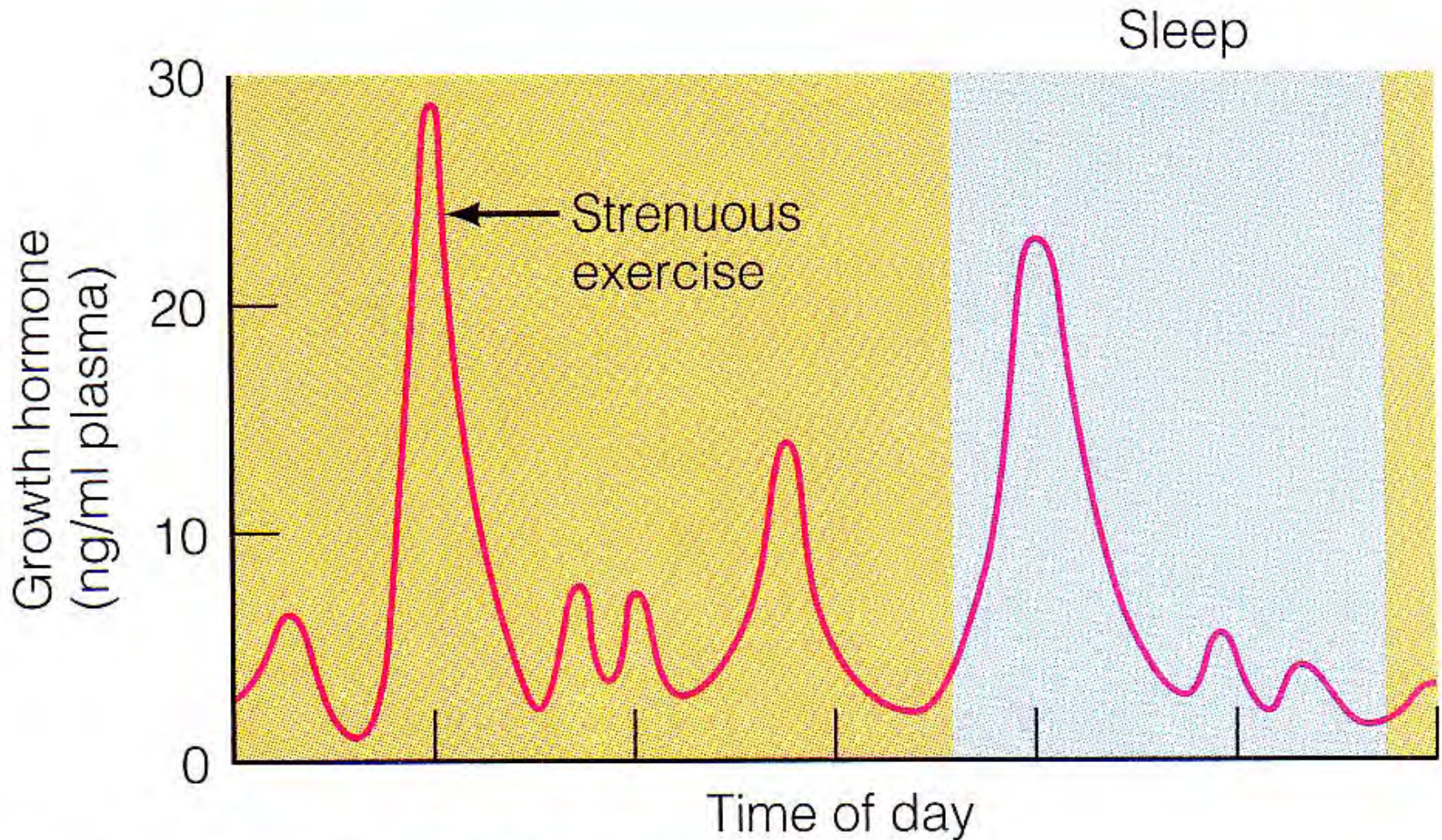
↑ Lipolysis & Fatty Acid mobilization

↓ Glucose uptake
(skeletal muscle & adipocytes)

↑ Glucose production
(liver glycogenolysis)

↑ Insulin secretion

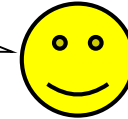
Increase GH naturally with exercise & sleep!!



ng/ml = nanograms per milliliter

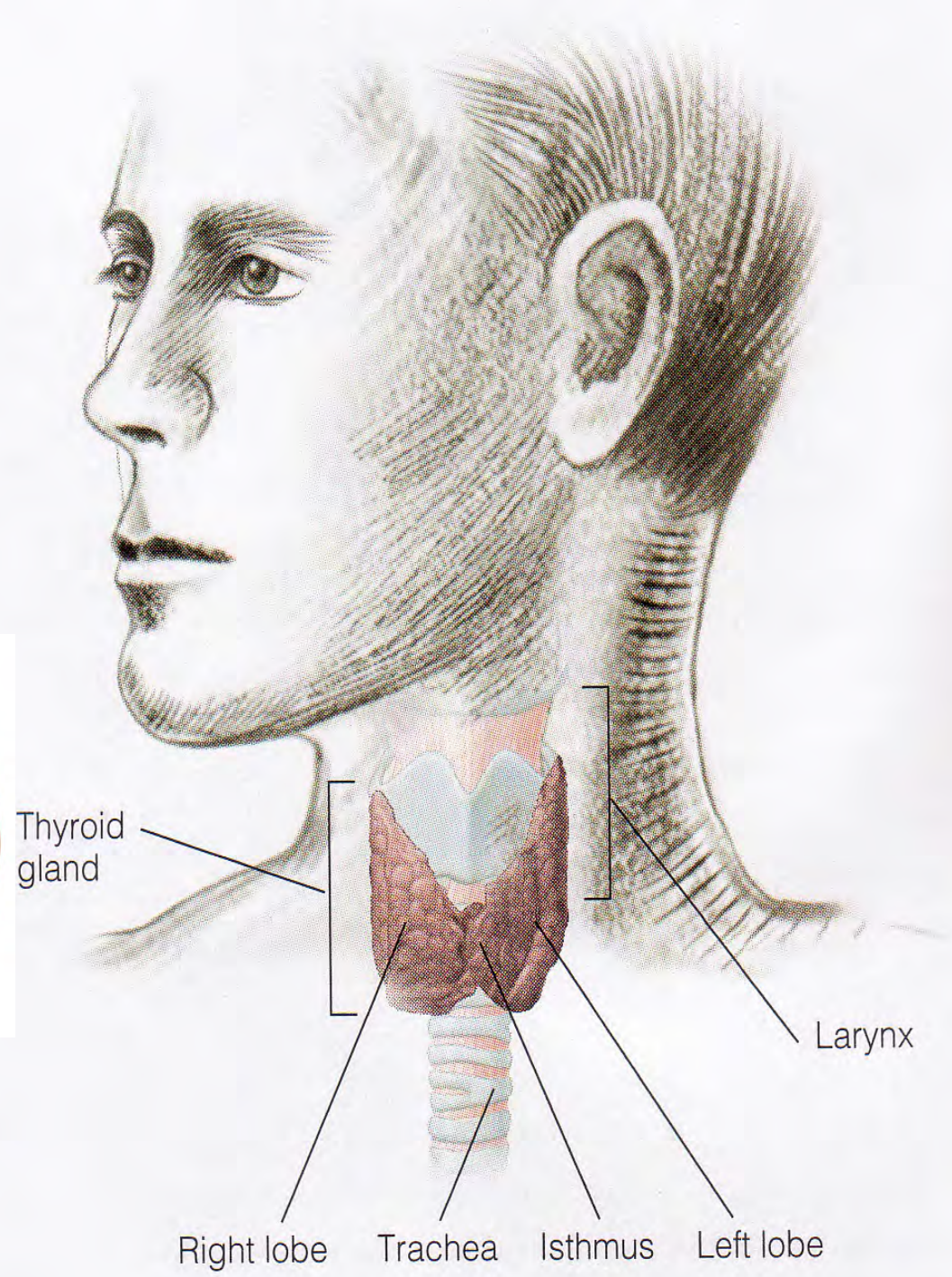
BI 121 Lecture 12

Thanks to you, Holly, Sarah, & Christina!



For your effort & your  !!

- I. **Announcements** Thanks for your help with blood lab! Great job! No lab this week. Study for Exam II, Dec 8, Mon!
- II. **Endocrine Connections** Thyroid + Adrenals/Suprarenals
LS pp 513-25 fig 17-18, 17-19; DC p 109-113 +...
- III. **Introduction to the Nervous System** LS ch 5, DC Module 9
 - A. How is the nervous system organized? LS fig 5-1 DC p 67
 - B. Neurons? What kind? Classes? Velocity? LS fig 5-2, 5-4
 - C. What's myelin? How does it help? DC fig 9-3, LS pp 83-5
 - D. Brain structure & function DC fig 9-6 thru 9-10 pp 71-5 +...
 - E. **Protect your head with a helmet!** Bicycle head injury statistics, *NHTSA* & *BHSI* from 2011, the most recent yr
- IV. **Autonomic Nervous System** LS ch 7 pp 178-85+...
 - A. Sympathetic vs Parasympathetic branches LS fig 7-3
 - B. Neurotransmitters & receptors LS fig 7-1 & 7-2, tab 7-2
 - C. Actions LS tab 7-1
 - D. Fight-or-flight stories!



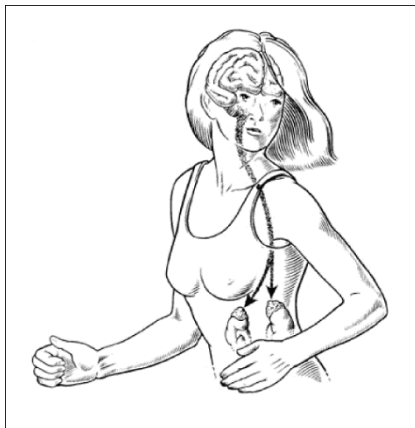




BI 121!!



Epinephrine
80%
Norepinephrine
20%



Guyton & Hall 2000

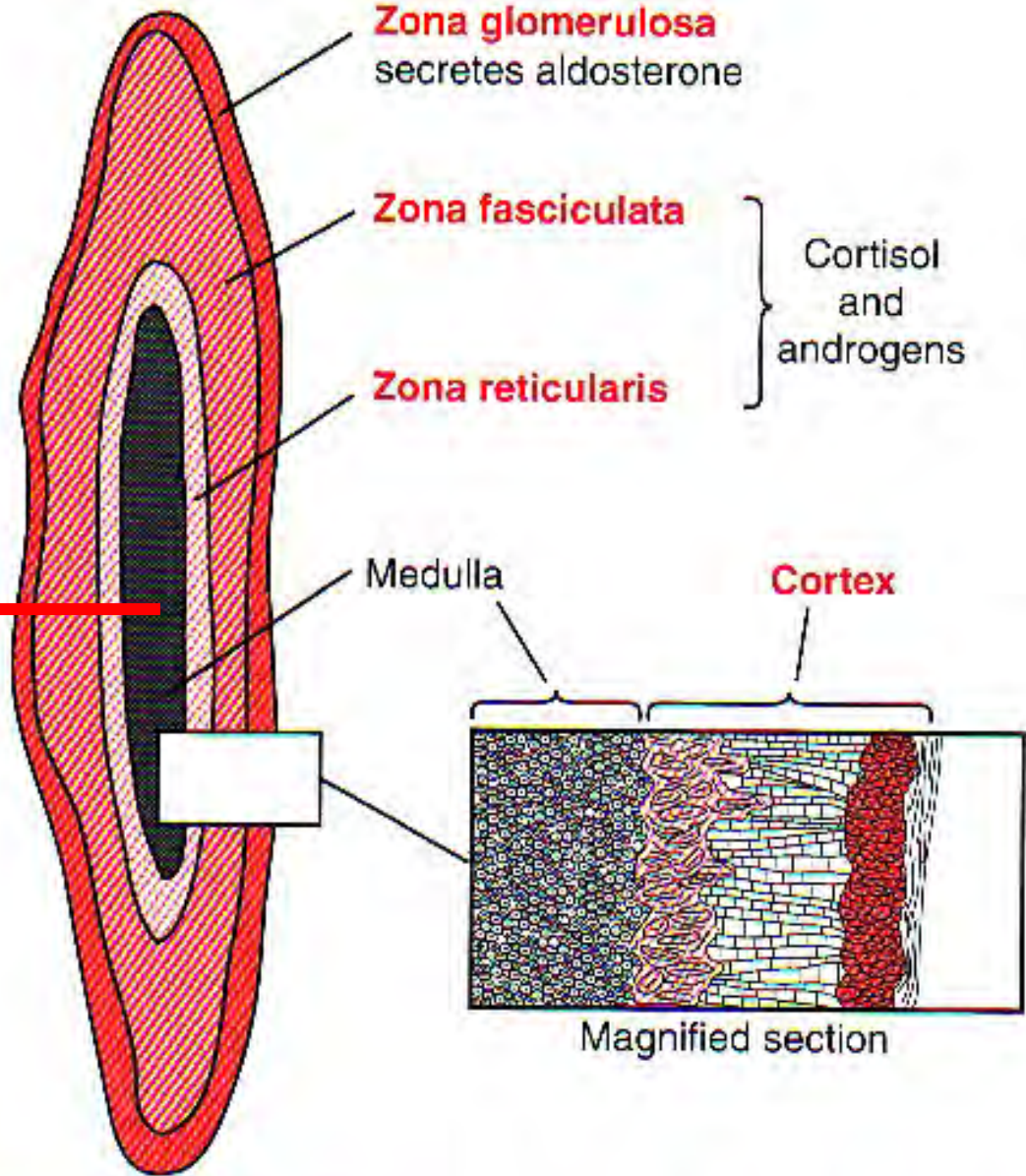
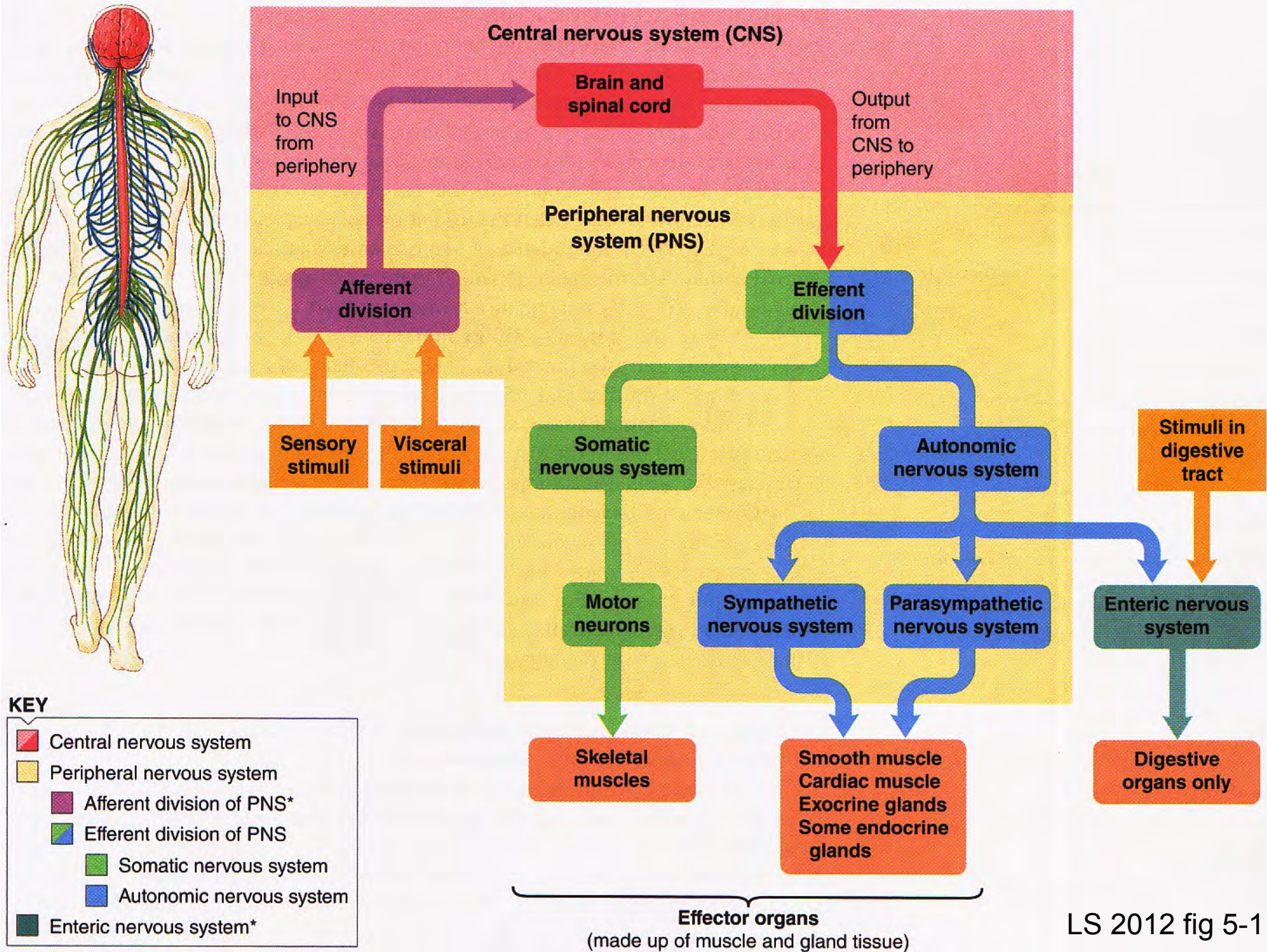
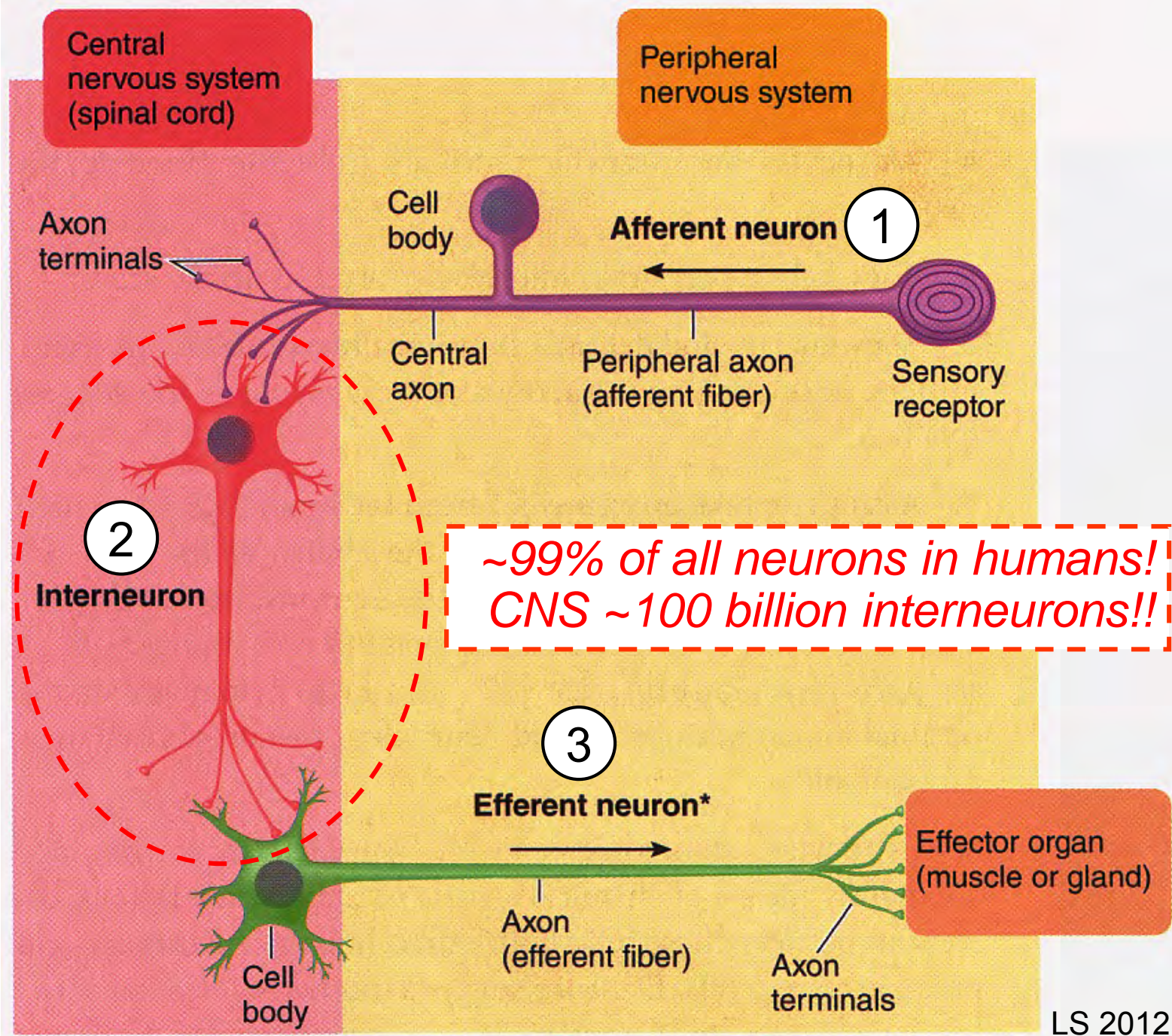


FIGURE 77 - 1

Secretion of adrenocortical hormones by the different zones of the adrenal cortex.







I'm gonna smash Exam II because
— I'm dedicated & I ♥ physiology!



BI 121 Lecture 13

I. Announcements **No lab today – Study for Exam II!!**

Optional Lab notebook check after last Lab 6, Mac pulmonary function testing (PFT) next Thursday. Q?

II. CNS Connections Myelin, brain + spinal cord (CNS)

Protect your head with a helmet! Bicycle head injury statistics *NHTSA & BHSI, 2011 data*

III. Peripheral Nervous System LS sections of ch 3, 4, & 7

A. Autonomic NS: Branches, neurotransmitters, receptors, actions, fight-or-flight stories ch 7 pp179-85

B. Why are nerve & muscle unique? ch 4 p 71

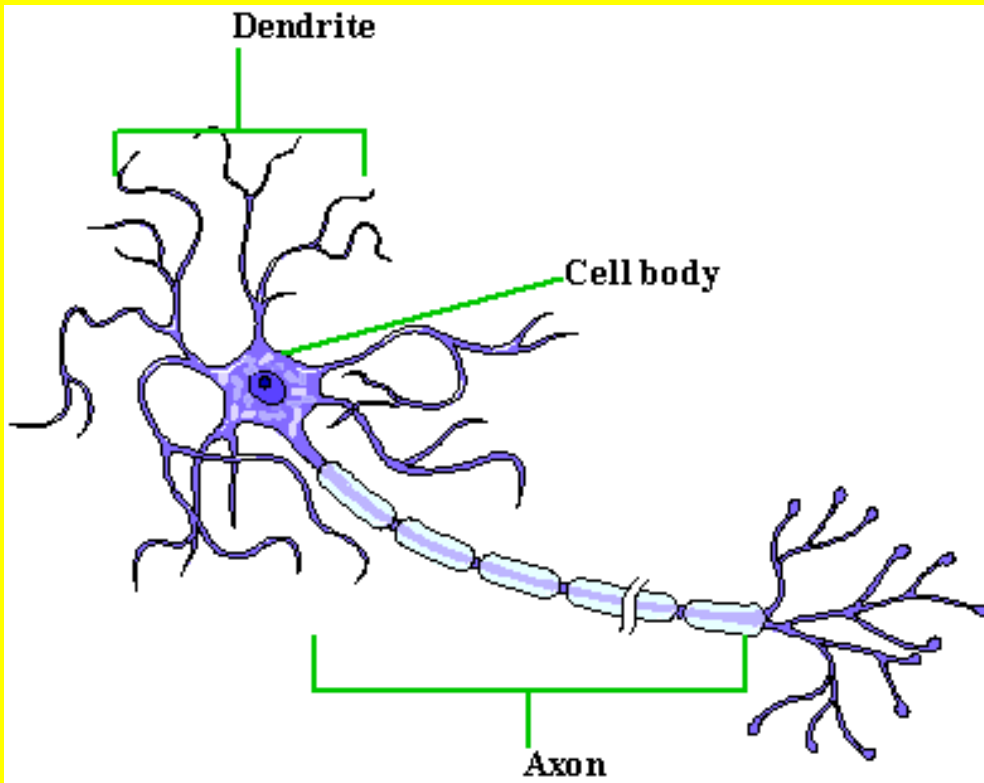
C. How do excitable cells signal? ch 3 pp62-7; ch 4 pp74-83

D. How does the signal cross the nerve-muscle gap?
ch 7 p 185-92 fig 7-5 p 190

1. Ca²⁺ bones!...but what else? p 190

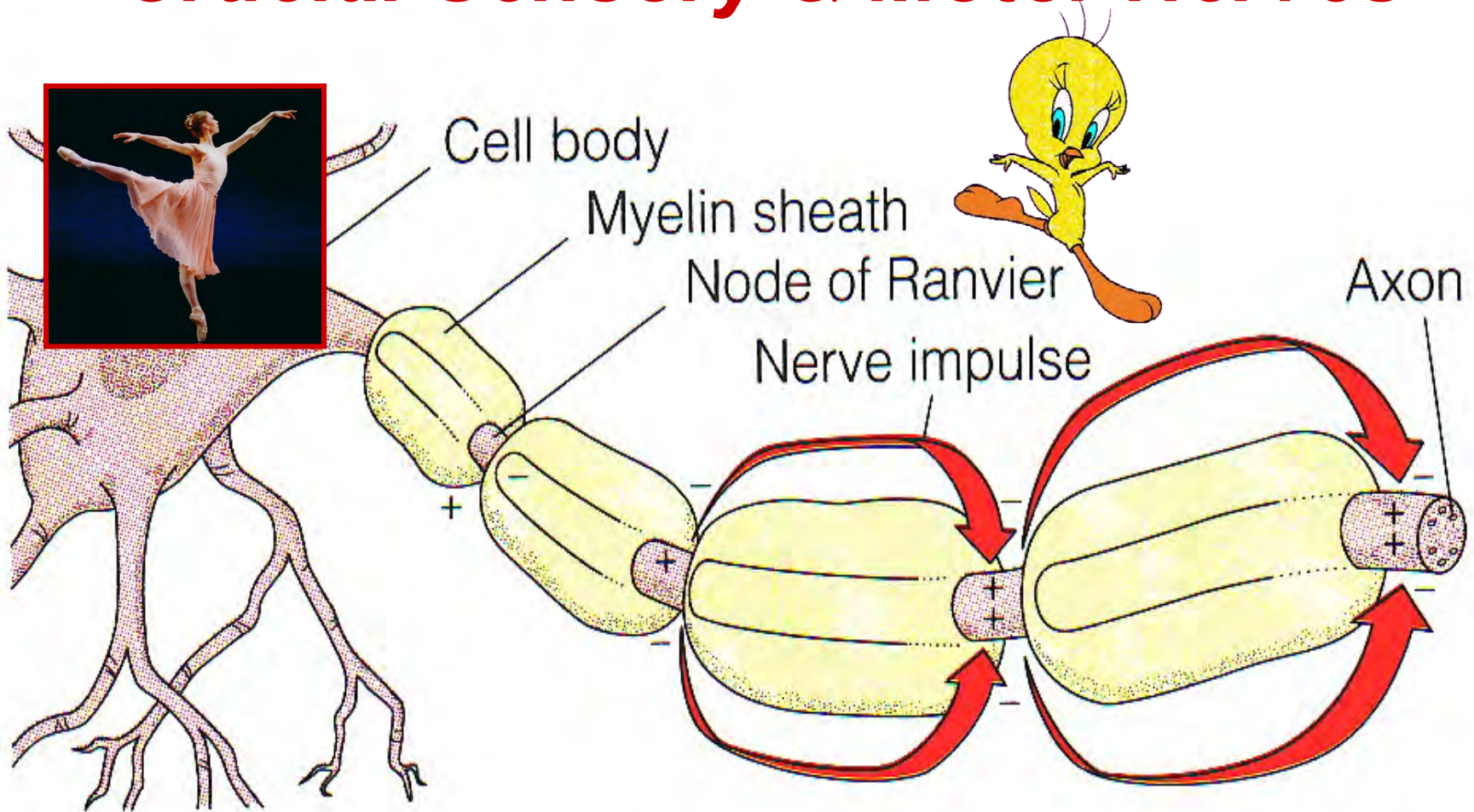
2. What do black widow spider venom, botulism, curare & nerve gas have in common? Botox pp 189-92

What is myelin? Why is it important?

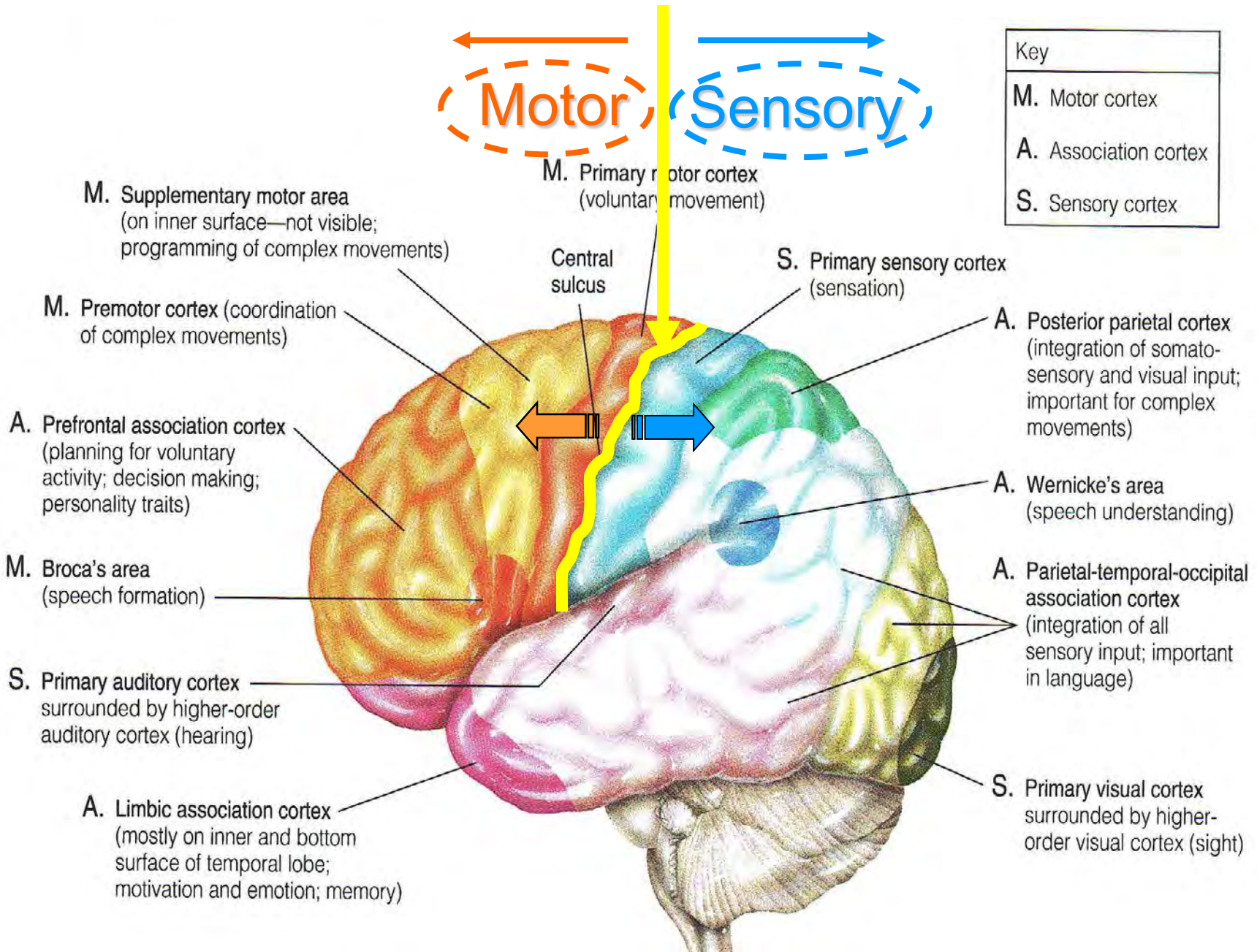


Lipid insulative coat
 $\uparrow \vec{v}$, *conserves ions & ATP*

Saltatory/Leaping Conduction! Crucial Sensory & Motor Nerves



L. saltare to hop or leap! Fr. salt, sautier, sauté, leap, high air, vault



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

MRI 061307
Lumbar spine
Lateral view

L1

L2

L3

L4

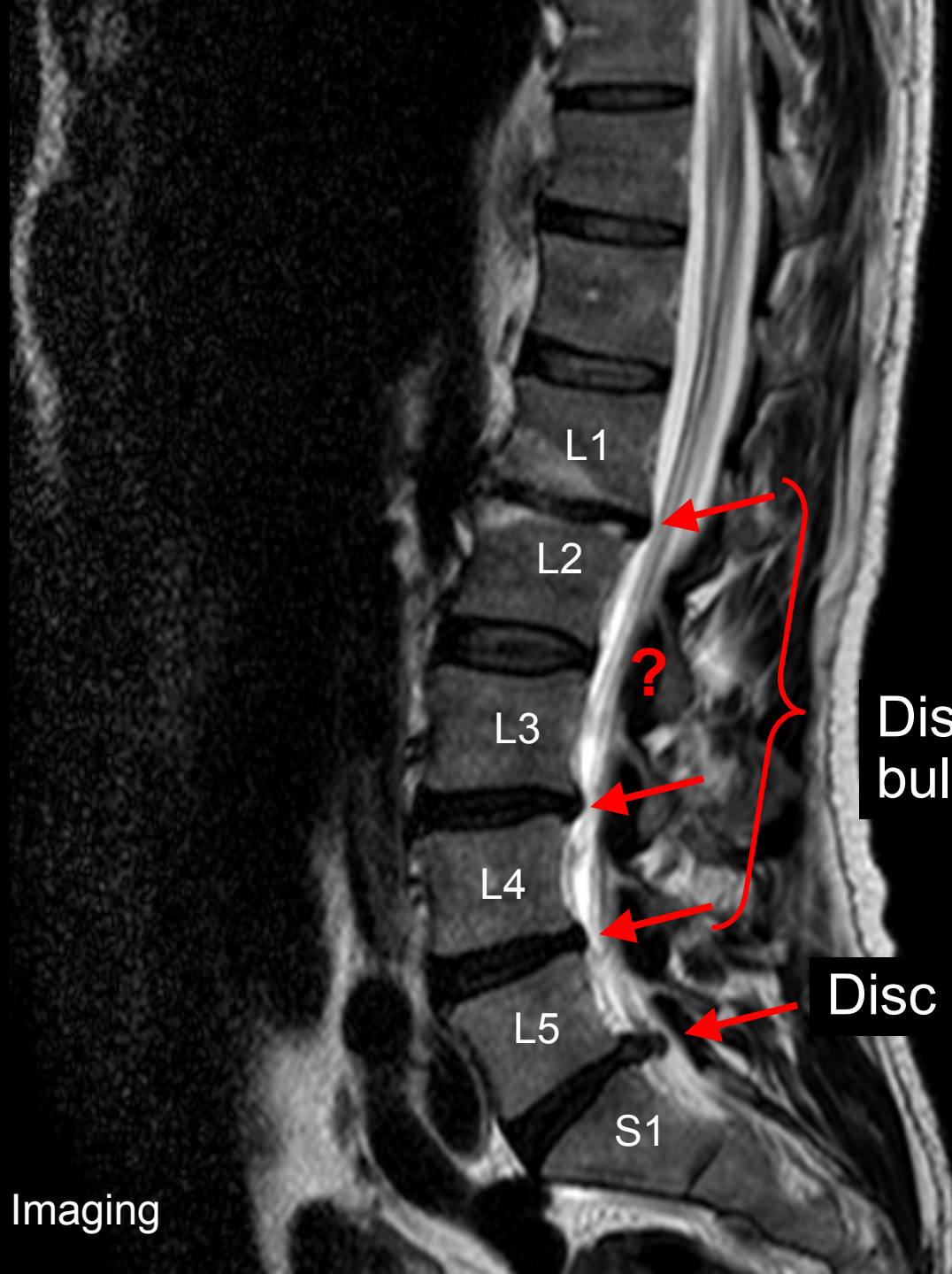
L5

S1

?

Discs
bulging

Disc herniation



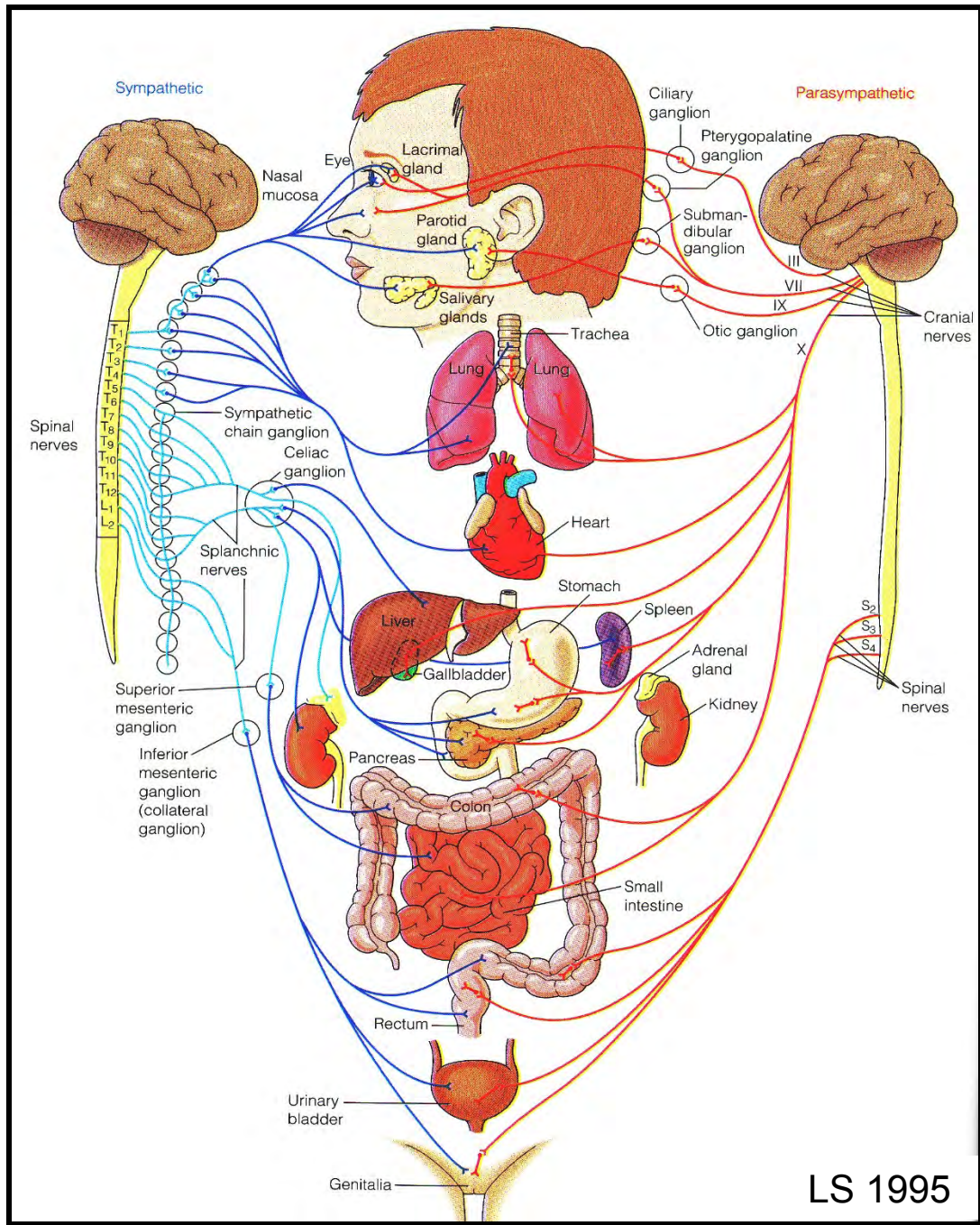
The "typical" bicyclist killed on our roads is a sober male over 16 riding without a helmet. He's hit by a car on a major road between intersections in an urban area on a summer evening. Please wear a helmet – it can make the difference between life and death.



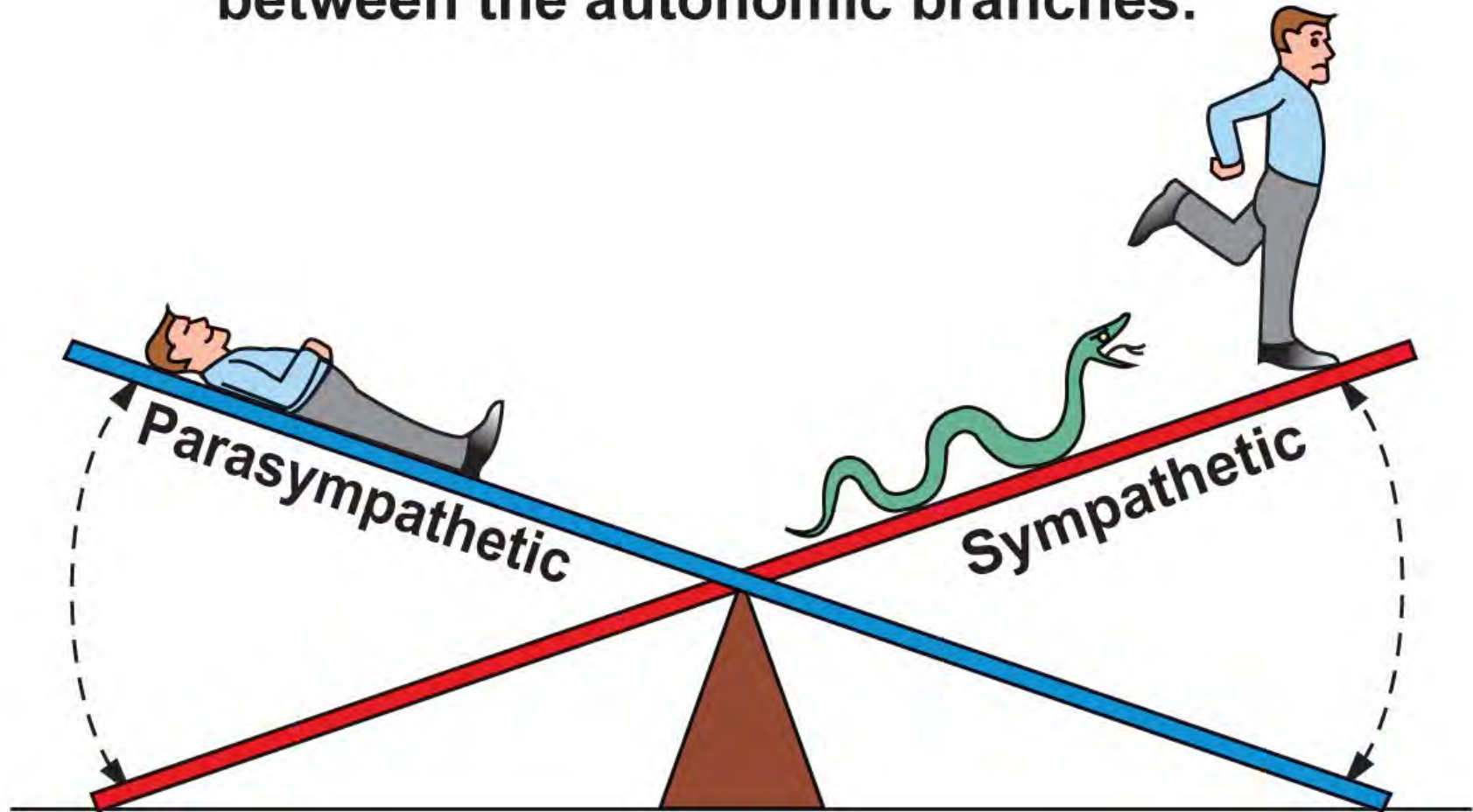
Autonomic Nervous System

Why overlap or dual innervation?

Fine-tune control & safety!



Homeostasis is a dynamic balance between the autonomic branches.



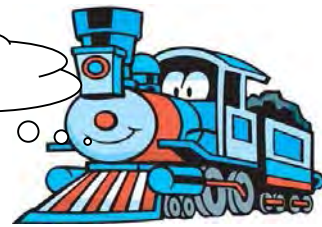
**Rest-and-digest:
Parasympathetic
activity dominates.**

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

Exam II is coming! I'll be ready!!...



BI 121 Exam II!



BI 121 Lecture 14

I. Announcements Last Lab 6, Pulmonary Function Testing + optional notebook ✓ this Thurs. **Exam II Tues, Dec 8, 8 am Q?**

II. Nervous System Connections LS 7

- A. Autonomic NS: Branches, neurotransmitters, receptors, actions, fight-or-flight stories ch 7 pp 179-85
- B. Why are nerve & muscle unique? ch 4 p 71
- C. How do excitable cells signal? ch 3 pp 62-7; ch 4 pp 74-83
- D. How does the signal cross the nerve-muscle gap?
ch 7 p 185-92 fig 7-5 p 190
- E. What do black widow spider venom, botulism/Botox?, curare & nerve gas have in common? LS fig 7-5 p 190

III. Muscle Structure-Function & Adaptation LS ch 8 + DC Mod 12

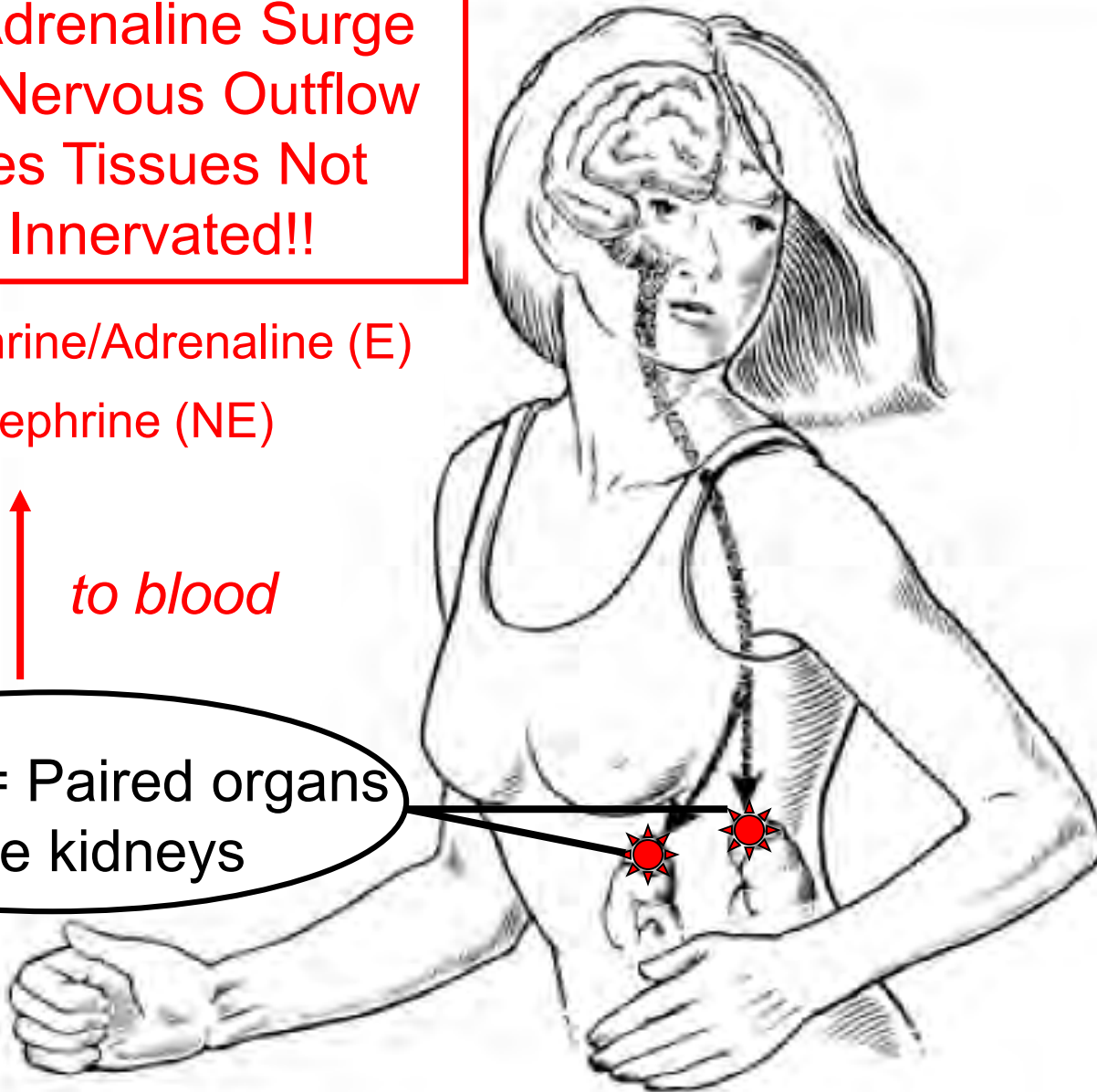
- A. Muscle types: cardiac, smooth, skeletal LS fig 8-1 pp 194-6
- B. How is skeletal muscle organized? LS fig 8-2, DC fig 12-2
- C. What do thick filaments look like? LS fig 8-4, DC fig 12-4
- D. Thin filaments? Banding pattern LS fig 8-5, 8-3, 8-7
- E. How do muscles contract? LS fig 8-6, 8-10
- F. What's a cross-bridge cycle? LS fig 8-11 +...

**Hormonal Adrenaline Surge
Reinforces Nervous Outflow
& Accesses Tissues Not
Directly Innervated!!**

80% Epinephrine/Adrenaline (E)
20% Norepinephrine (NE)

Output ↑ *to blood*

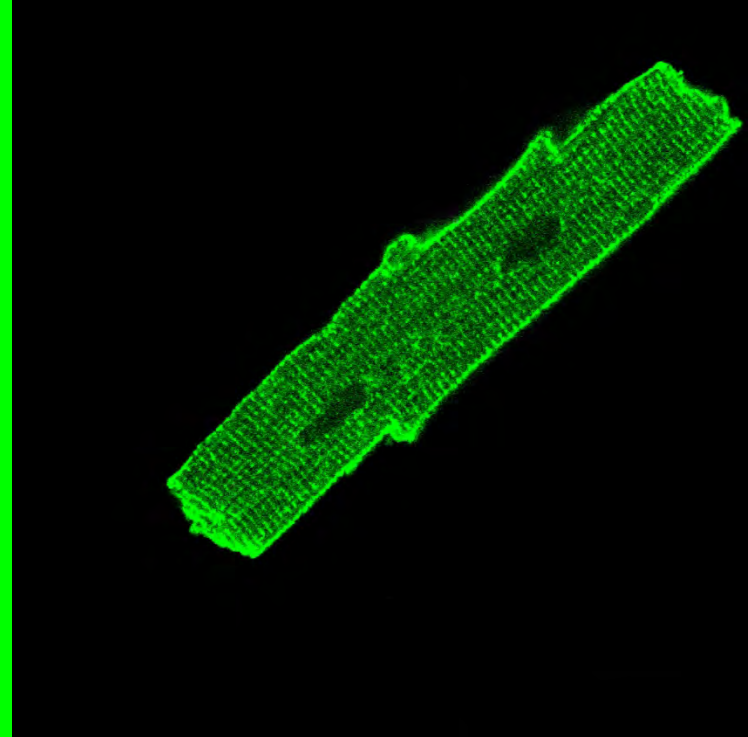
Adrenals = Paired organs
above kidneys



▲ 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

Why are nerve & muscle unique?



They are excitable!!

Action Potentials \equiv Spikes \equiv Impulses

Ultra-short reversal of membrane potential

Only in nerve and muscle cells

Maintains strength over distance

Primary way nerves & muscles communicate!

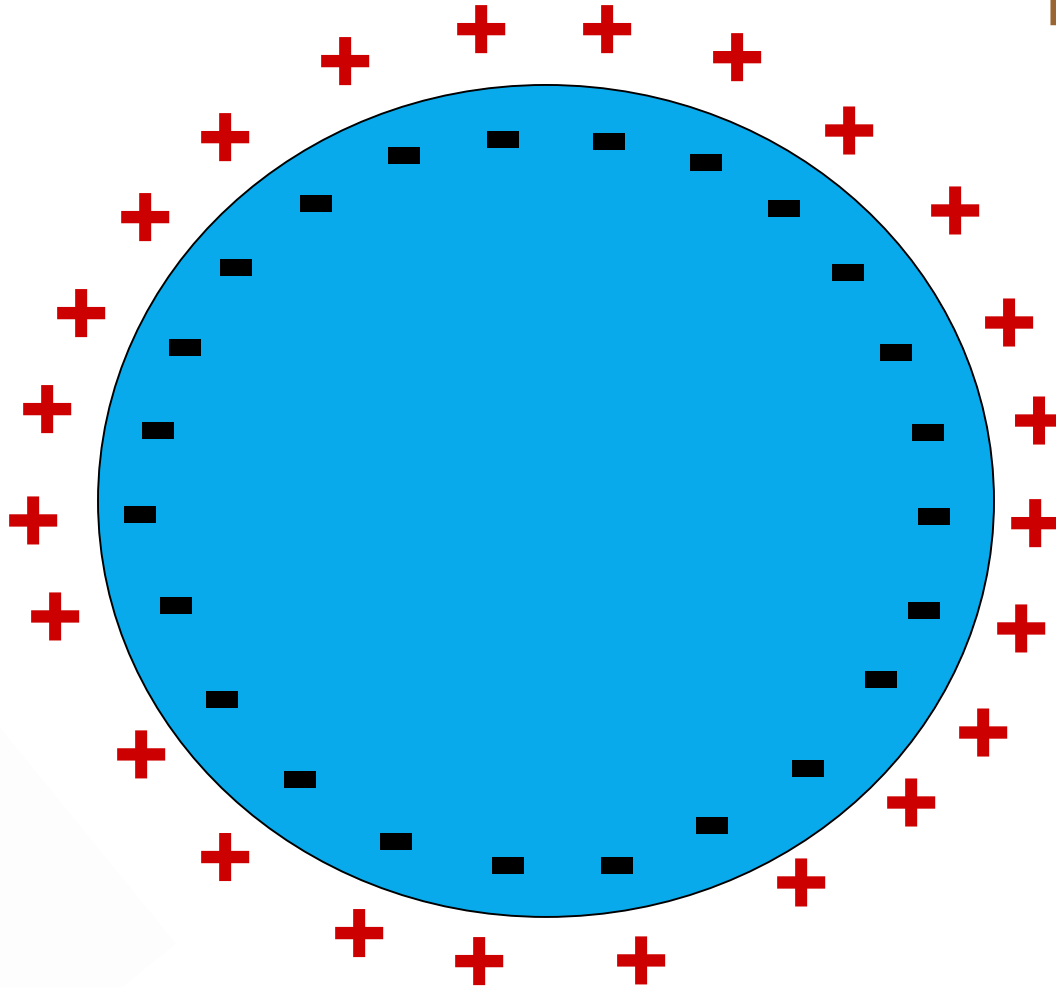
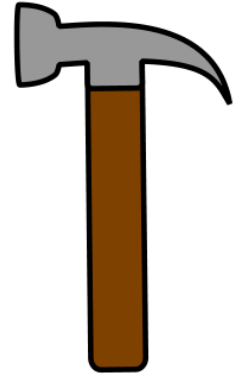


Stimulate Cell @ Rest

Thermal



Mechanical

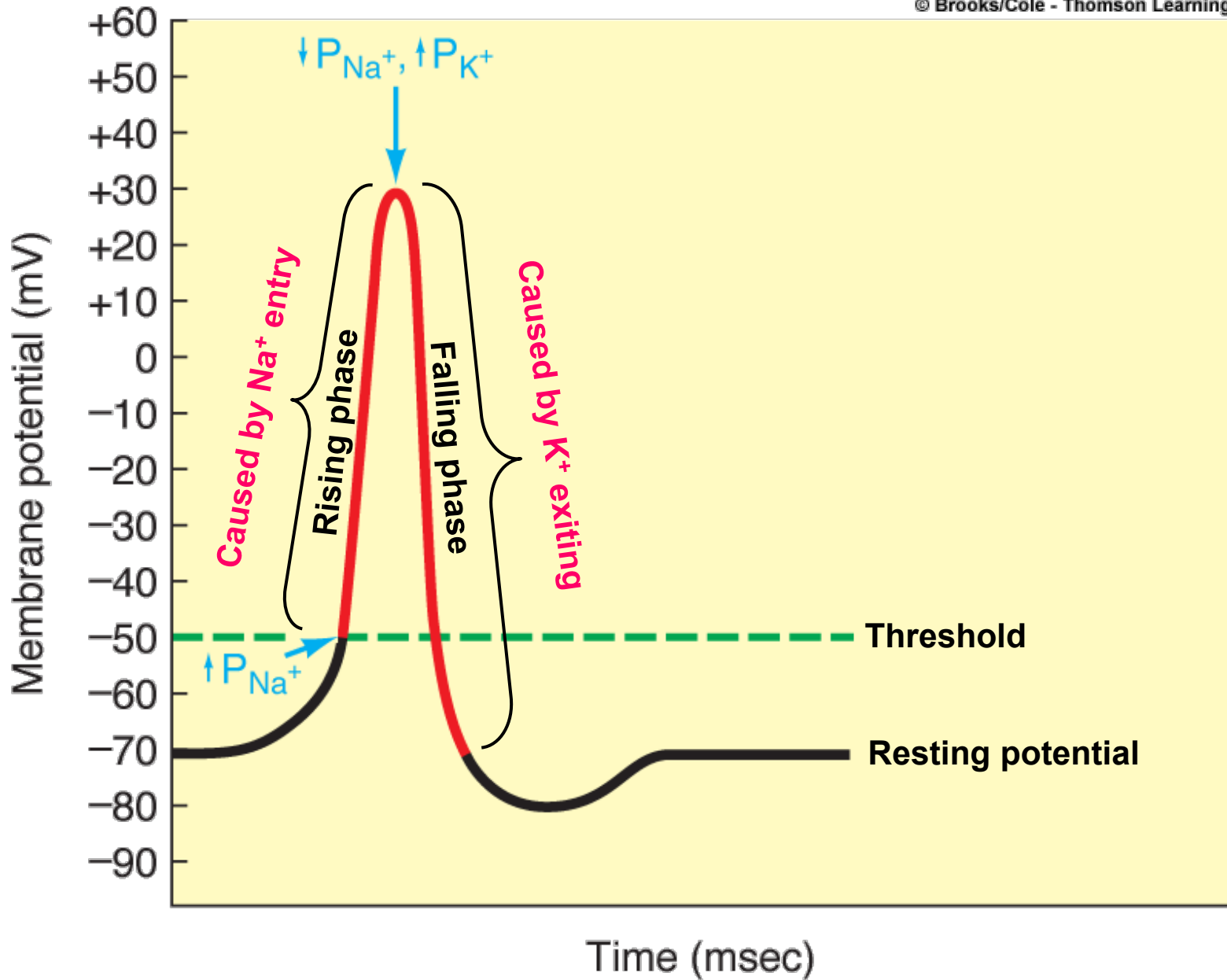


1

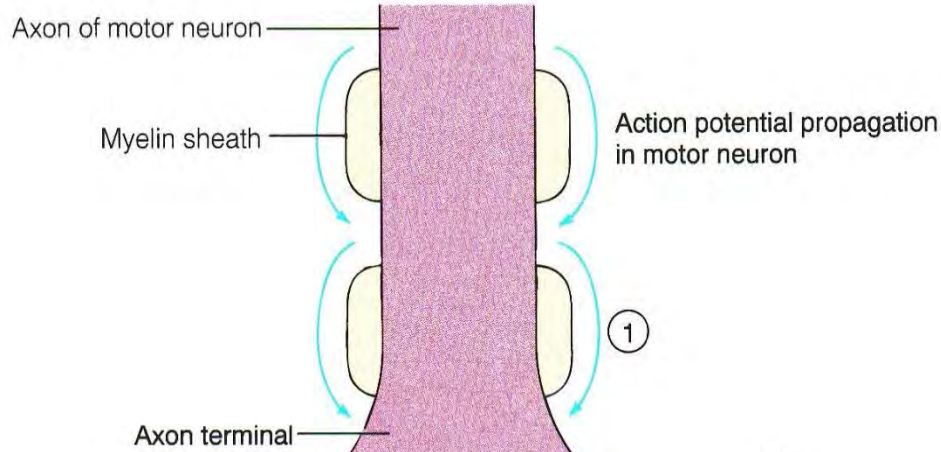
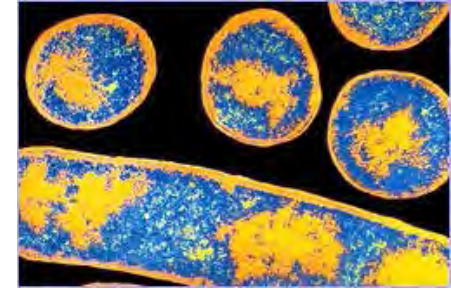


Electrical

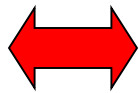
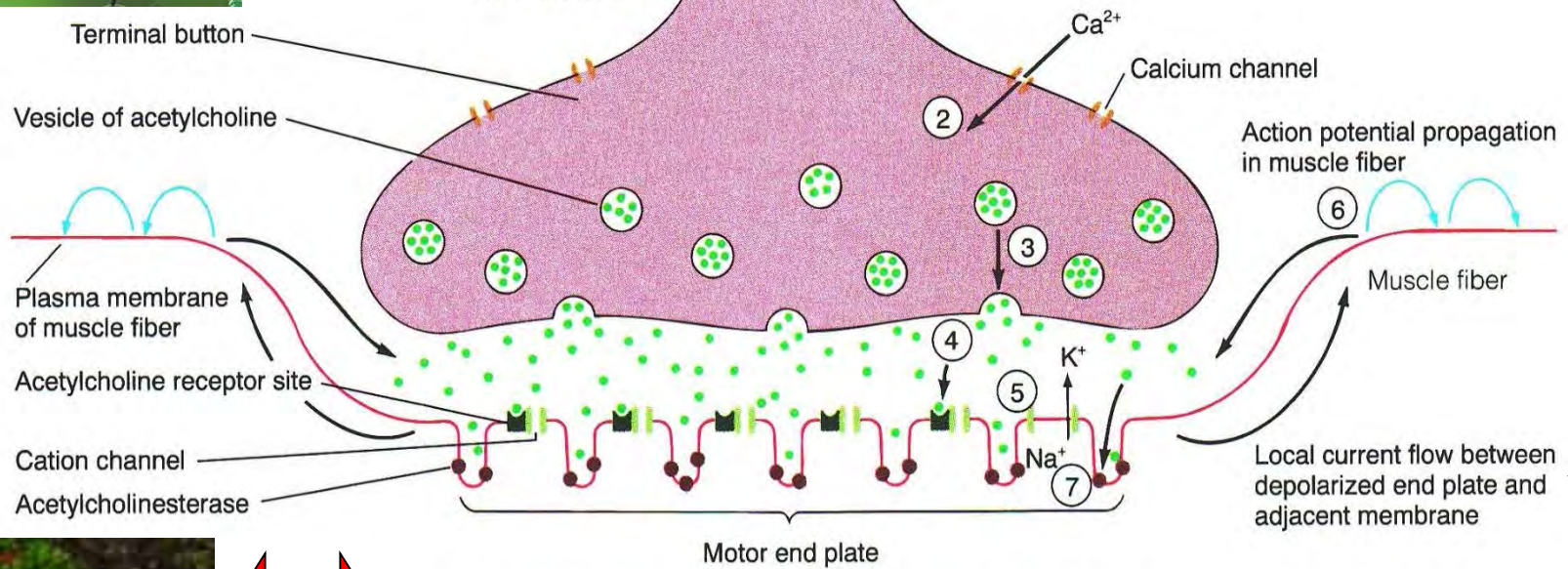
Chemical



↑ 3



~~3~~



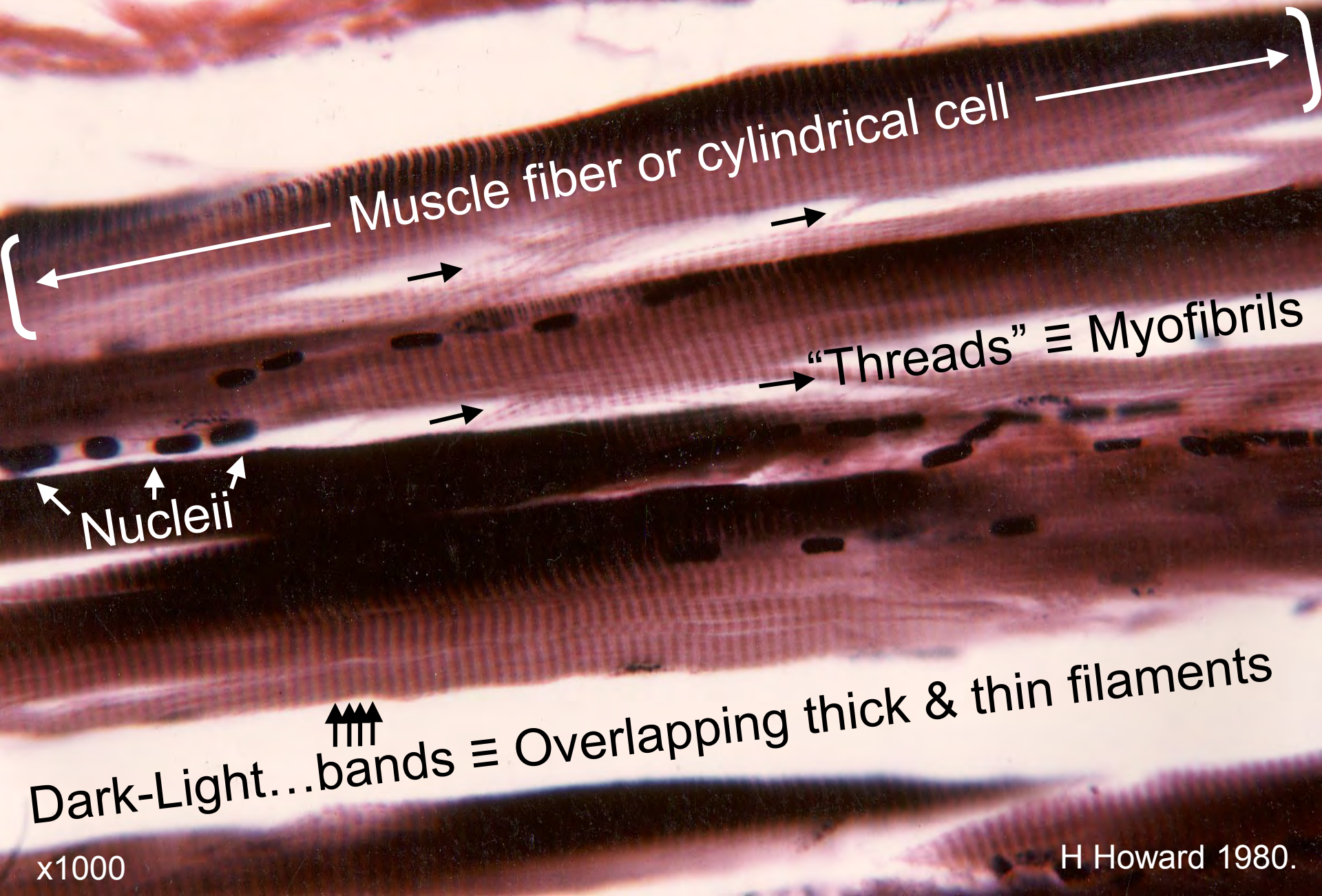
4



~~7~~



Skeletal Muscle Histology: Microscopic Anatomy



Muscle fiber or cylindrical cell

Nucleii

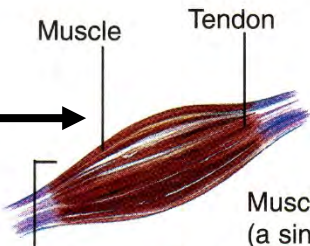
"Threads" ≡ Myofibrils

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

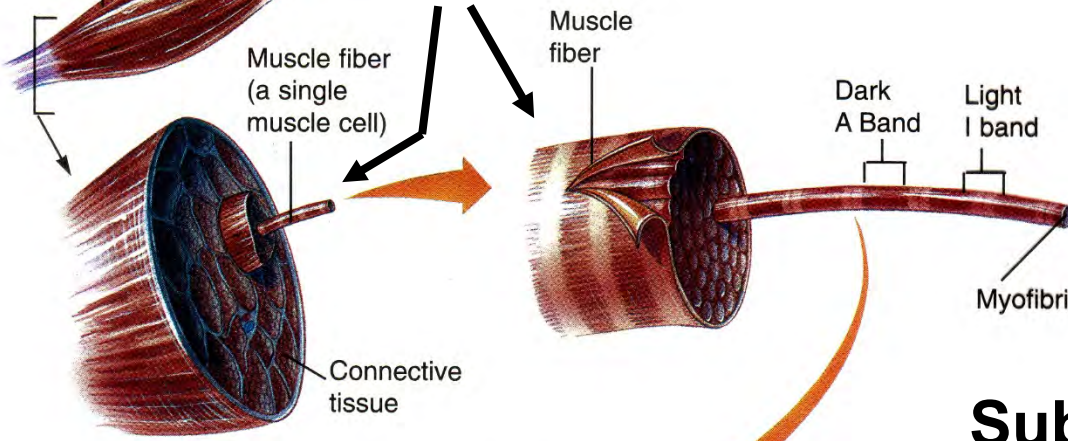
x1000

H Howard 1980.

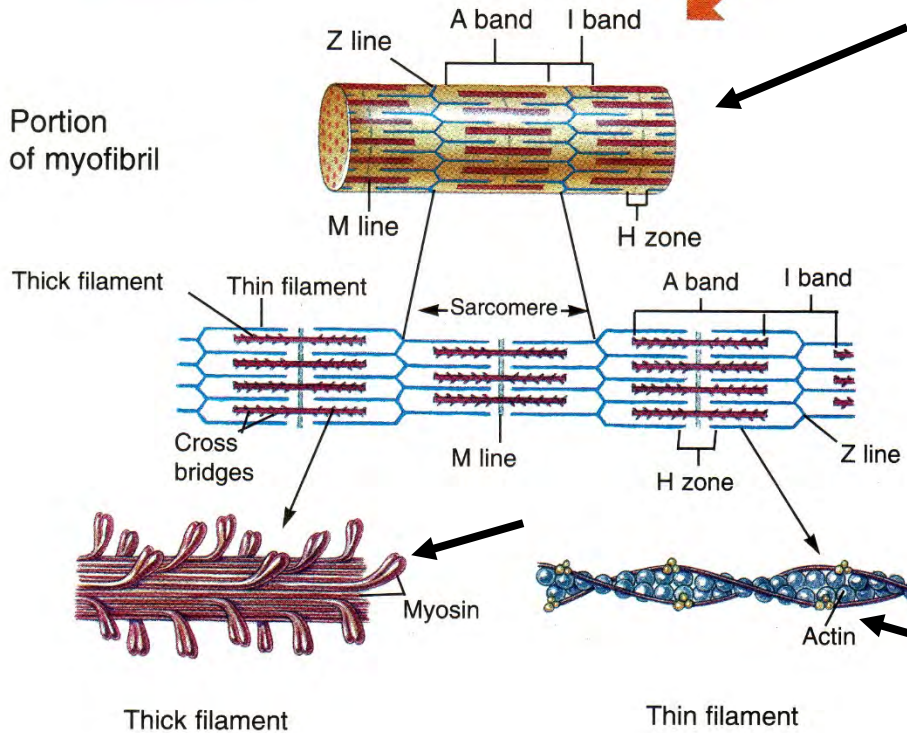
**Organ =
Muscle**



Cell = Myocyte = Fiber



**Subcellular =
Cytoskeleton**



**Molecules =
Actin & Myosin**

BI 121 Lecture 15



Fun lab with personal lifetime data!

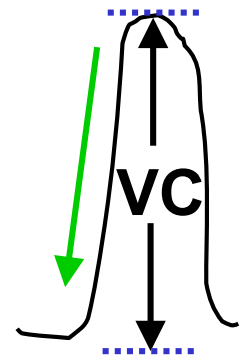
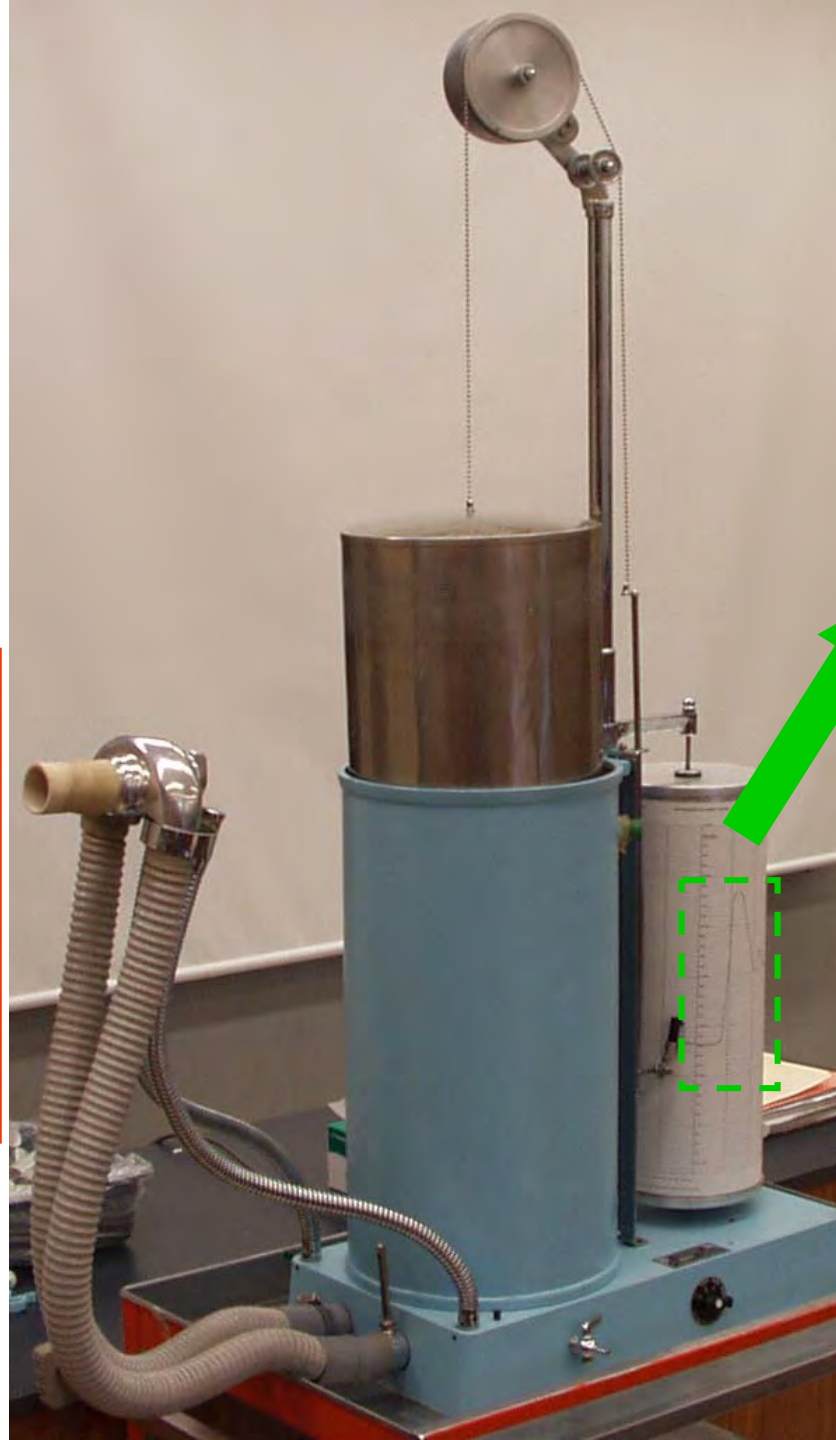
Yes!!



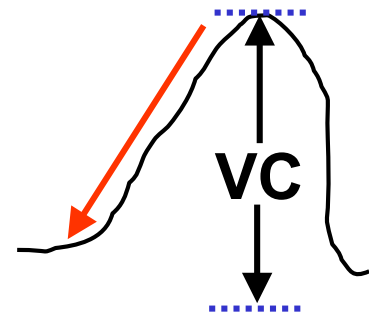
- I. Announcements** Lab 6, Pulmonary Function Testing (PFT) + optional notebook check today. Exam II Dec 8 Tuesday, 8 am!
- II. Introduction to PFT Lab 6** Pulmonary Function Testing
- III. Connections: Muscle Contraction+Adaptation** DC Mod 12+
 - A.** Review of structure + banding pattern? LS fig 8-2 thru 8-5
 - B.** How do muscles contract? LS fig 8-6, 8-10, 8-11 +...
 - C.** Summary of skeletal muscle contraction with videos
Courtesy David Bolinsky, *XVIVO* & Malcolm Campbell, Department of Biology, Davidson College, NC +...
 - D.** Exercise adaptation variables LS ch 8 pp 210-214
mode, intensity, duration, frequency, distribution of training sessions, individual & environmental factors
 - E.** *Endurance vs. Strength* training continuum? fiber types...

**Respirometer →
measures complete
Pulmonary Function
Test or PFT!**

**NB: Should be able to
blow out $\geq 75 - 85\%$ of
VC/FVC in 1 second!
That's $FEV_{1.0}/FVC \geq$
 $0.75 - 0.85$. If less,
may indicate asthma
or other lung disease.**

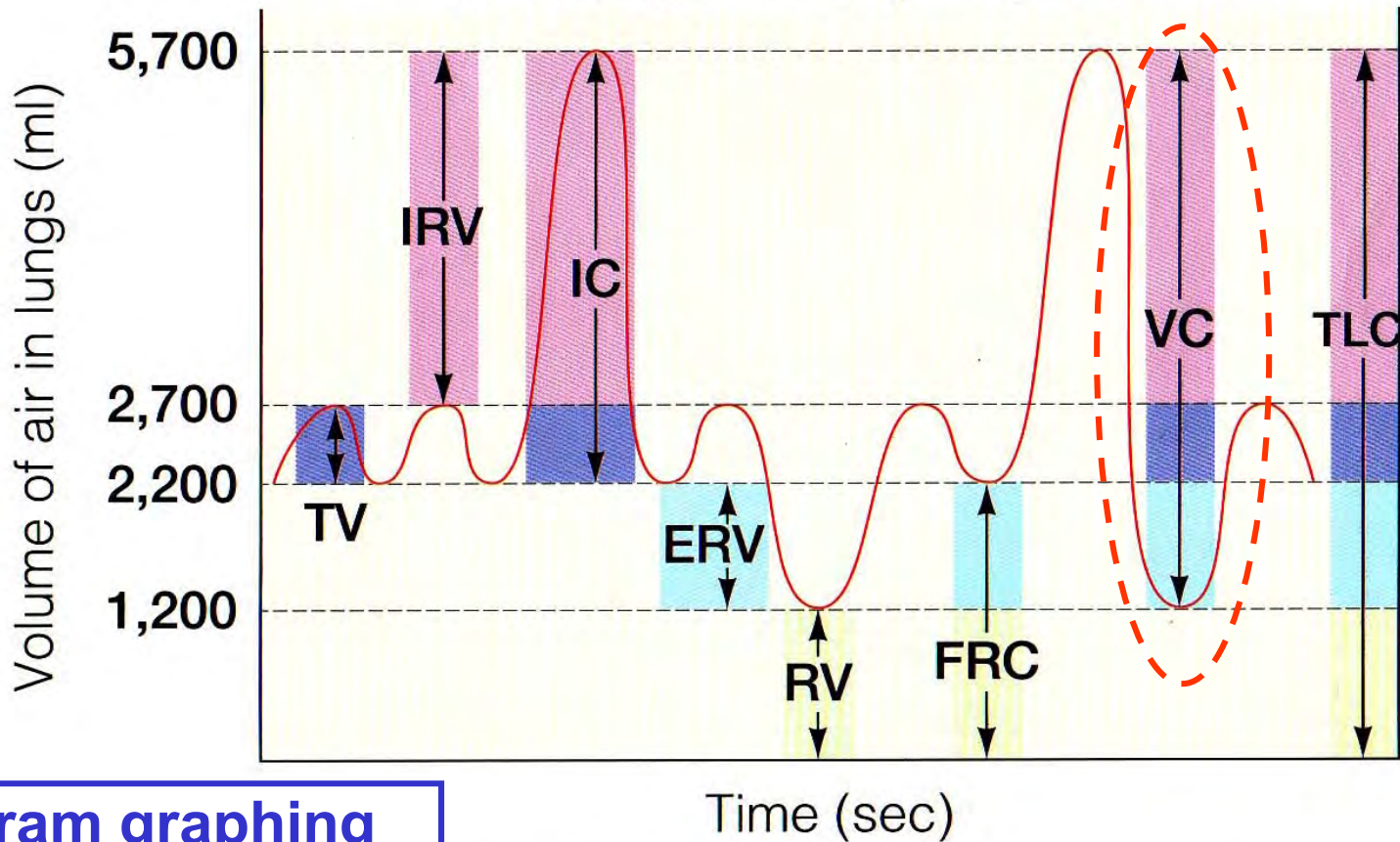


**Normal =
Steep**



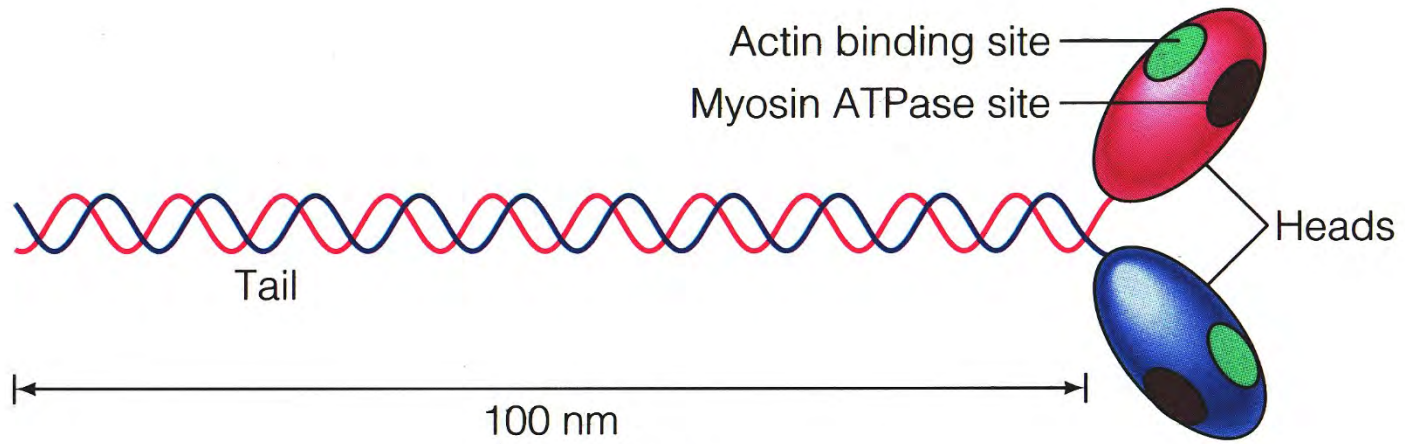
**Abnormal =
Flatter
Downslope
(eg, Asthma)**

Normal Spirogram of Healthy Young Adult Male



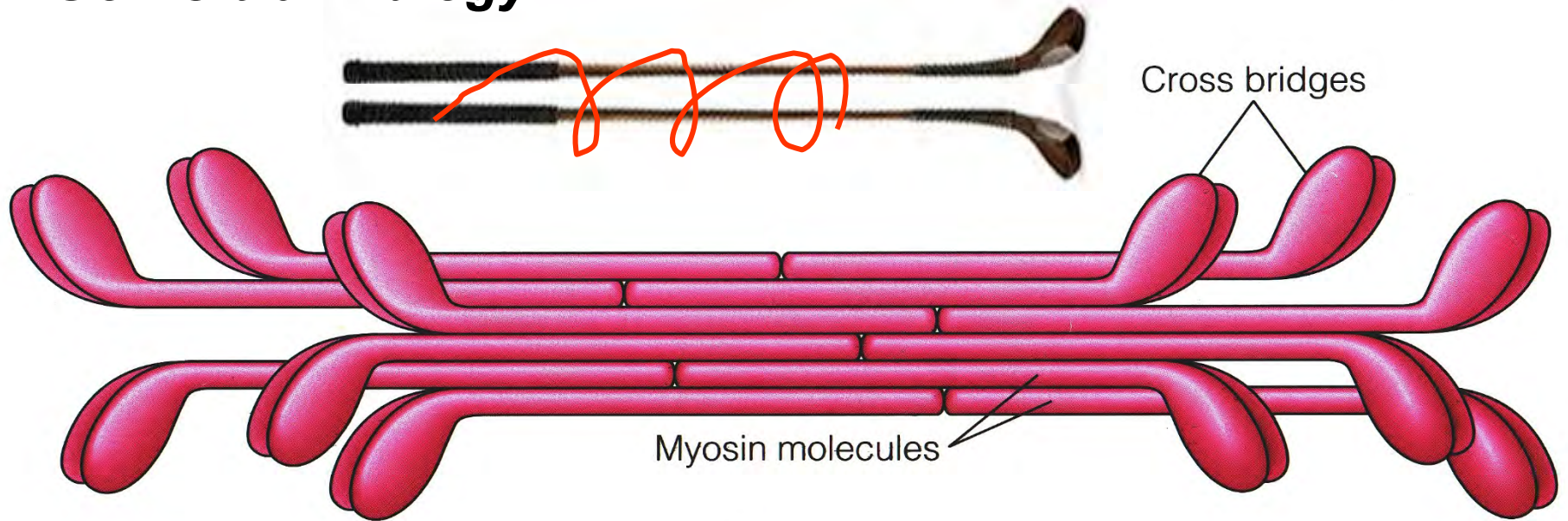
**Spirogram graphing
complete *PFT* from
computer simulation.**

- 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)

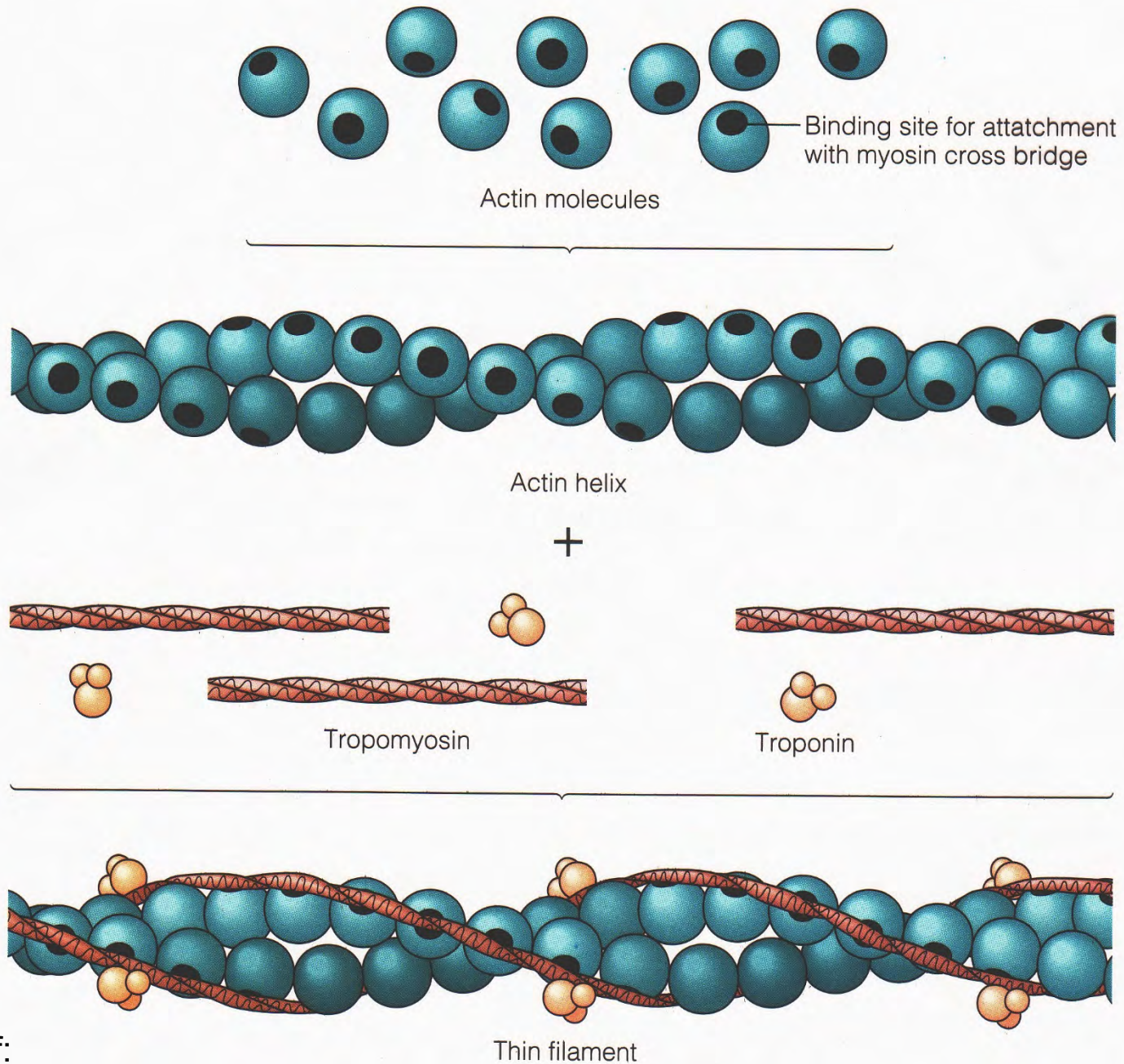


(a)

Golf Club Analogy?

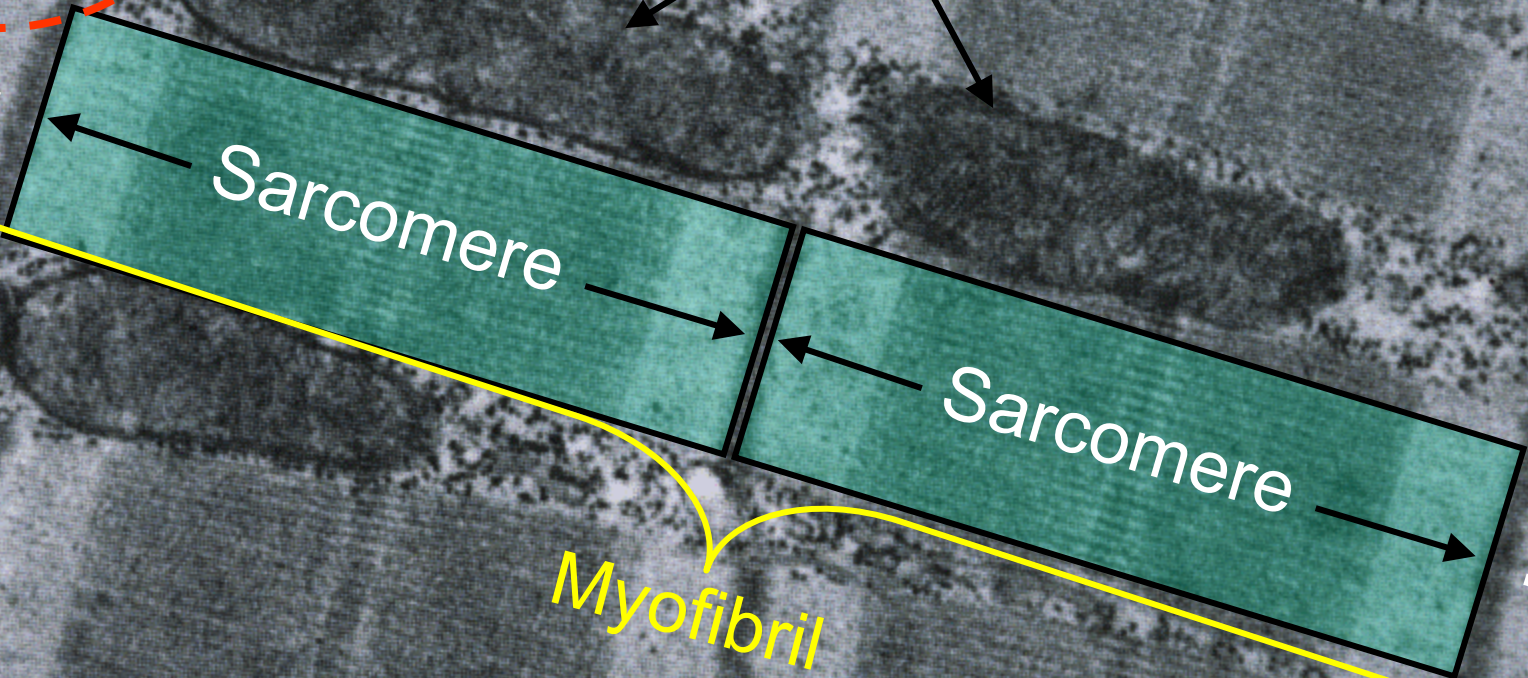


(b)



Triad \equiv T tubule abutting cisternae

Mitochondria



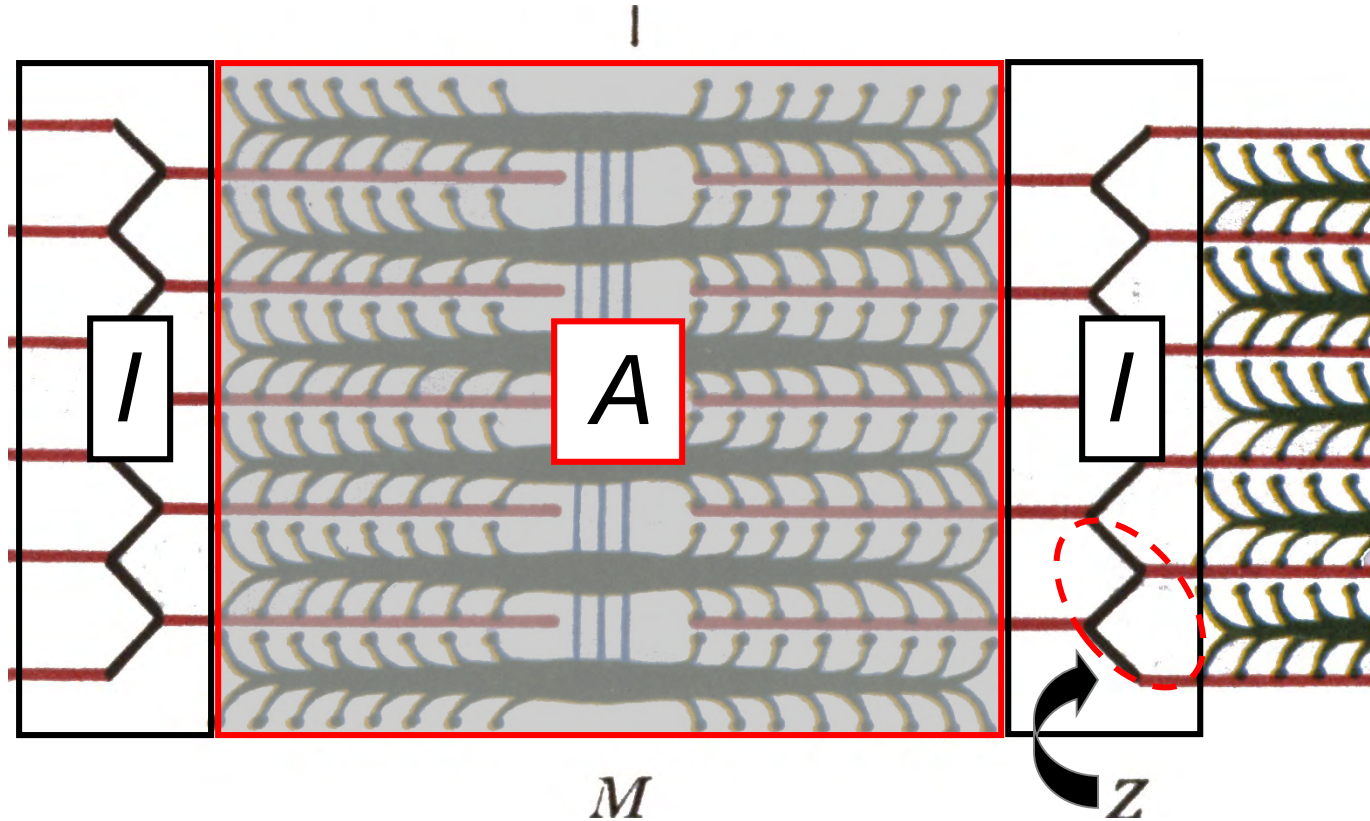
Sarcomere

Sarcomere

Myofibril

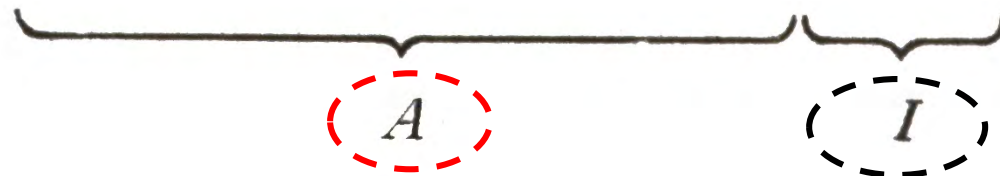
A Band = Dark Band

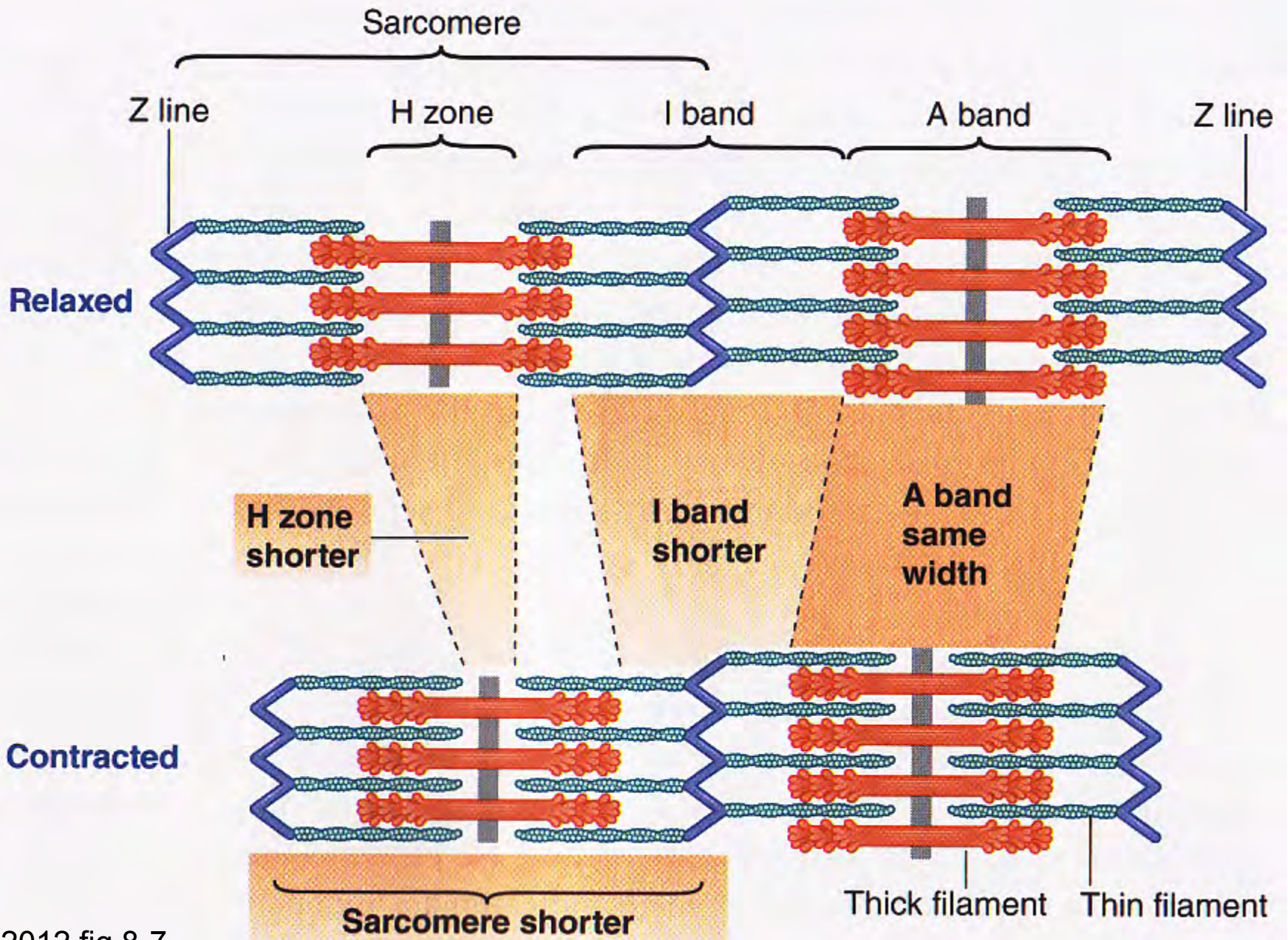
Anisotropic = Light Can't Shine Through



I Band = Light Band

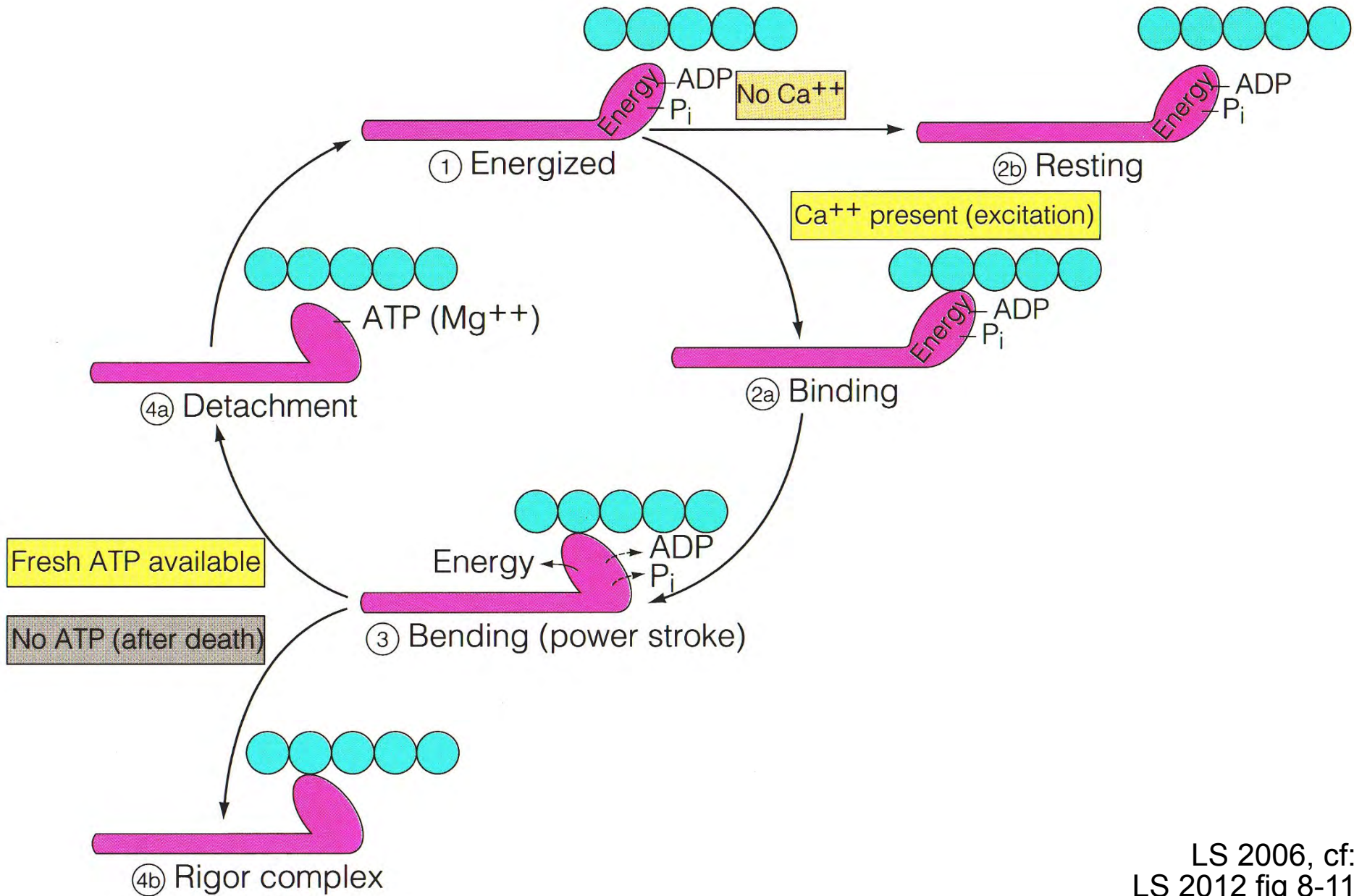
Isootropic = Light Can Shine Through



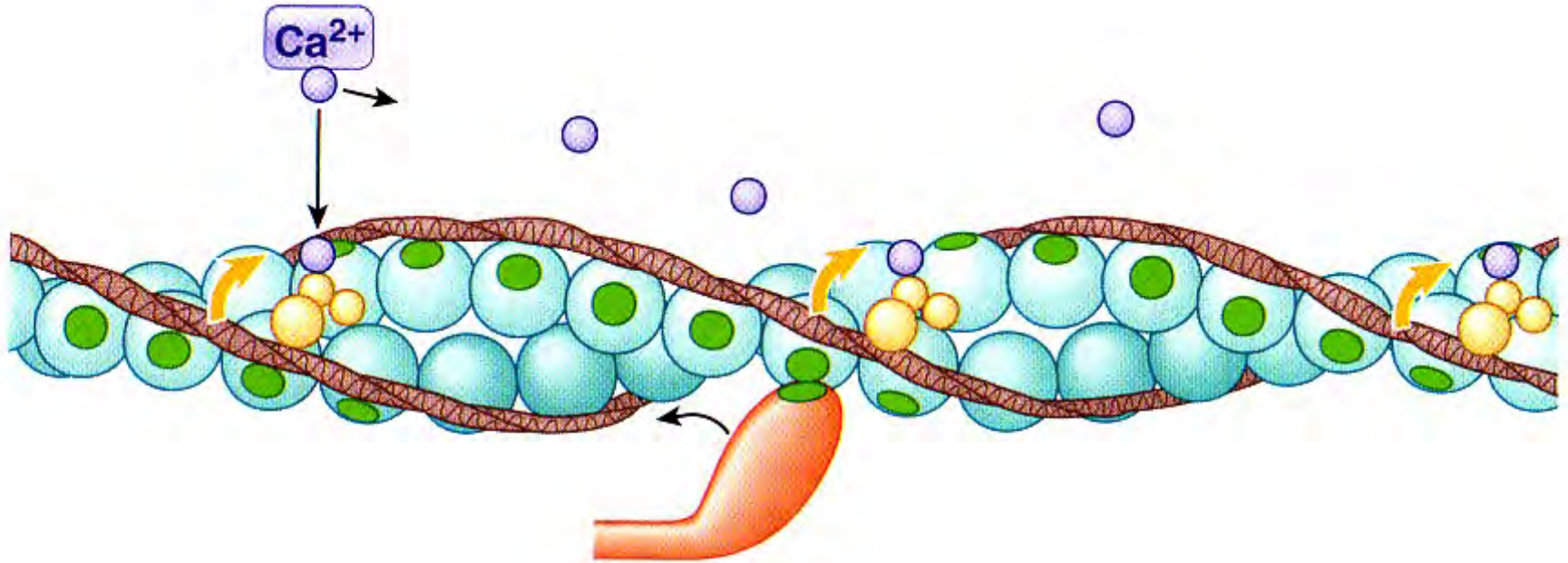


LS 2012 fig 8-7

Cross-Bridge Cycle



Excited: Calcium Triggers Cross-Bridge Binding



(b) Excited

- 1** Muscle fiber is excited and Ca²⁺ is released.
- 2** Released Ca²⁺ binds with troponin, pulling troponin–tropomyosin complex aside to expose cross-bridge binding site.
- 3** Cross-bridge binding occurs.
- 4** Binding of actin and myosin cross bridge triggers power stroke that pulls thin filament inward during contraction.

Rope Climb or Tug of War Grasp, then Regrasp!



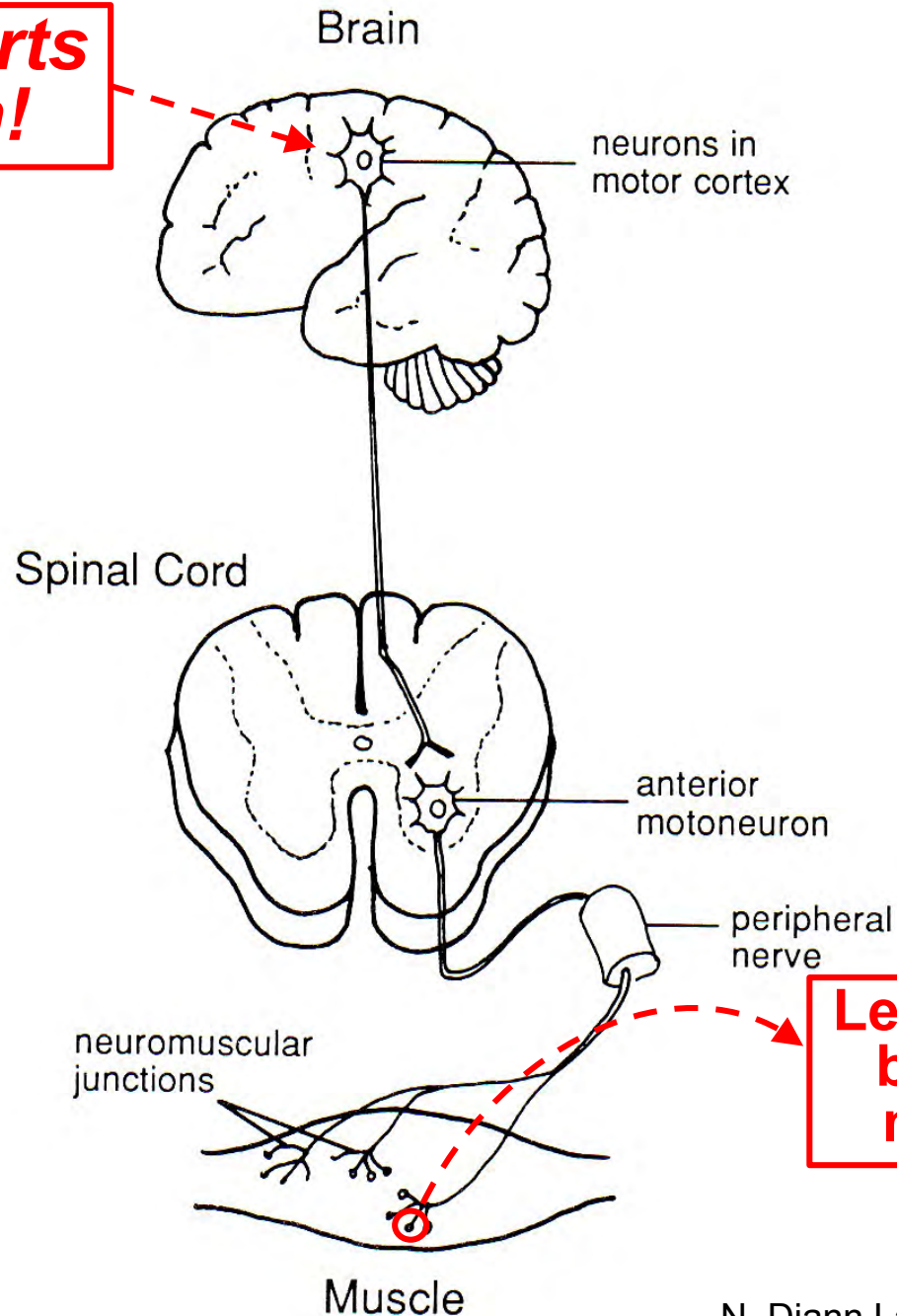
We're on a roll! Bring on Exam II!



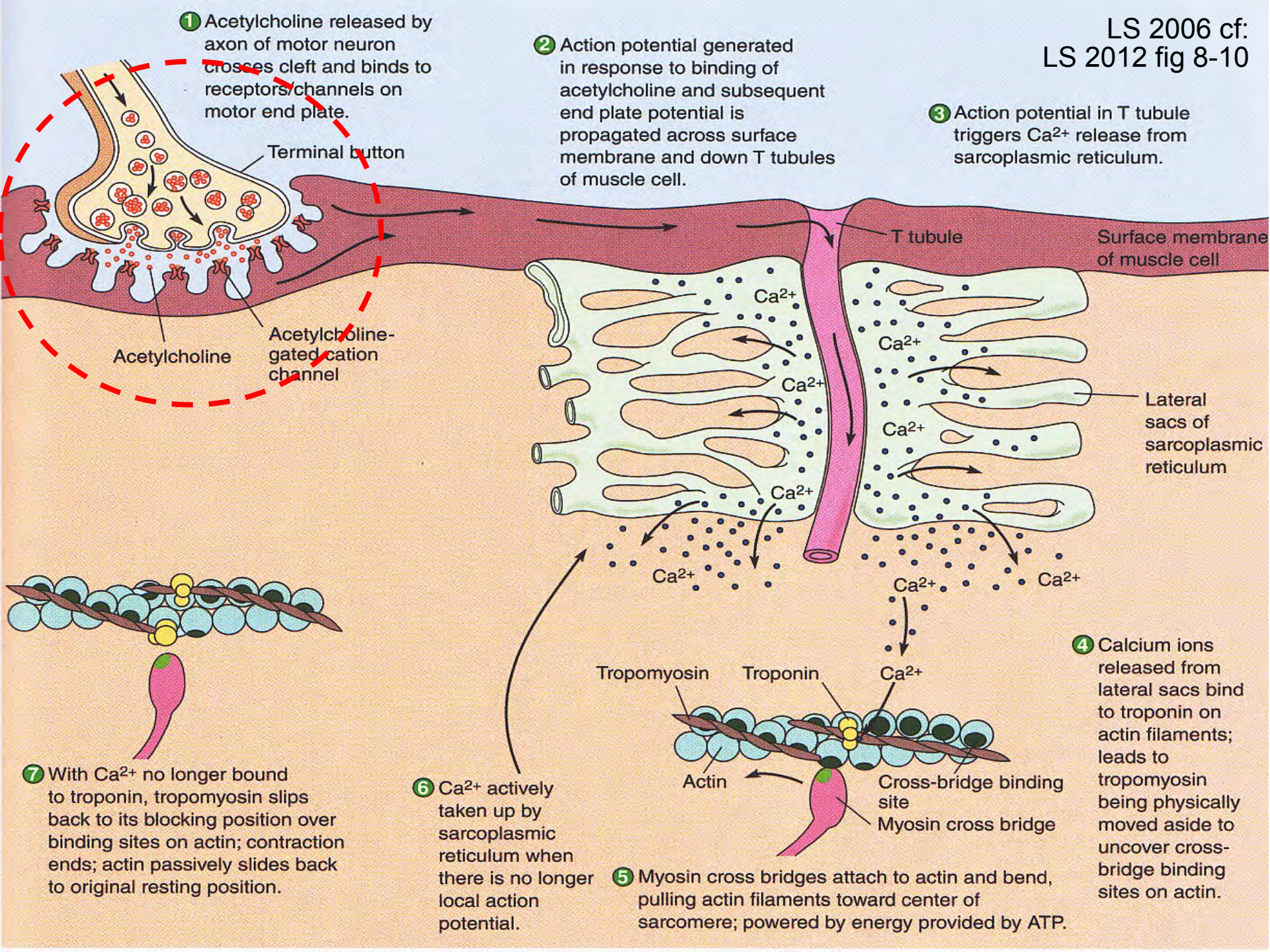
BI 121 Lecture 16

- I. Announcements** Notebooks? **Exam II, December 8th Tuesday 8 am.** Review session in class next Thursday. Q?
- II. Muscle + Adaptation Connections** LS ch 8, DC Module 12
- III. Respiratory System** LS ch 12, DC Module 7, Fox +...
 - A. Steps of respiration? External vs. cellular/internal?**
LS fig 12-1 pp 345-347
 - B. Respiratory anatomy** LS fig 12-2 p 347, DC, Fox +...
 - C. Histology** LS fig 12- 4 pp 347-349, DC
 - D. How do we breathe?** LS fig 12-12, fig 12-25 pp 349-356, pp 373-378
 - E. Gas exchange** LS fig 12-19 pp 362-5
 - F. Gas transport** LS tab 12-3 pp 365-70

**1st signal starts
in the brain!**



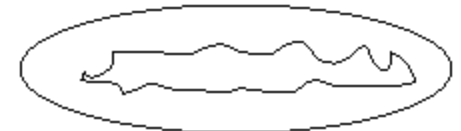
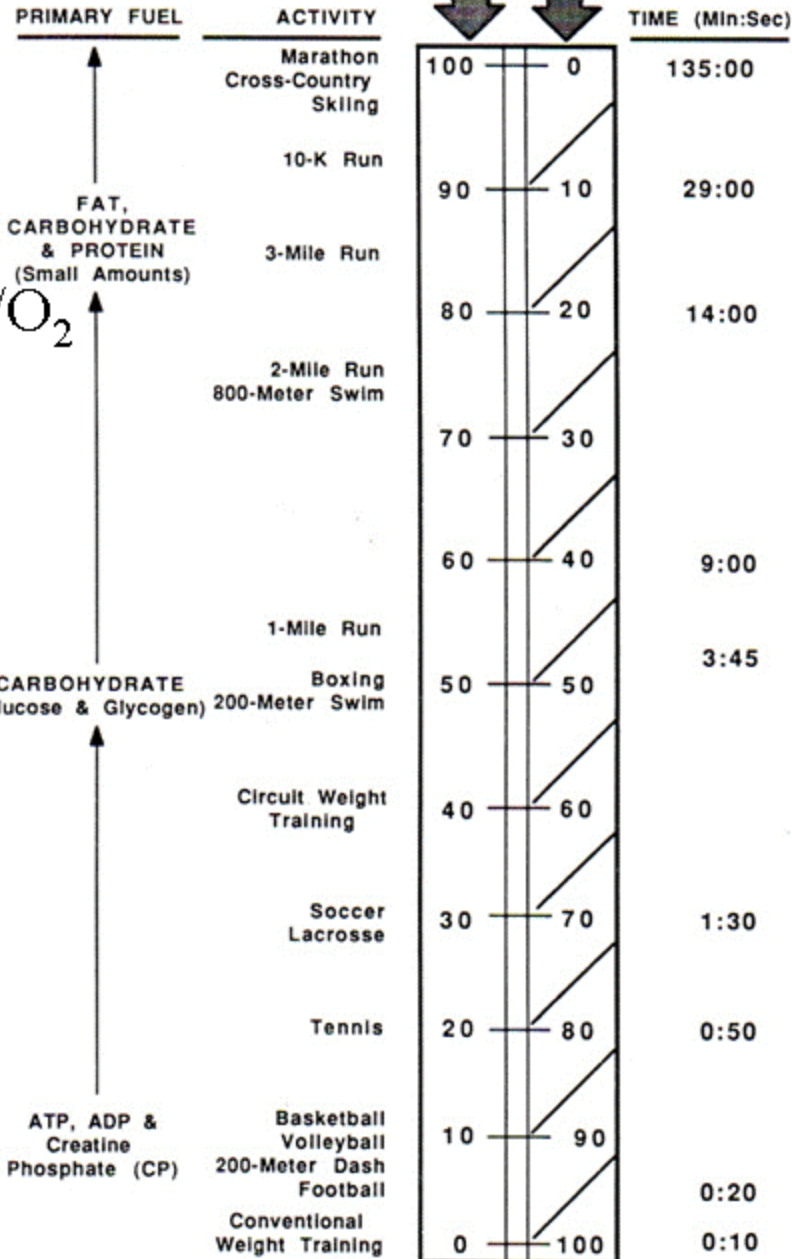
**Let's look @ one
bouton & one
muscle fiber!**





AEROBIC

w/O₂



MITOCHONDRIA

CYTOSOL

Glycolysis



Immediate/ATP-PC



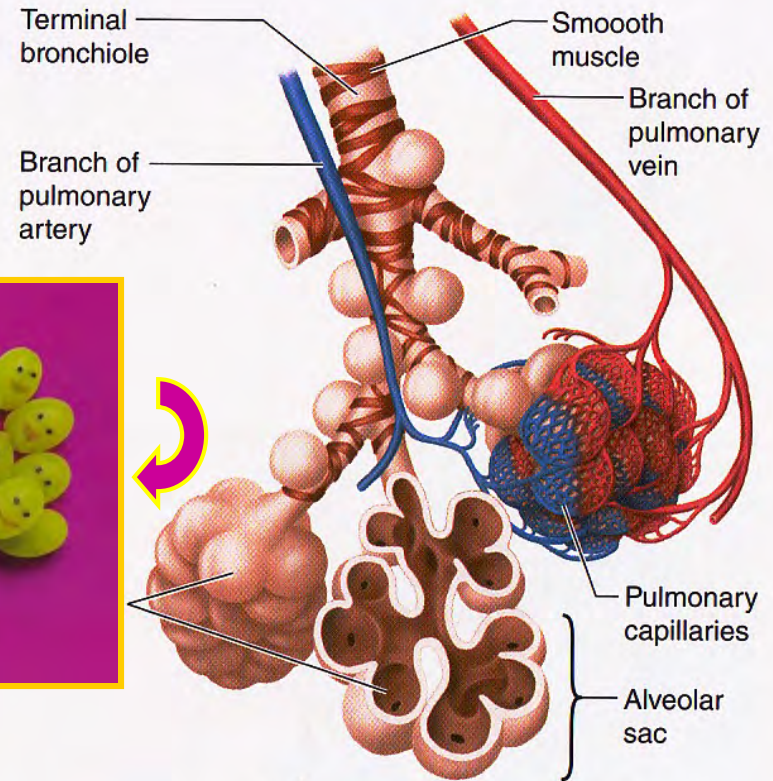
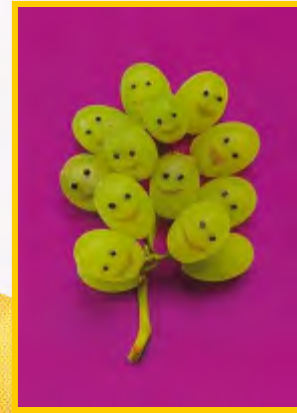
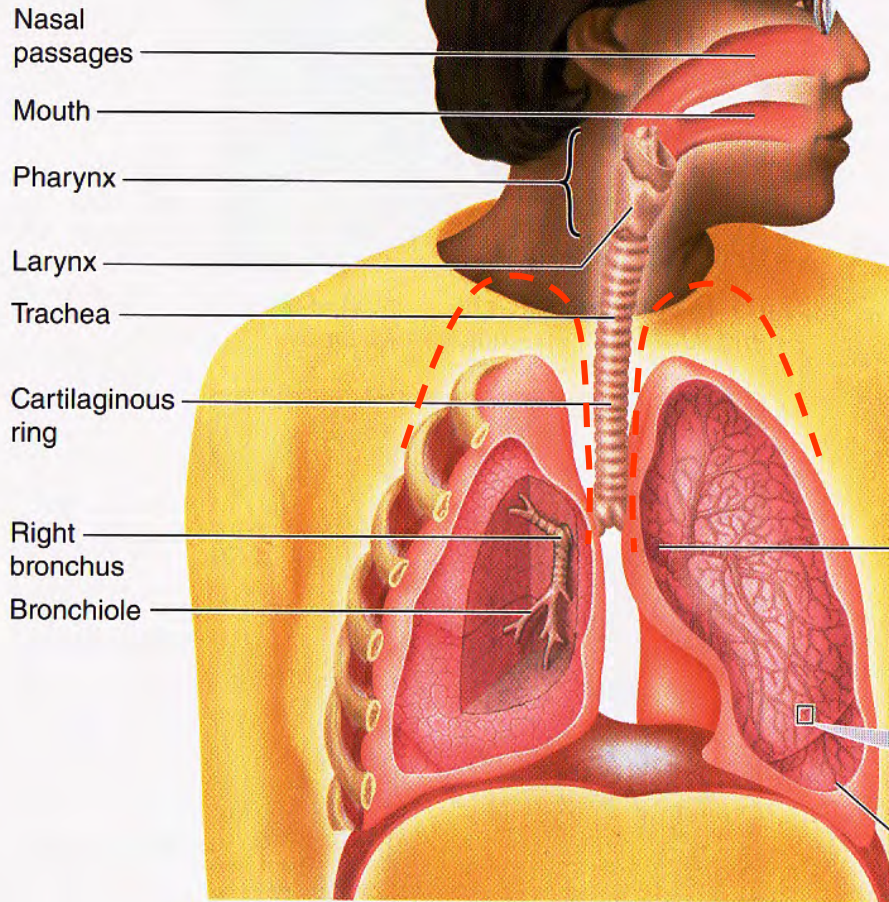
ANAEROBIC

Characteristics of Skeletal Muscle Fibers

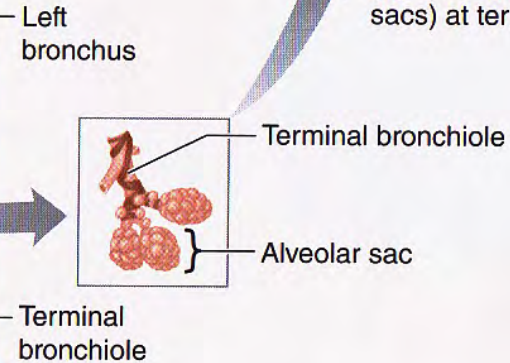
Characteristic	TYPE OF FIBER		
	Slow Oxidative (Type I)	Fast Oxidative (Type IIa)	Fast Glycolytic (Type IIb)
Myosin-ATPase Activity	Low	High	High
Speed of Contraction	Slow	Fast	Fast
Resistance to Fatigue	High	Intermediate	Low
Aerobic Capacity	High	High	Low
Anaerobic Capacity	Low	Intermediate	High
Mitochondria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

Respiratory System Anatomy

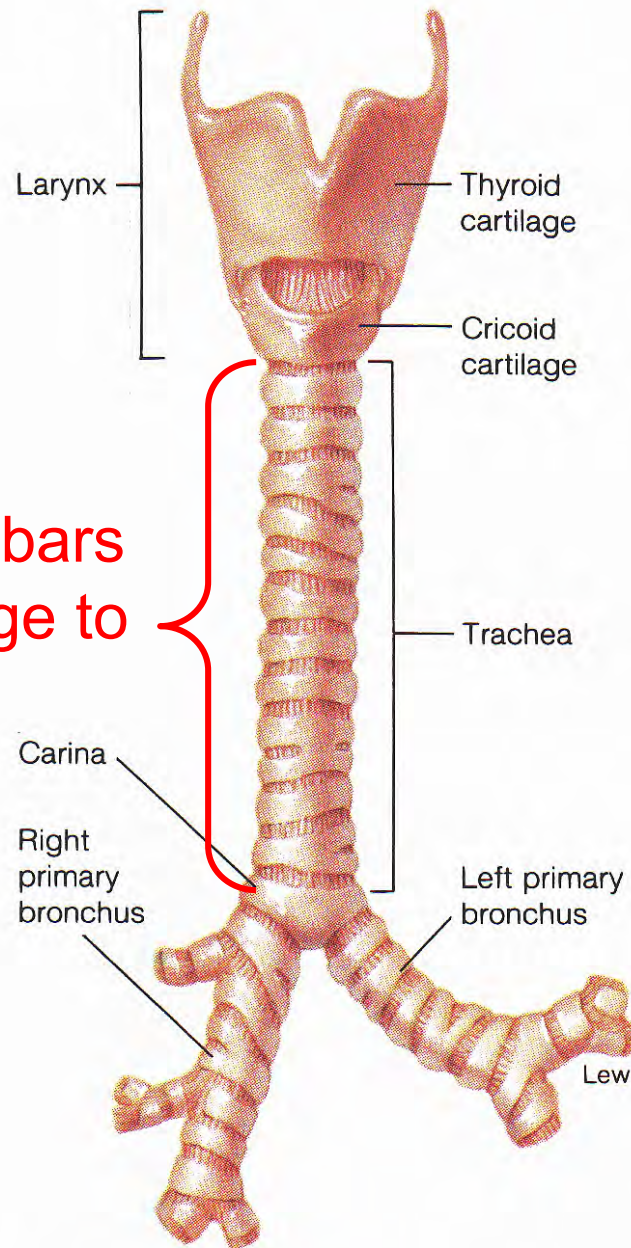
NB: In vivo,
Cupola or peak
of each lung
goes into neck
> clavicle line!



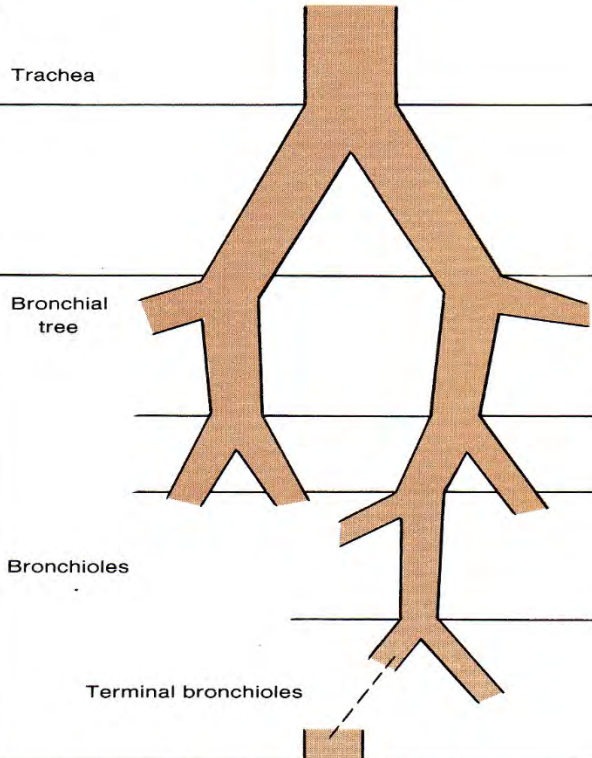
(b) Enlargement of alveoli (air sacs) at terminal ends of airways



16-20 C-shaped bars
of hyaline cartilage to
prevent collapse

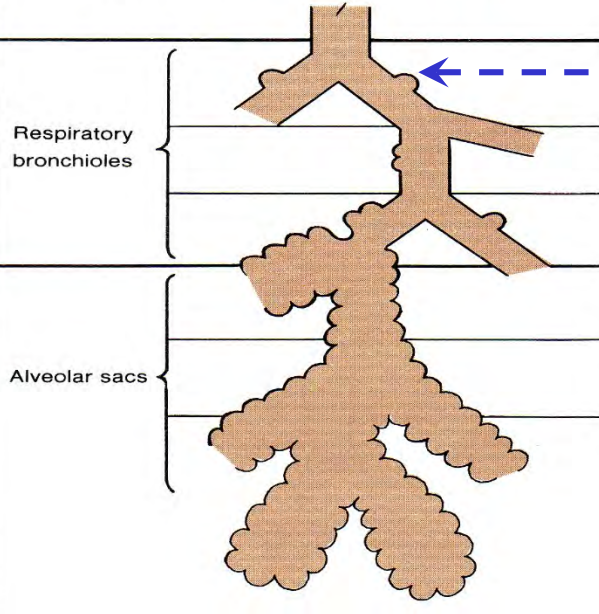


Conductive Zone



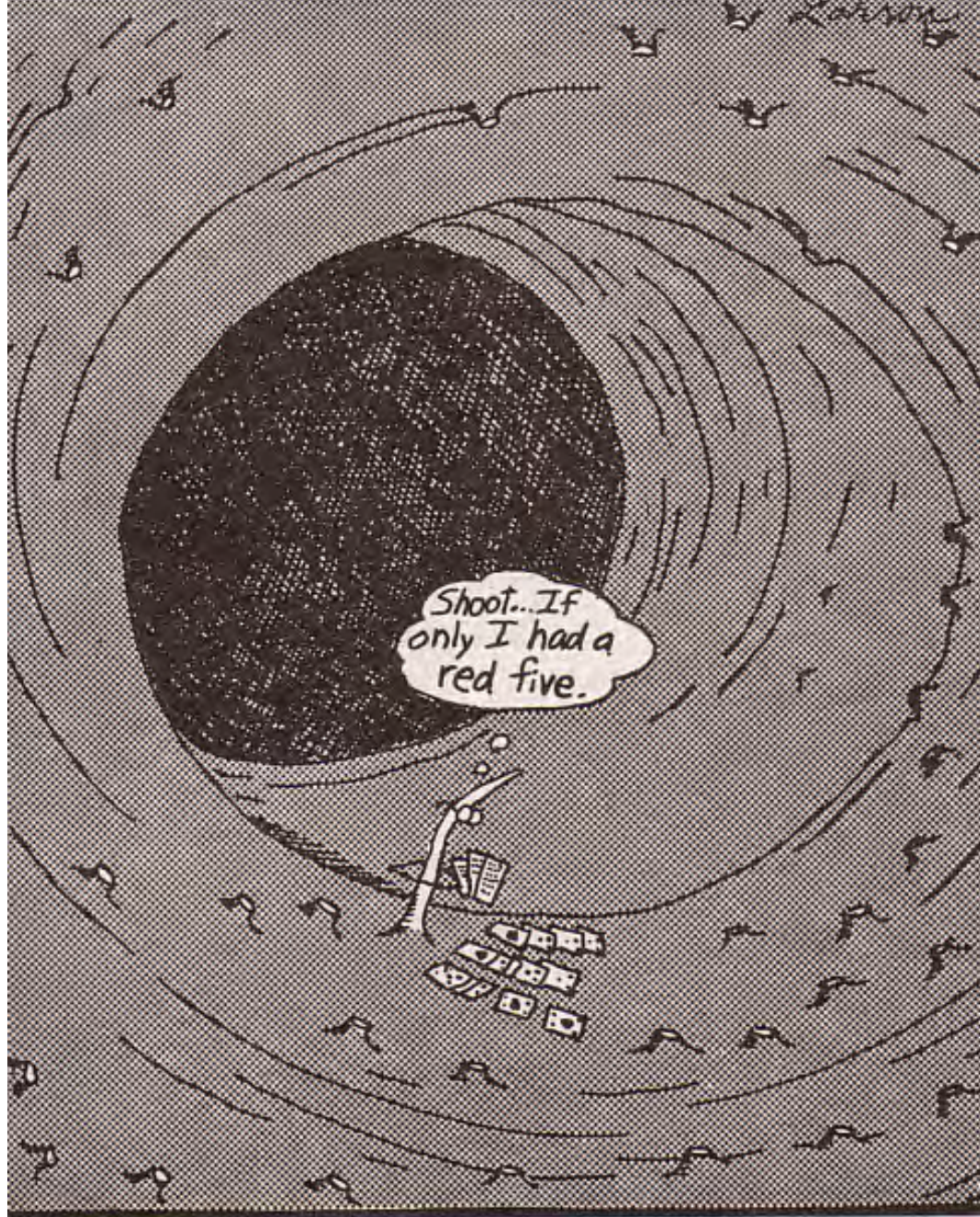
No Gas Exchange

Respiratory Zone



-1st alveolar outpouching!

Gas Exchange



The last cilium on a smoker's lung

BI 121 Lecture 17

*We're so close. Let's
shine on the exam!*



**I. Announcements Exam II Tuesday Dec 8th
@ 8:00 am! 12 n lab section report to 112 HUE,
1 pm lab section 130 HUE. All others here!**

Discussion-Review, this Thursday, here in 100 WIL!

II. Respiratory System Connections LS ch 12, DC Module 7+

A. How do we breathe?

LS fig 12-12, fig 12-25 pp 349-356, pp 373-378

B. Gas exchange LS fig 12-4, fig 12-19 pp 362-5

C. Gas transport LS fig 11-2 p 299, tab 12-3 pp 365-70

D. What happens in a gunshot wound or impalement injury? Pulmonary membranes? Pneumothorax?

LS fig 12-5, 12-6, 12-8, 12-9, pp 349-52

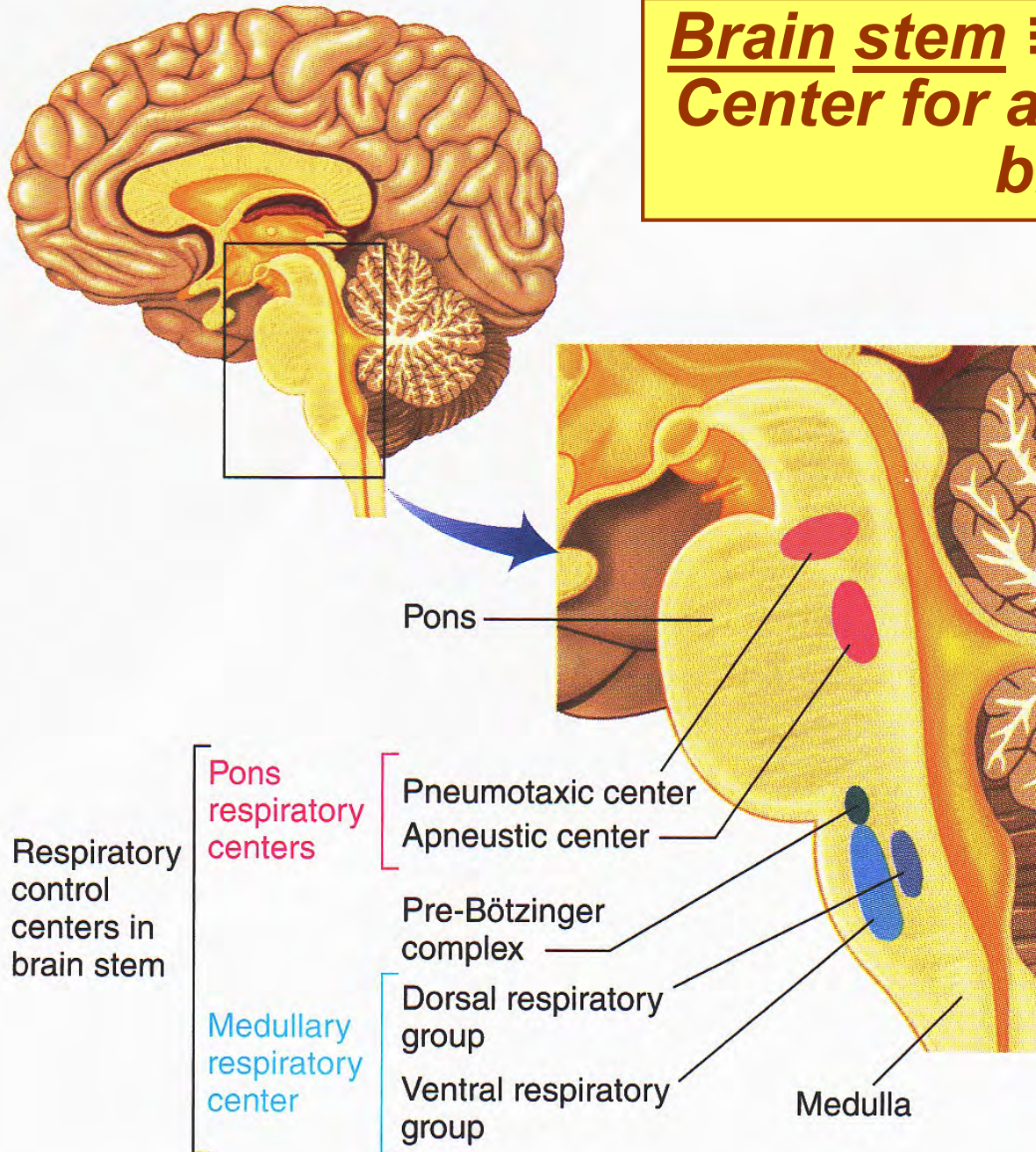
III. Physiology of Cigarette Smoking LS + DC + ACS +...

A. ANS, autonomic nerves & nicotine? Chemical route

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

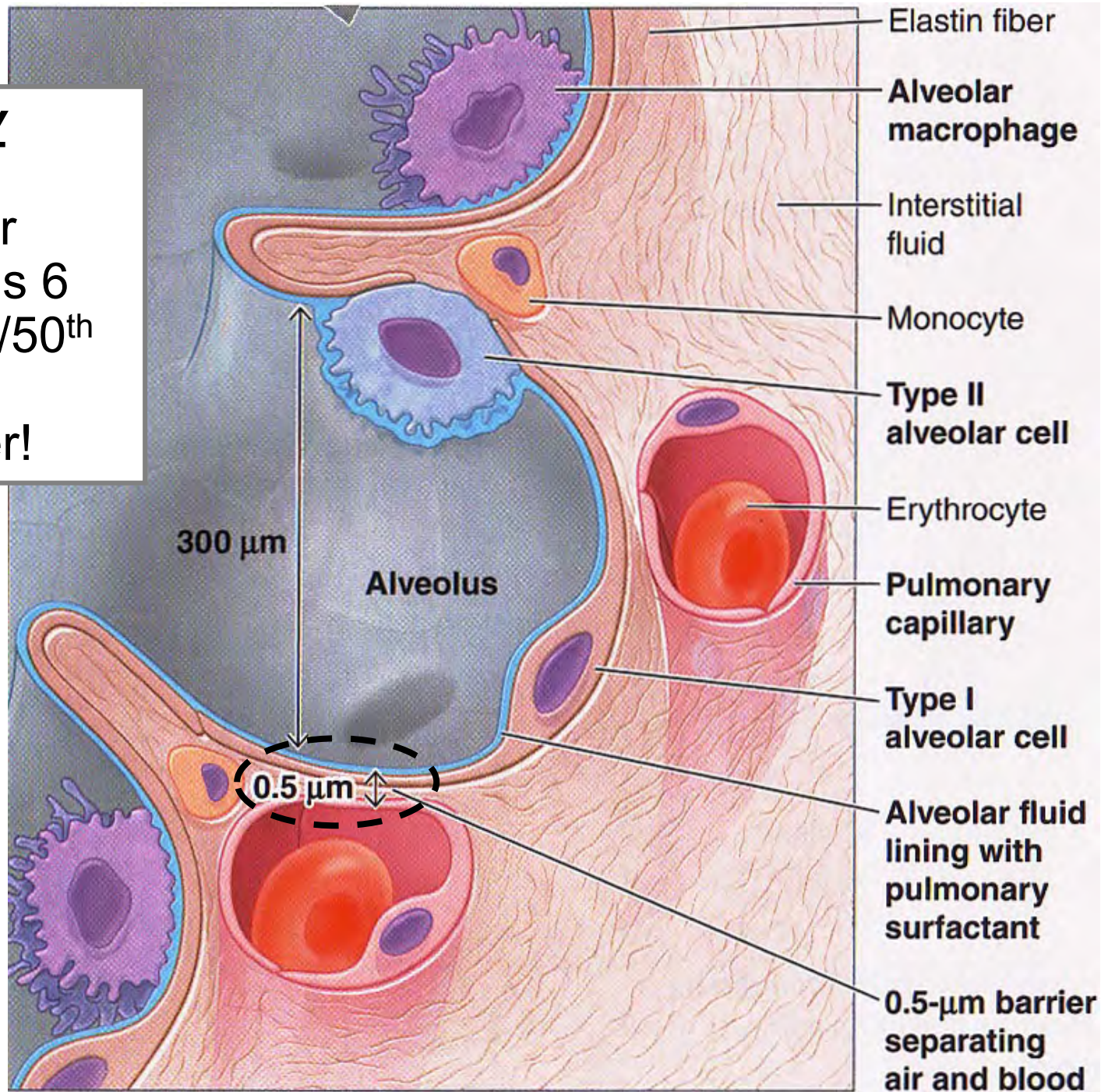
C. UO Smoke-Free since Fall 2012! Help is available!

Brain stem ≡ Control Center for automatic breathing!

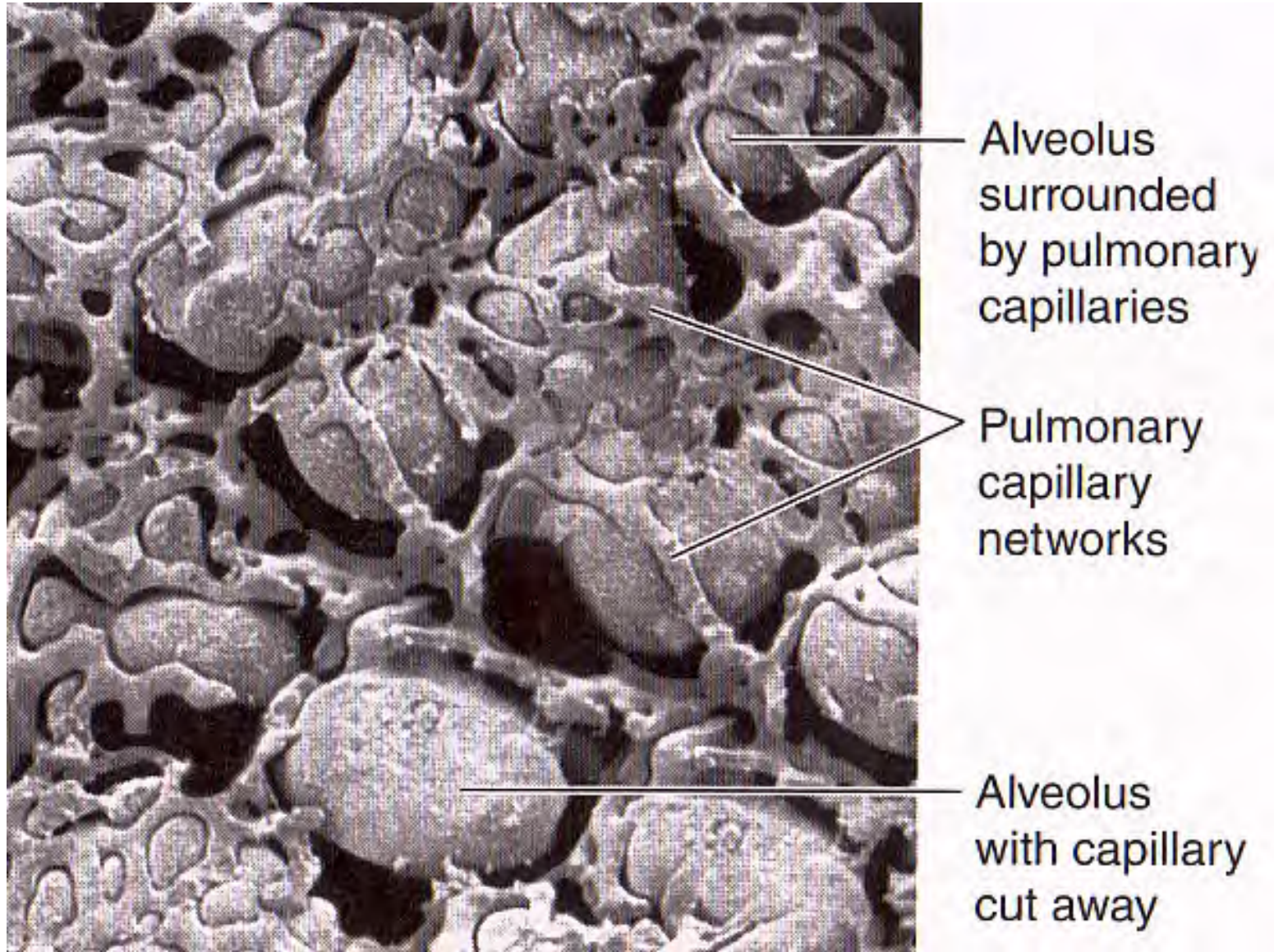


Respiratory membrane

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



Alveoli are surrounded by jackets of capillaries!



Gas Exchange

CO₂ LOW

O₂ HIGH

Across pulmonary capillaries:

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

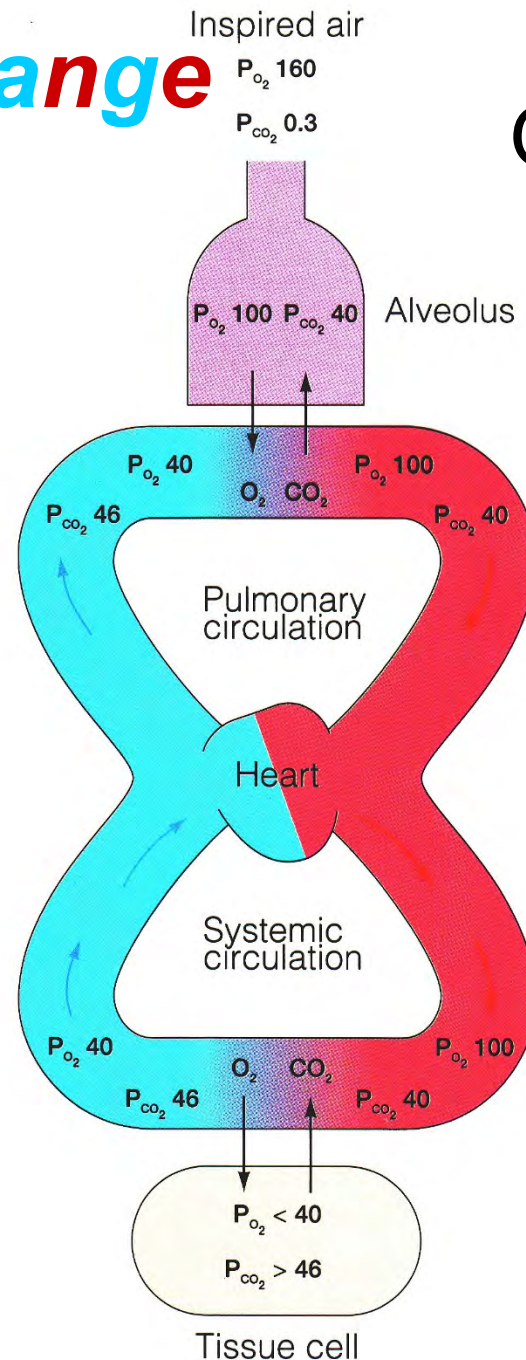
CO₂ partial pressure gradient from blood to alveoli = 6 mm Hg (46 → 40)

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)

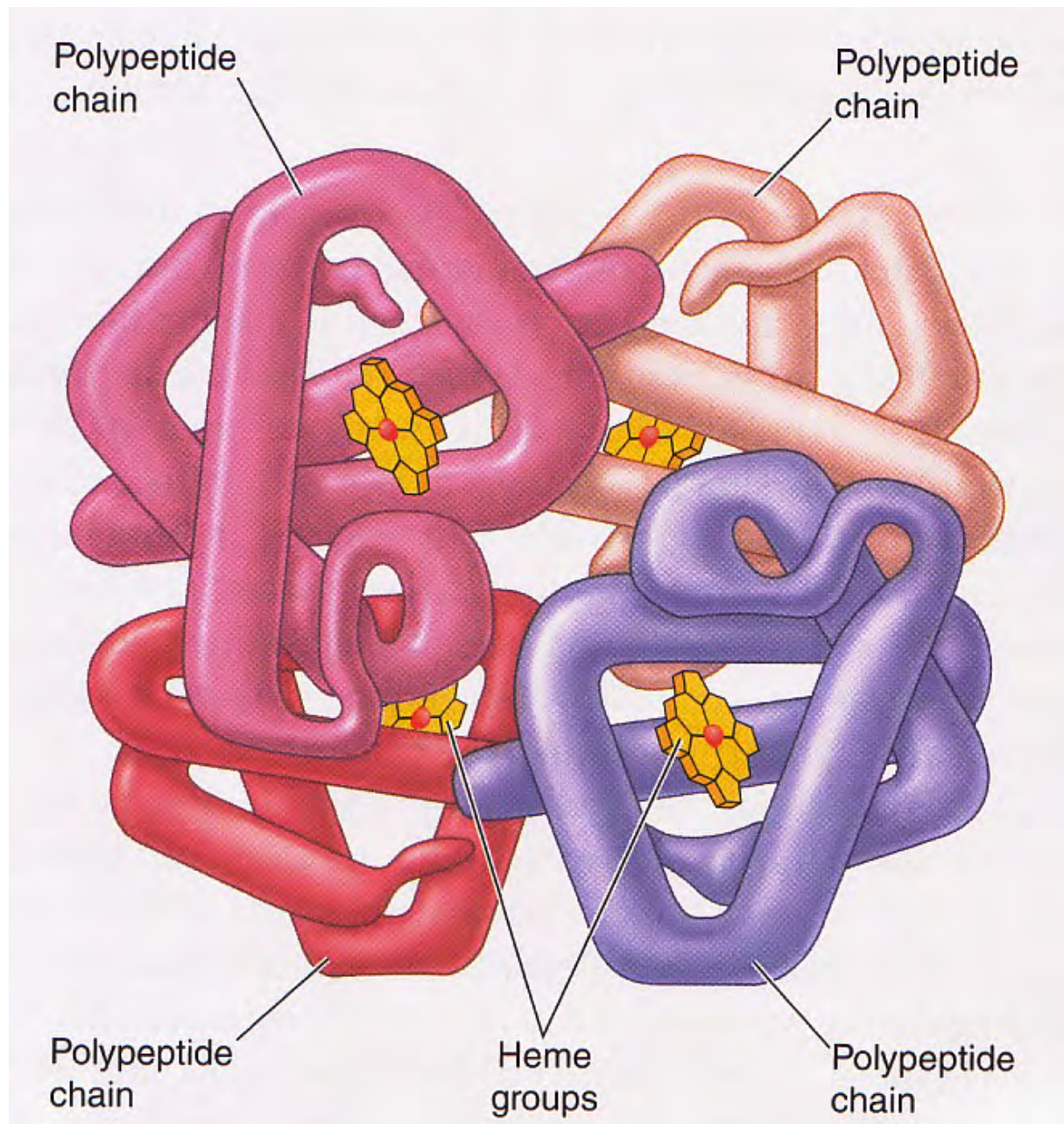
Numbers are mm Hg pressure.

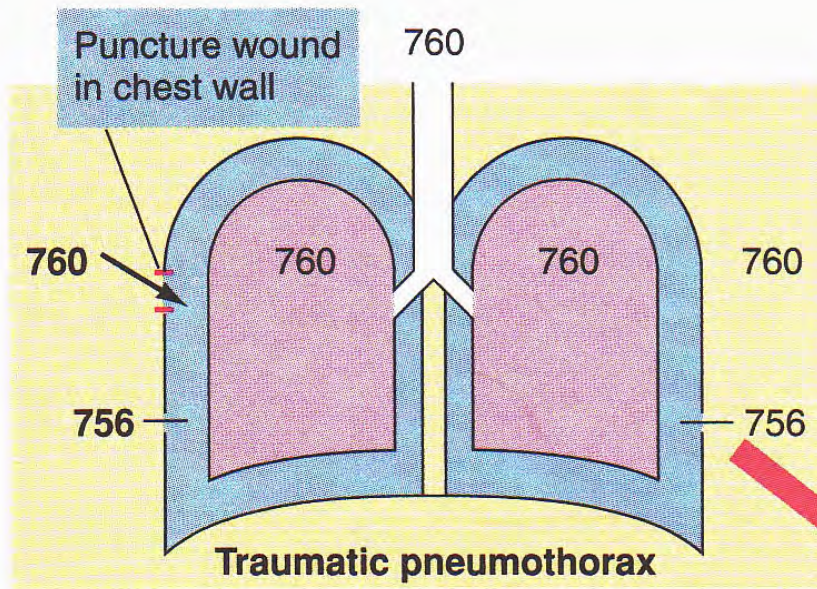


CO₂ HIGH

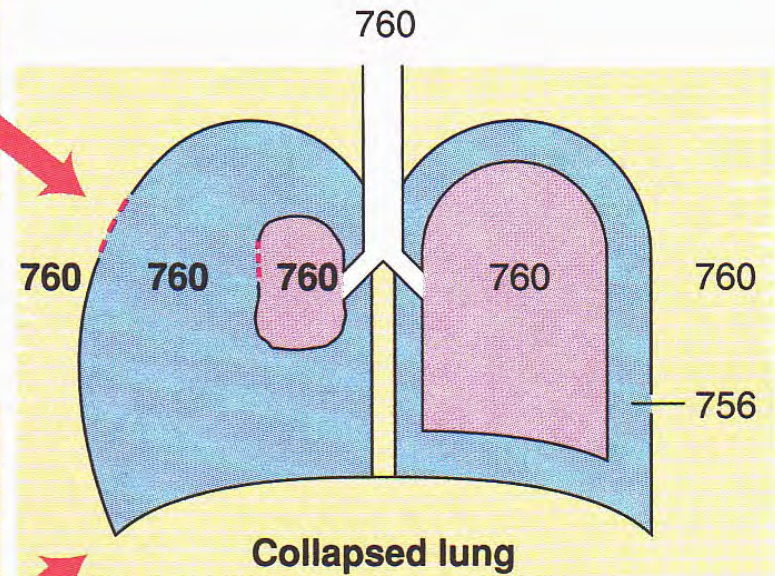
O₂ LOW

O₂ is carried mainly by red blood cell hemoglobin!

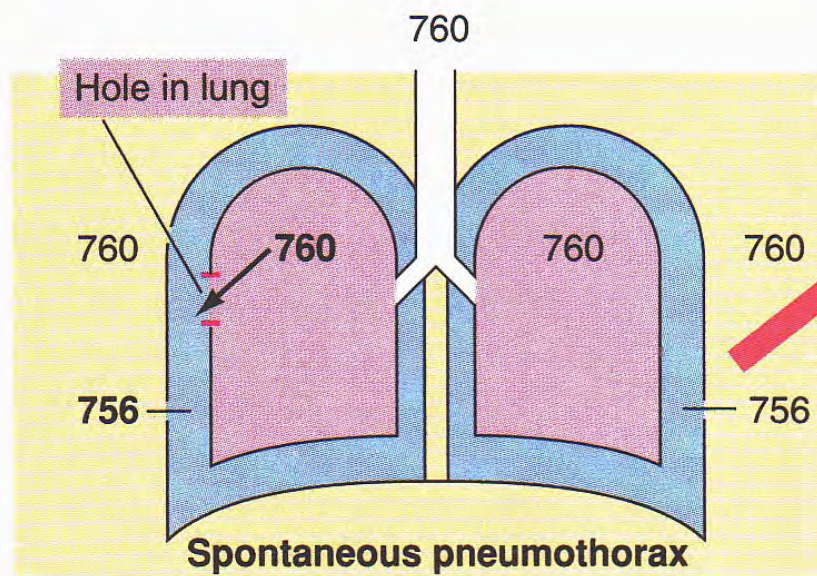




(a)



(b)



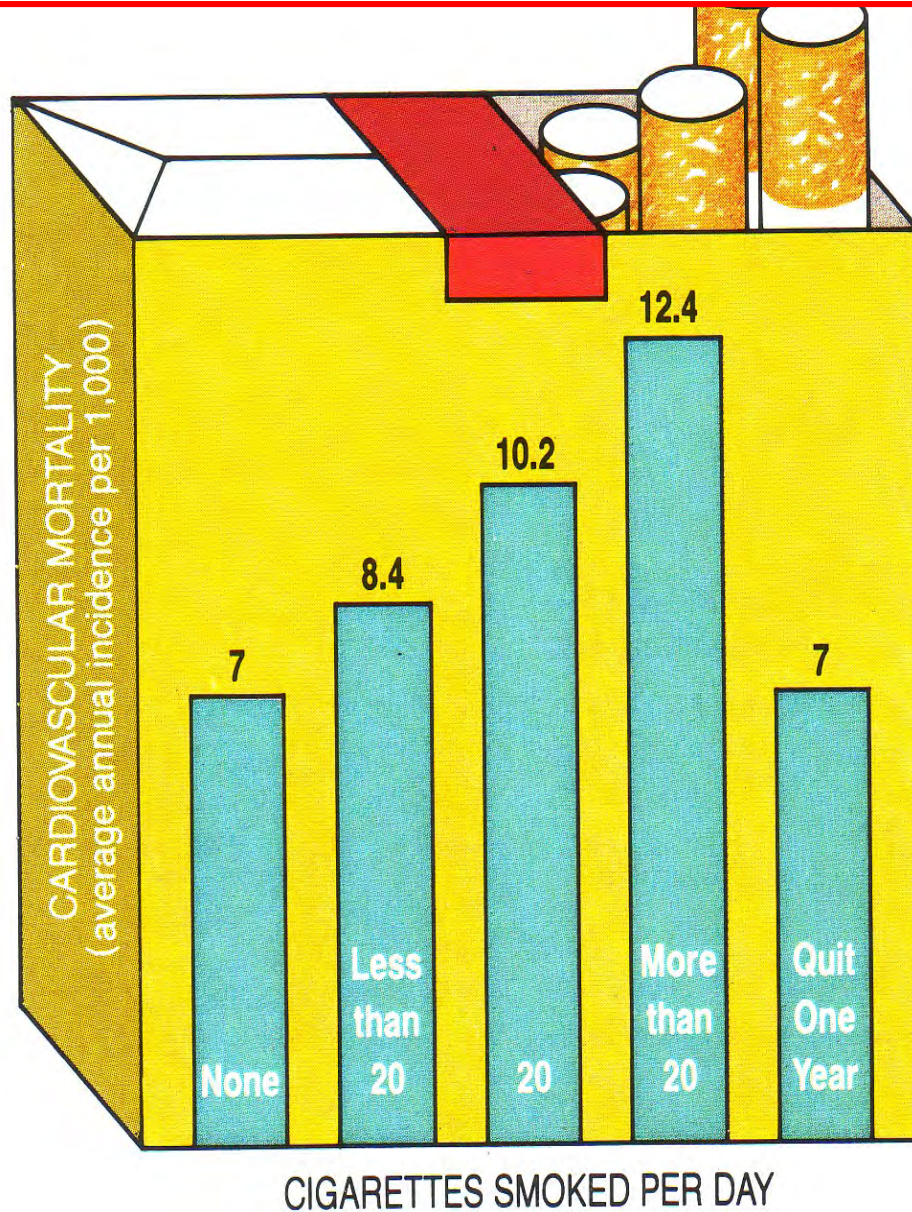
(c)

American Cancer Society Great American Smoke Out!

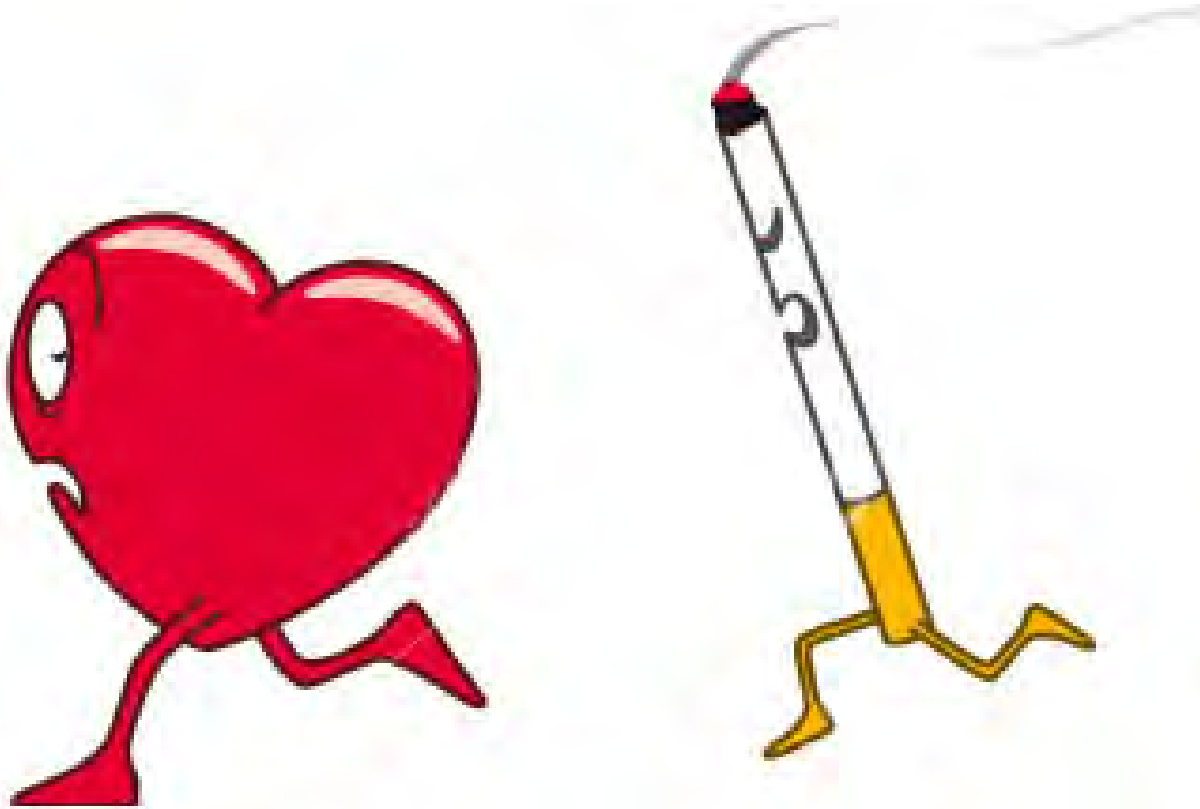


**[http://www.cancer.org/healthy/stayawayfromtobacco/
greatamericansmokeout/](http://www.cancer.org/healthy/stayawayfromtobacco/greatamericansmokeout/)**

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/)**

Cancer-causing Chemicals



Formaldehyde
Used to embalm dead bodies



Benzene
Found in gasoline



Polonium 210
Radioactive and very toxic



Vinyl chloride
Used to make pipes

Toxic Metals



Chromium
Used to make steel



Arsenic
Used in pesticides



Lead
Once used in paint



Cadmium
Used in making batteries

Poison Gases



Carbon monoxide
Found in car exhaust



Hydrogen cyanide
Used in chemical weapons



Ammonia
Used in household cleaners



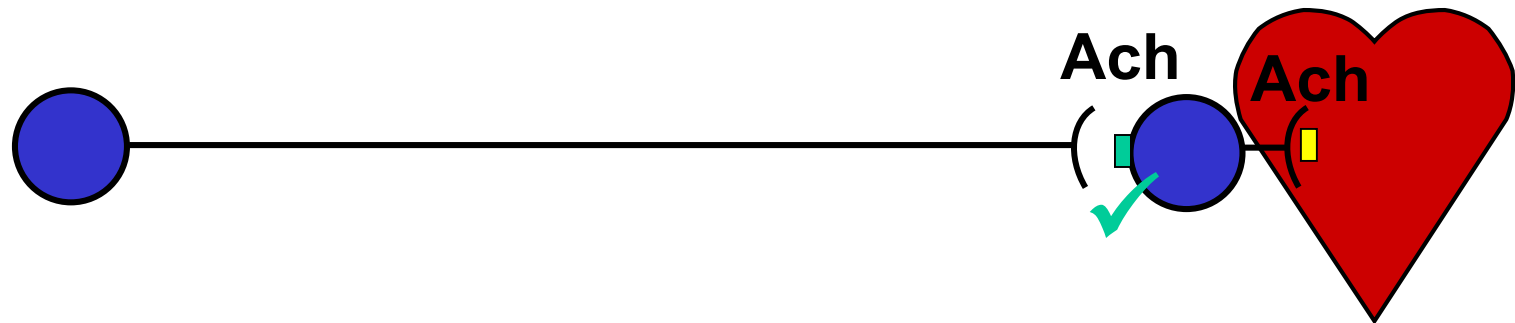
Butane
Used in lighter fluid



Toluene
Found in paint thinners

Tobacco smoke contains a deadly mix of **more than 7,000 chemicals**. Hundreds are toxic. About 70 can cause cancer. Here are some of the chemicals.

Parasympathetic

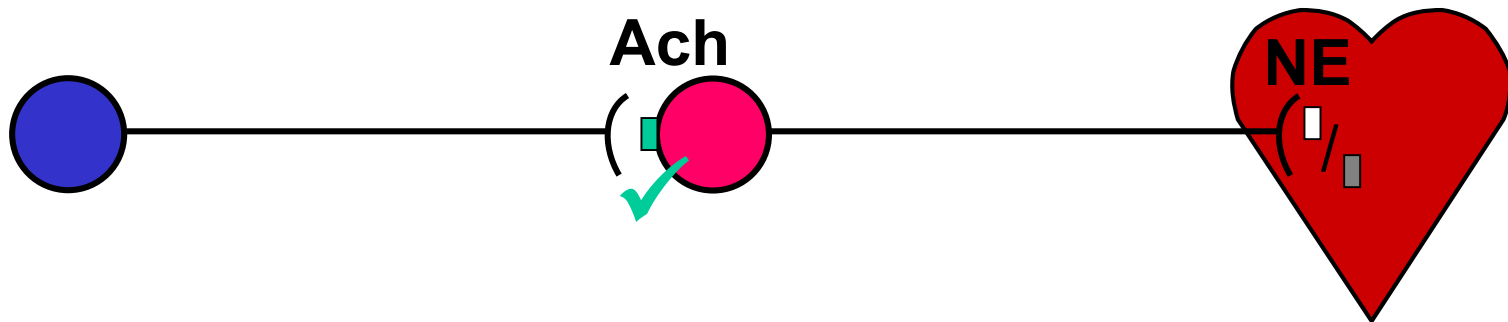


Ach = Acetylcholine

■ = Nicotinic Receptor

■ = Muscarinic Receptor

Sympathetic



NE = Norepinephrine

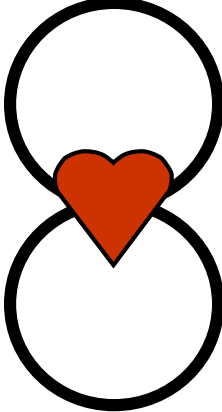
□ = α Receptor (α_1 , α_2)

■ = β Receptor (β_1 , β_2)

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



Pulmonary

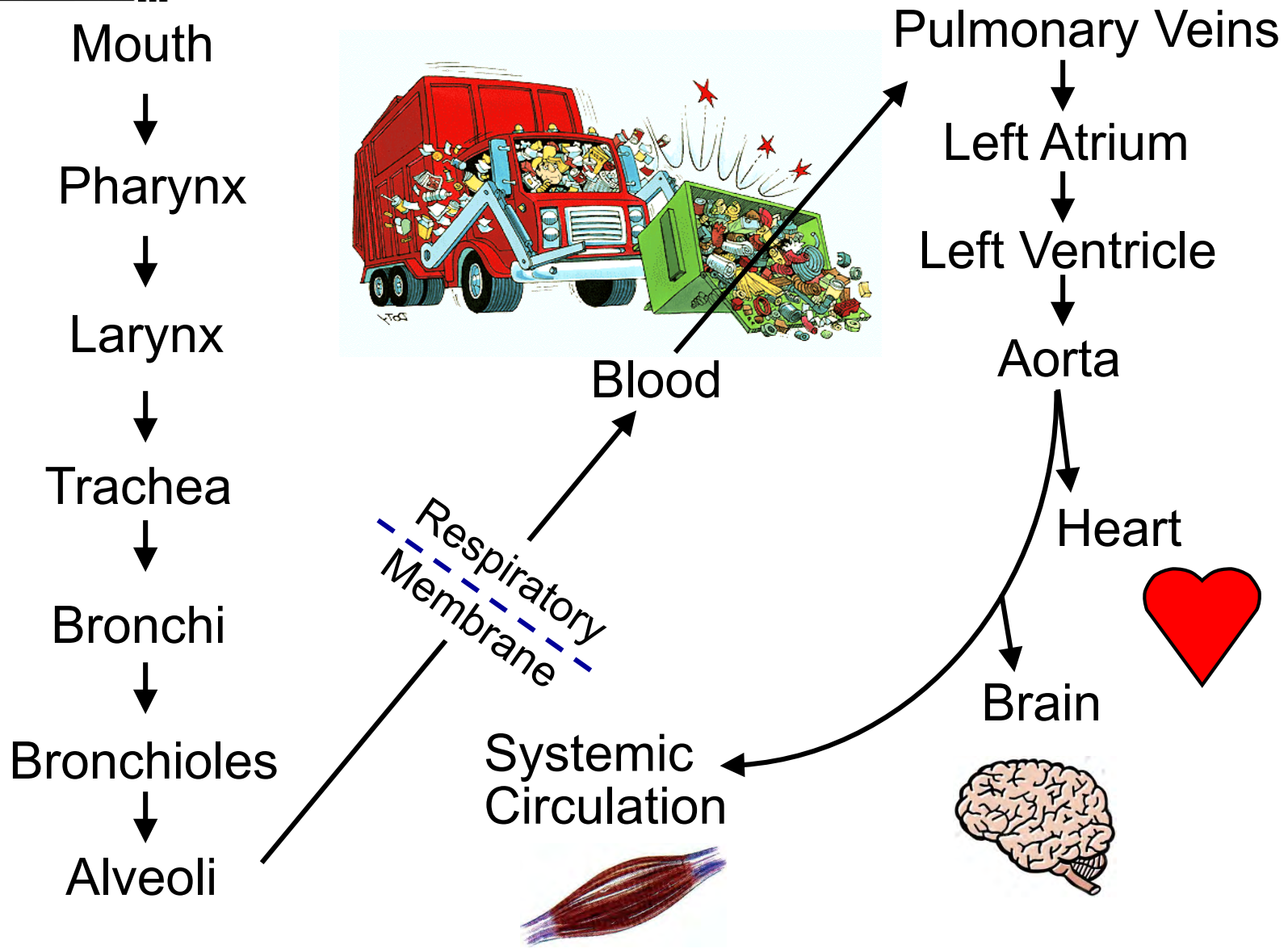


Systemic



Tracing the Route of Cigarette Smoke

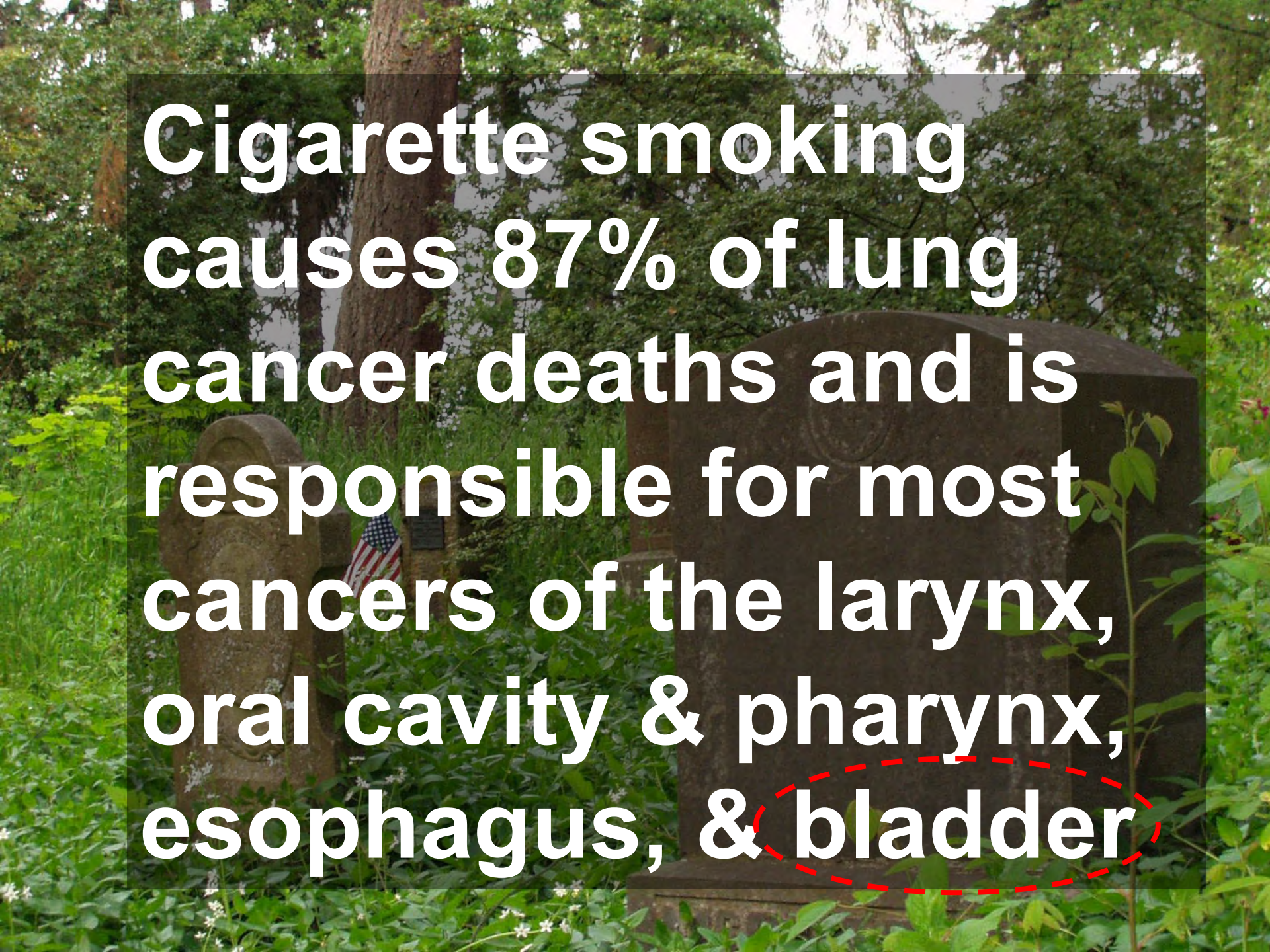
Puff to Brain Time 5 to 8 seconds!!



Keep it Basic?

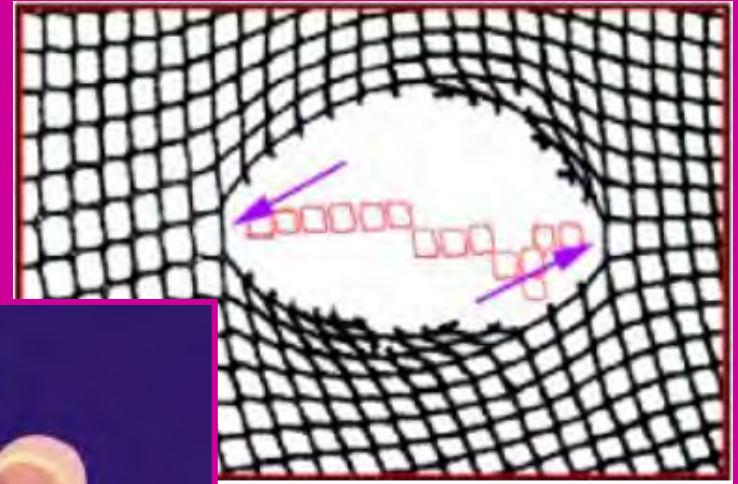
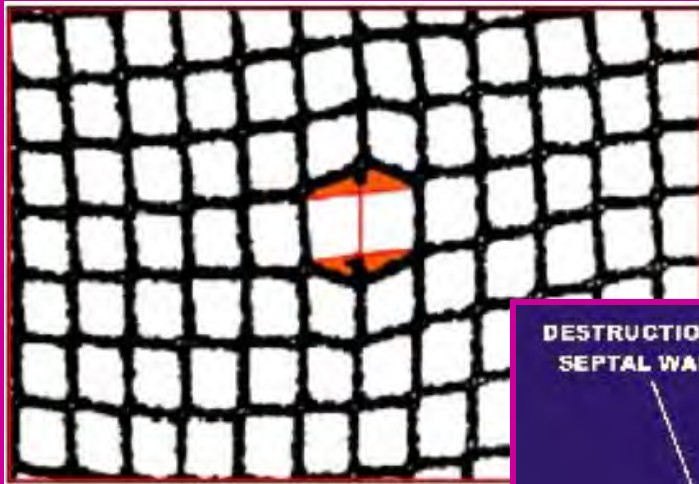
Cigarette smoking is the most important preventable cause of premature death in the U.S. accounting for 443,000 annual deaths.

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



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.



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.

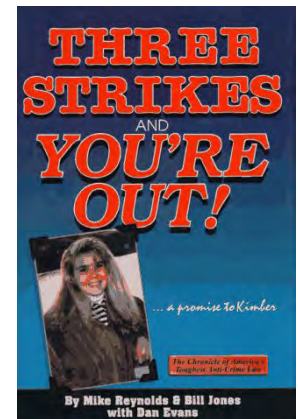
On the Pill & Smoke?

Increased Risk of:

1. Blood Clots

2. Heart Attack

3. Strokes!



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

A photograph of a man in a tuxedo smoking a cigarette, looking at a woman. The man is on the left, smiling slightly, with a lit cigarette in his mouth. The woman is on the right, looking towards the man. The background is a plain, light color.

"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

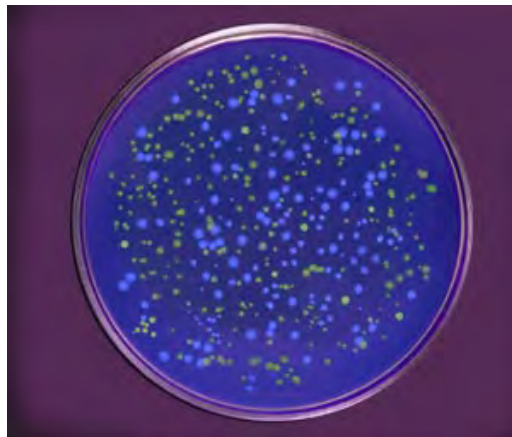
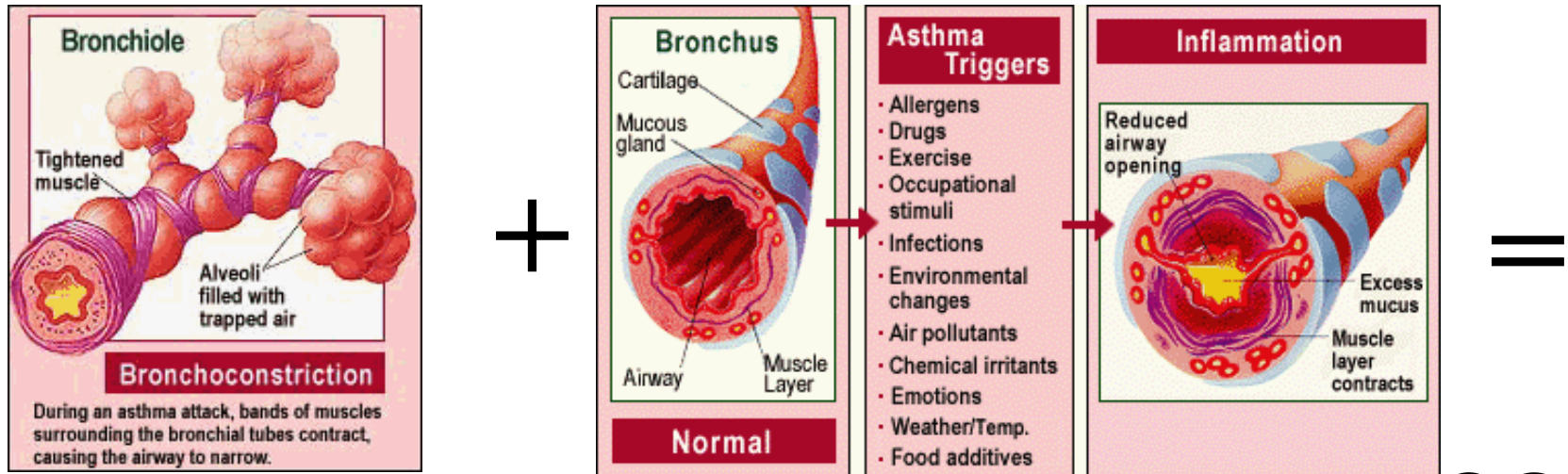
Vaping pollutes lungs with toxic chemicals and may even make antibiotic-resistant bacteria harder to kill

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



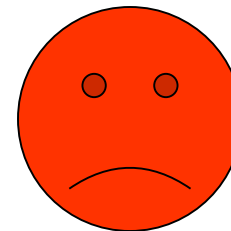
<https://www.sciencenews.org/article/health-risks-e-cigarettes-emerge>

SMOKING ≡ ASTHMA?



**Petri-dish
Effect**

Ugh!!
Cough!
Cough!!



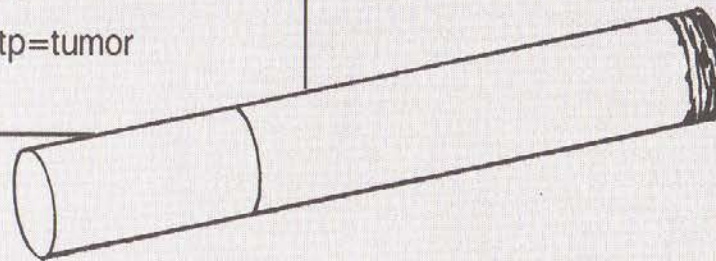
Source: *Reducing the Health Consequences of Smoking: 25 Years of Progress. A Report of the Surgeon General, 1989*

(per cigarette)

4-aminobiphenyl	c	140 ng
benz(a)anthracene	c	40-200 ng
benzene	c	400 μ g
benz(o)pyrene	c	40-70 ng
carbon monoxide	t	26.8-61 mg
formaldehyde	c	1,500 μ g
hydrazine	c	90 ng
hydrogen cyanide	t	14-110 μ g
2-naphtylamine	c	70 ng
nitrogen oxides	t	500-2,000 μ g
N-nitrosodimethylamine	c	200-1,040 ng
N-nitrosodiethanolamine	c	43 ng
N-nitrosopyrrolidine	c	30-390 ng
phenol	tp	70-250 μ g
polonium 210	c	.5 - 1.6 pCi
quinoline	c	15-20 μ g
o-toluidine	c	3 μ g

Note: c=carcinogenic; t=toxic; tp=tumor promoter

o-TOLUIDINE
4-AMINOBIIPHENYL
BENZENE
BENZ(A)ANTHRACENE
N-NITROSODIMETHYLAMINE
QUINOLINE
2-NAPHTYLAMINE
HYDRAZINE
PHENOL
CARBON MONOXIDE



**Some Toxic and Cancer-Causing Agents
You Breathe When You Are Exposed To Other People's Tobacco Smoke**



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

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/20211642>

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

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