

Thanks for your help with lab!



BI 121 Lecture 12

- I. Announcements Thanks! Q from last t?
- II. Endocrine Connections DC pp 109-13, LS pp 513-36
 - A. GH glucose mismatch. B. Peripheral endocrine organs
 1. Thyroid 2. Adrenals C. Stress response?
- III. Introduction to the Nervous System LS ch 5, DC Module 9
 - A. How 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, 2013 & 2014*
- 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!

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

↑ Amino Acid uptake & Protein synthesis

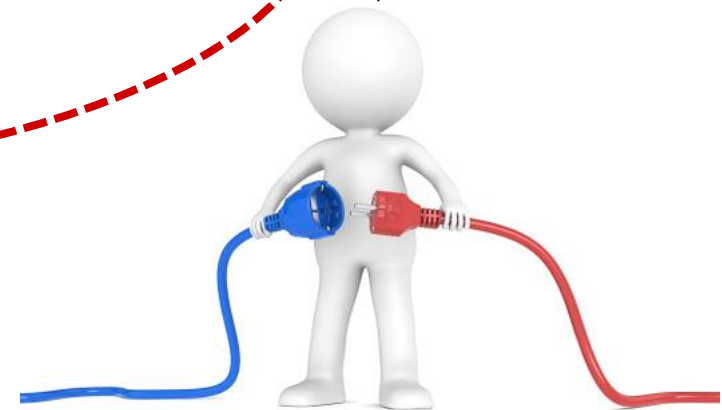
↑ Lipolysis & Fatty Acid mobilization

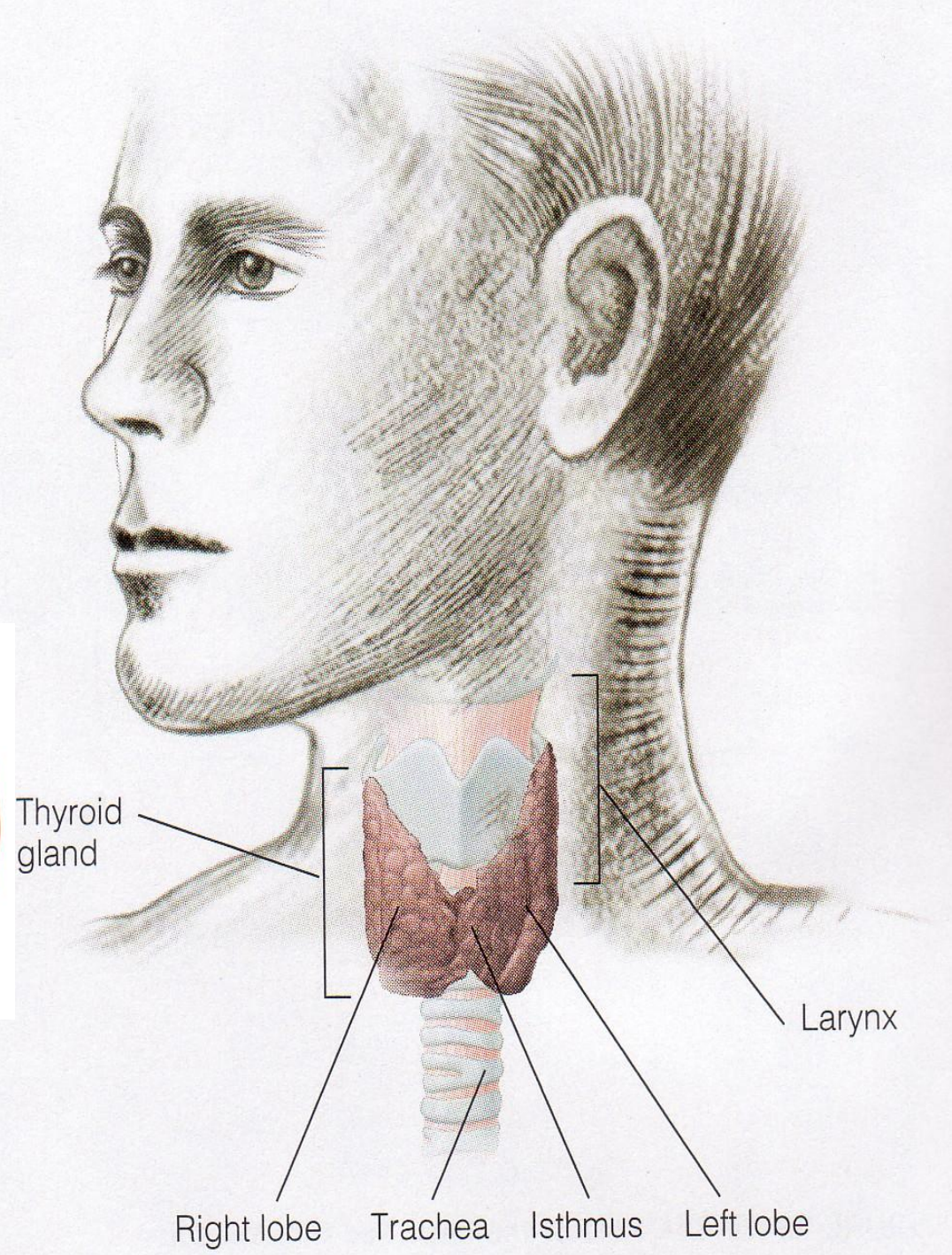
↓ Glucose uptake
(skeletal muscle & adipocytes)

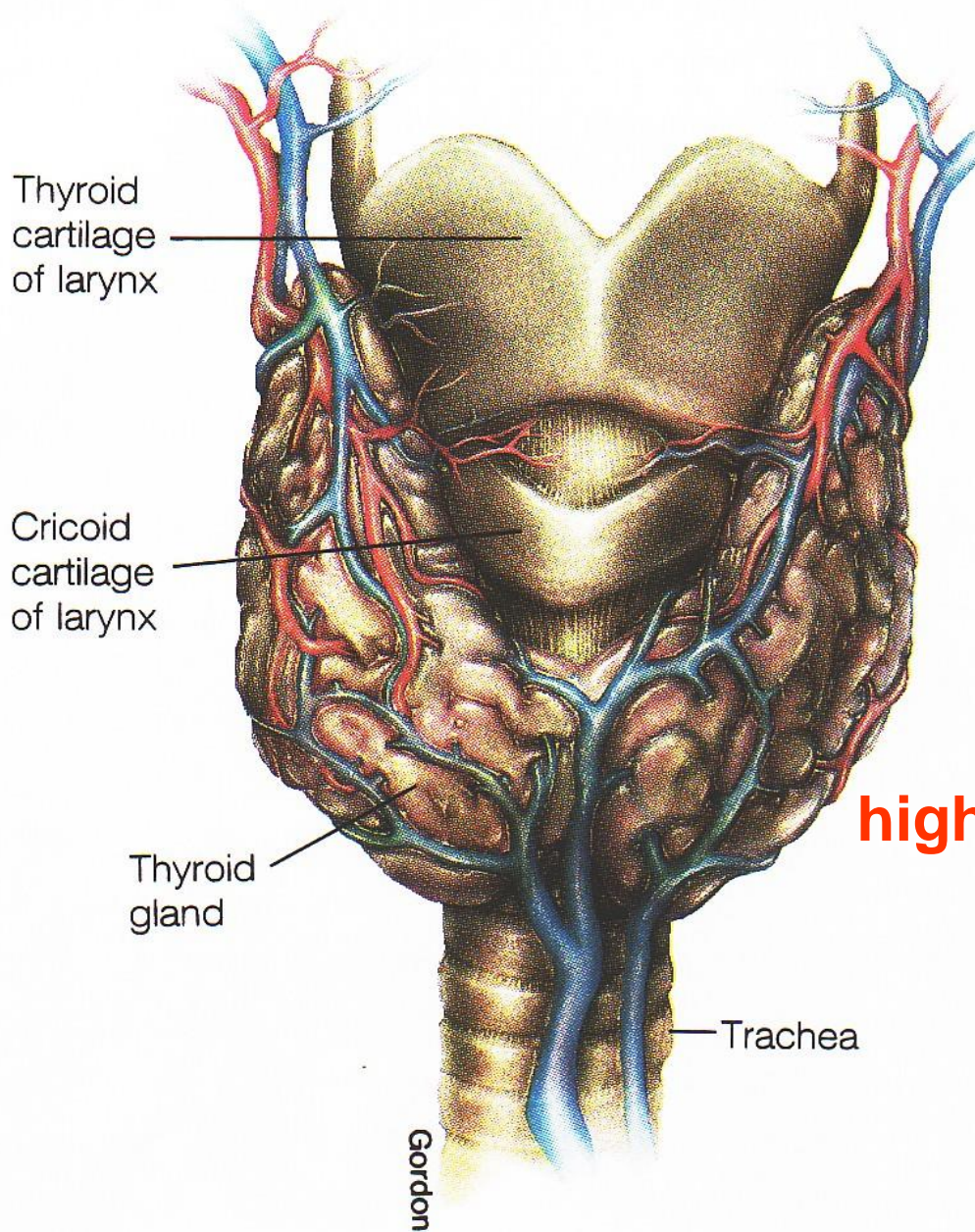
↑ Glucose production
(liver glycogenolysis)

↑ Insulin secretion

Mismatch!!

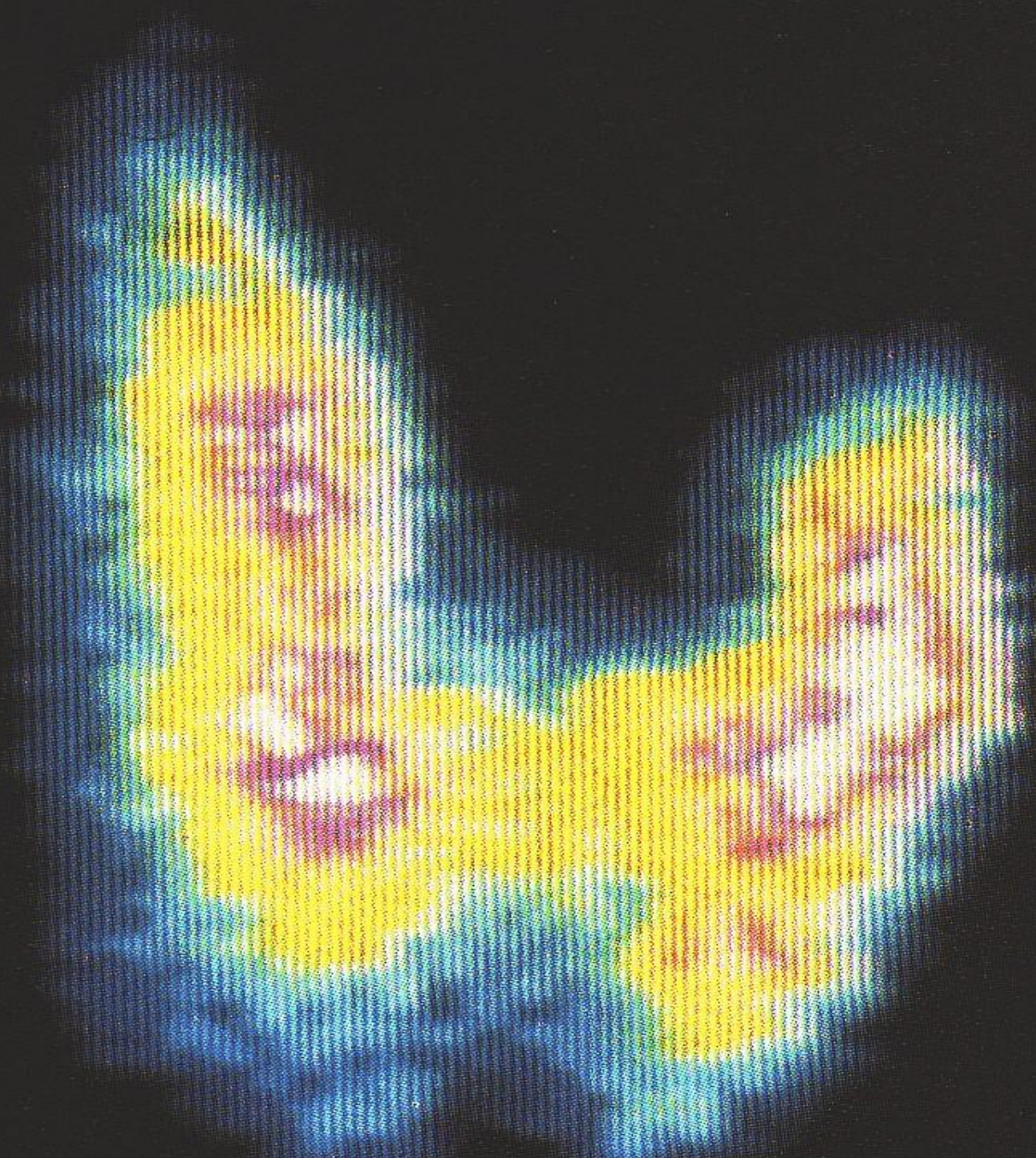






**Thyroid →
metabolism
highly vascularized**

<https://ed.ted.com/lessons/how-does-the-thyroid-manage-your-metabolism-emma-bryce>









Adrenals/Suprarenals

Adrenal gland

Cortisol

Adrenal cortex

Adrenal medulla

**Adrenalin
Hormones**

Kidney

**Stress
hormones!**

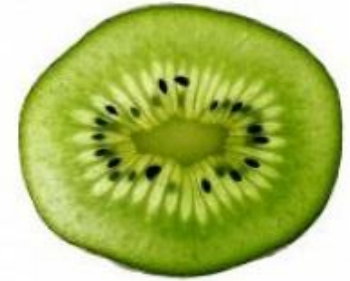
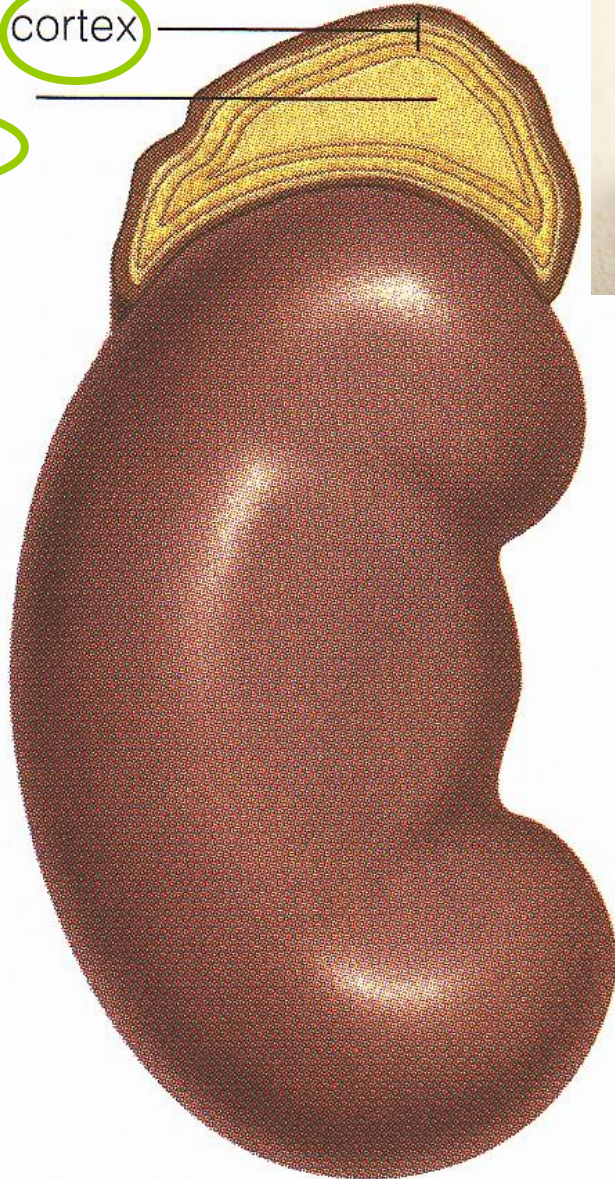


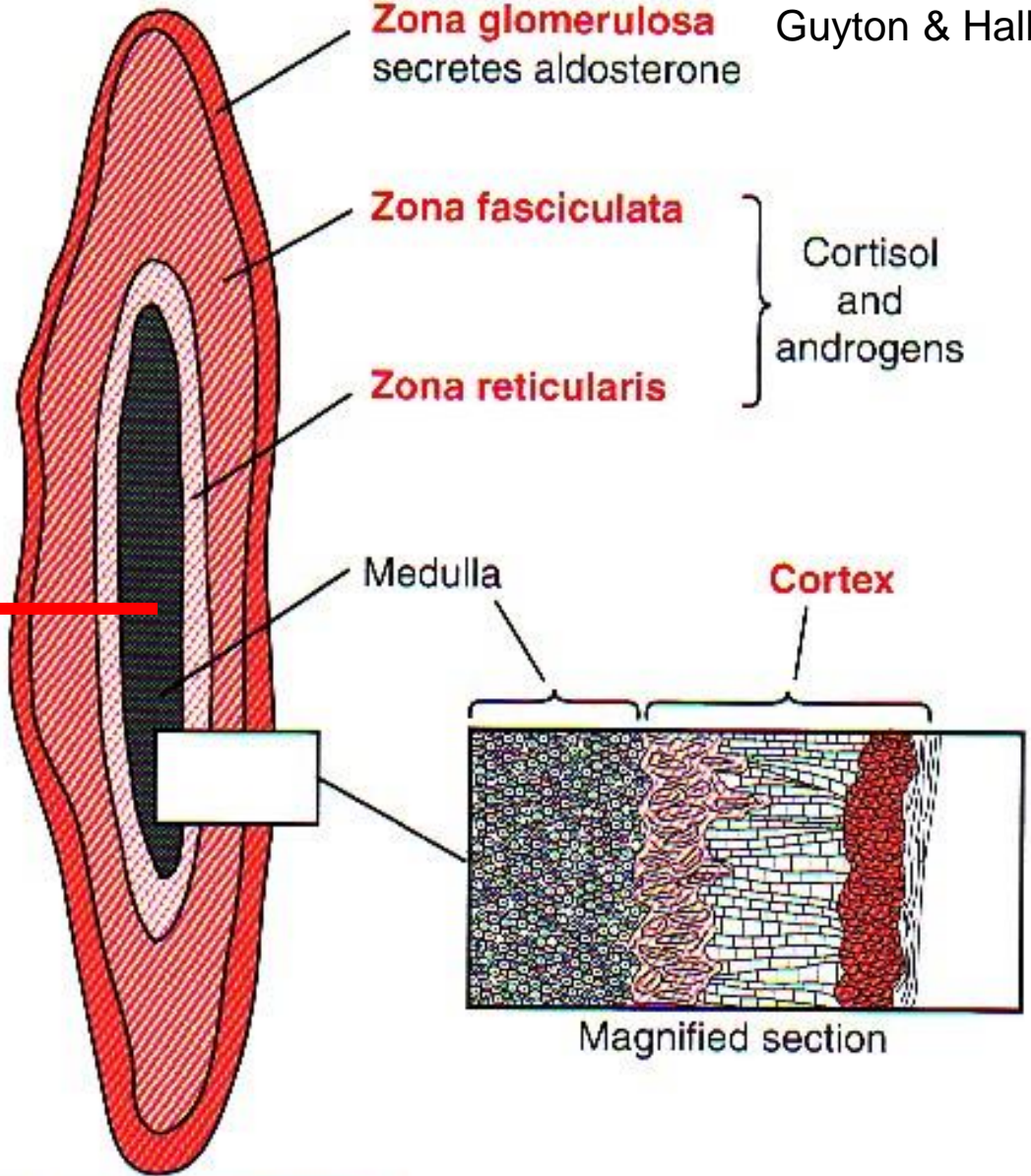
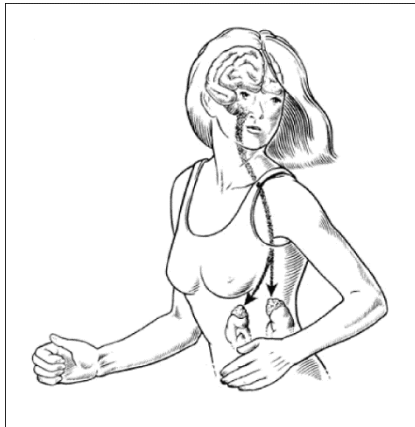
FIGURE 13-12

Adrenal Gland The adrenal glands sit atop the kidney and consist of an outer zone of cells, the adrenal cortex, which produces a variety of steroid hormones, and an inner zone, the adrenal medulla. The adrenal medulla produces adrenalin and noradrenalin.

BI 121!!



**Epinephrine
80%
Norepinephrine
20%**



Zona glomerulosa
secretes aldosterone

Guyton & Hall 2000

Zona fasciculata

Cortisol
and
androgens

Zona reticularis

Medulla

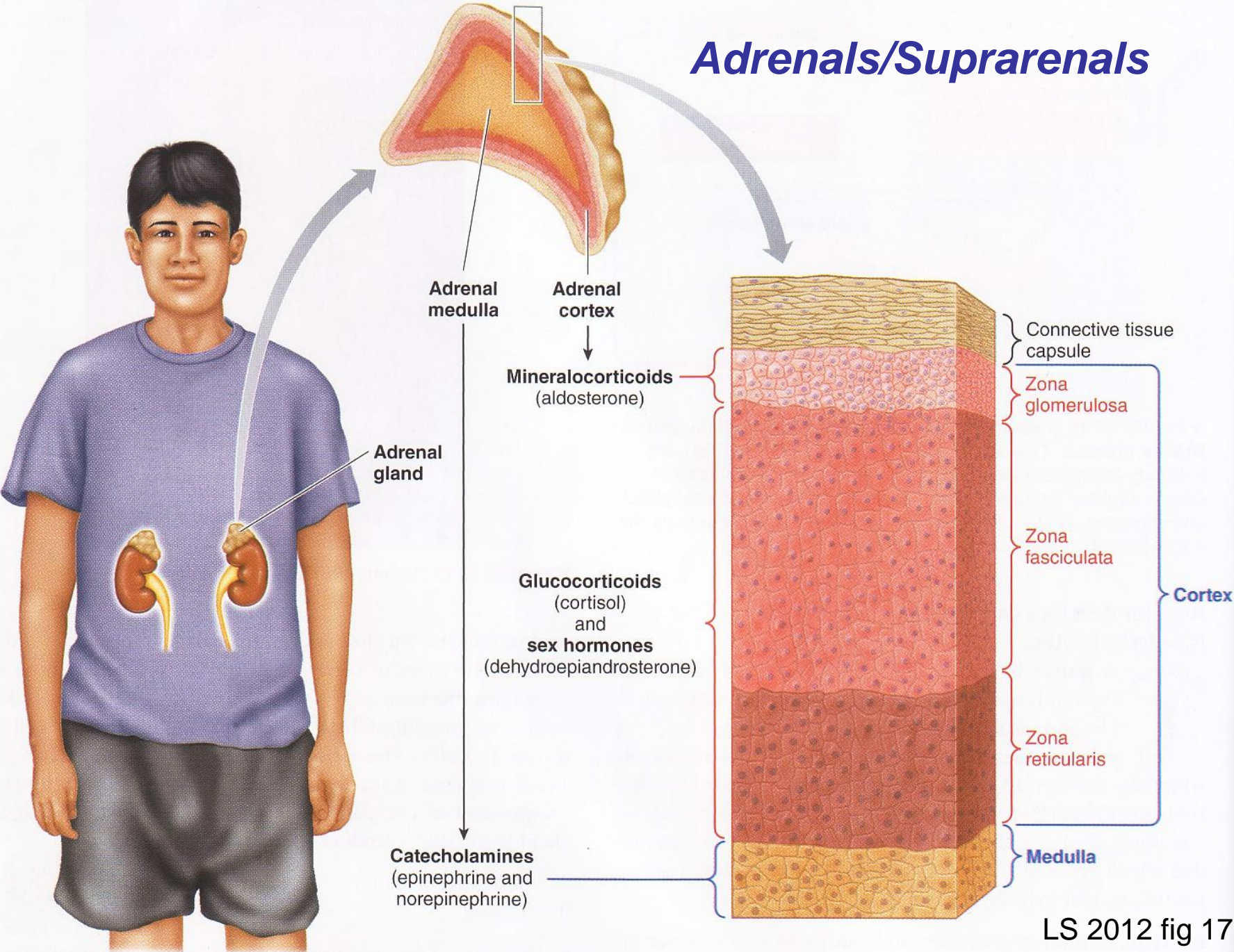
Cortex

Magnified section

FIGURE 77 - 1

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

Adrenals/Suprarenals

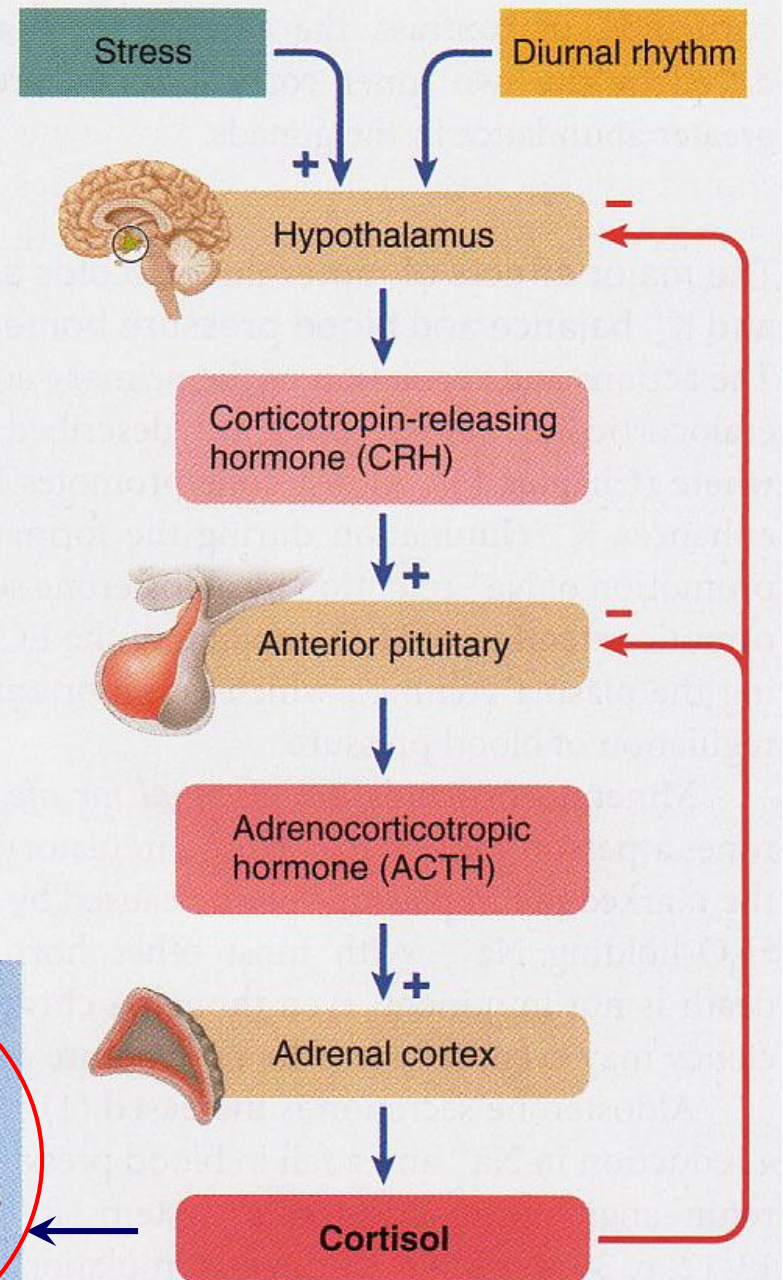


Stress Also Promotes Cortisol Secretion!

Cushing's Syndrome Excess Nutrients!

Metabolic fuels and building blocks available to help resist stress

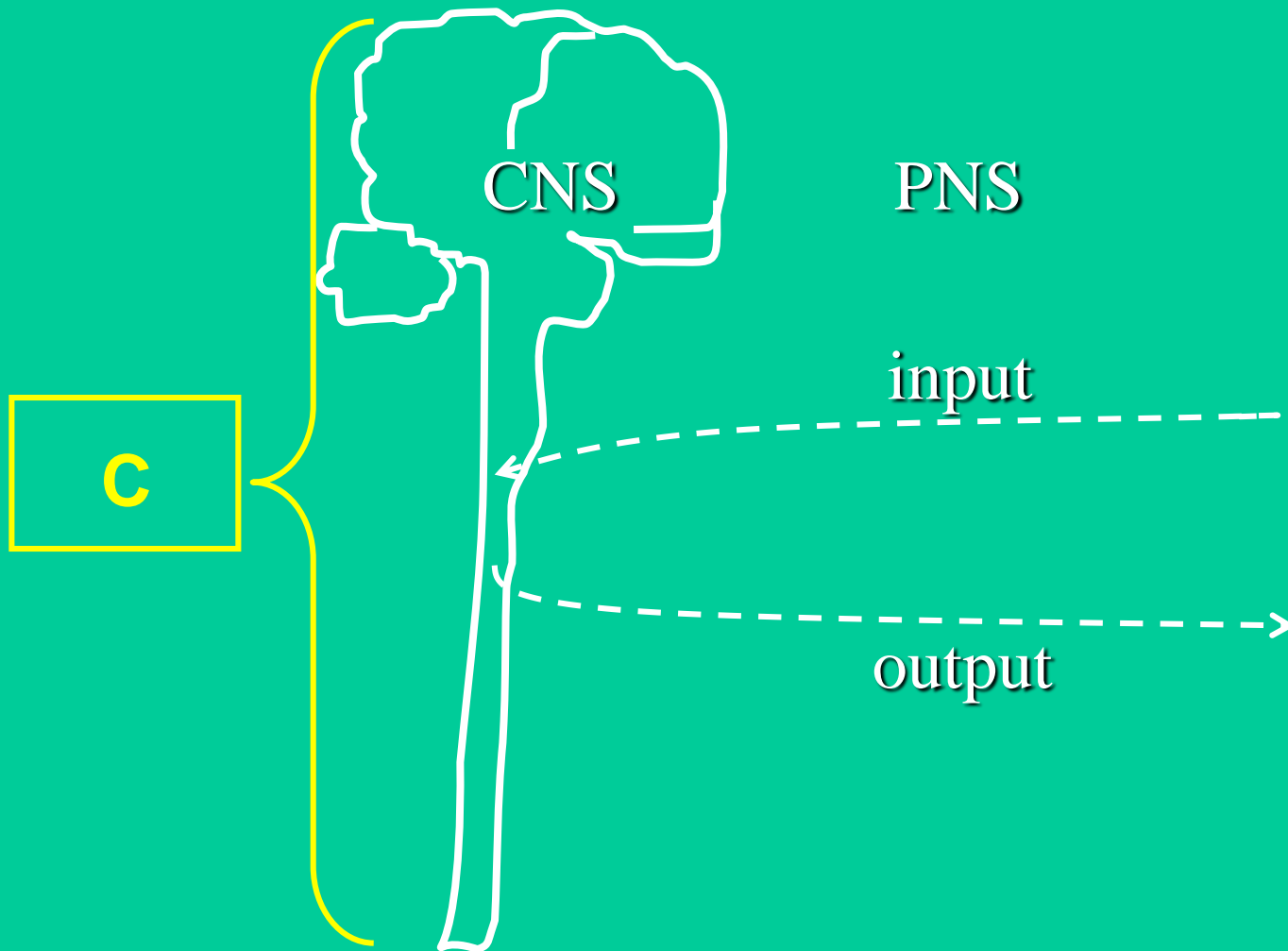
- ↑ Blood glucose (by stimulating gluconeogenesis and inhibiting glucose uptake)
- ↑ Blood amino acids (by stimulating protein degradation)
- ↑ Blood fatty acids (by stimulating lipolysis)



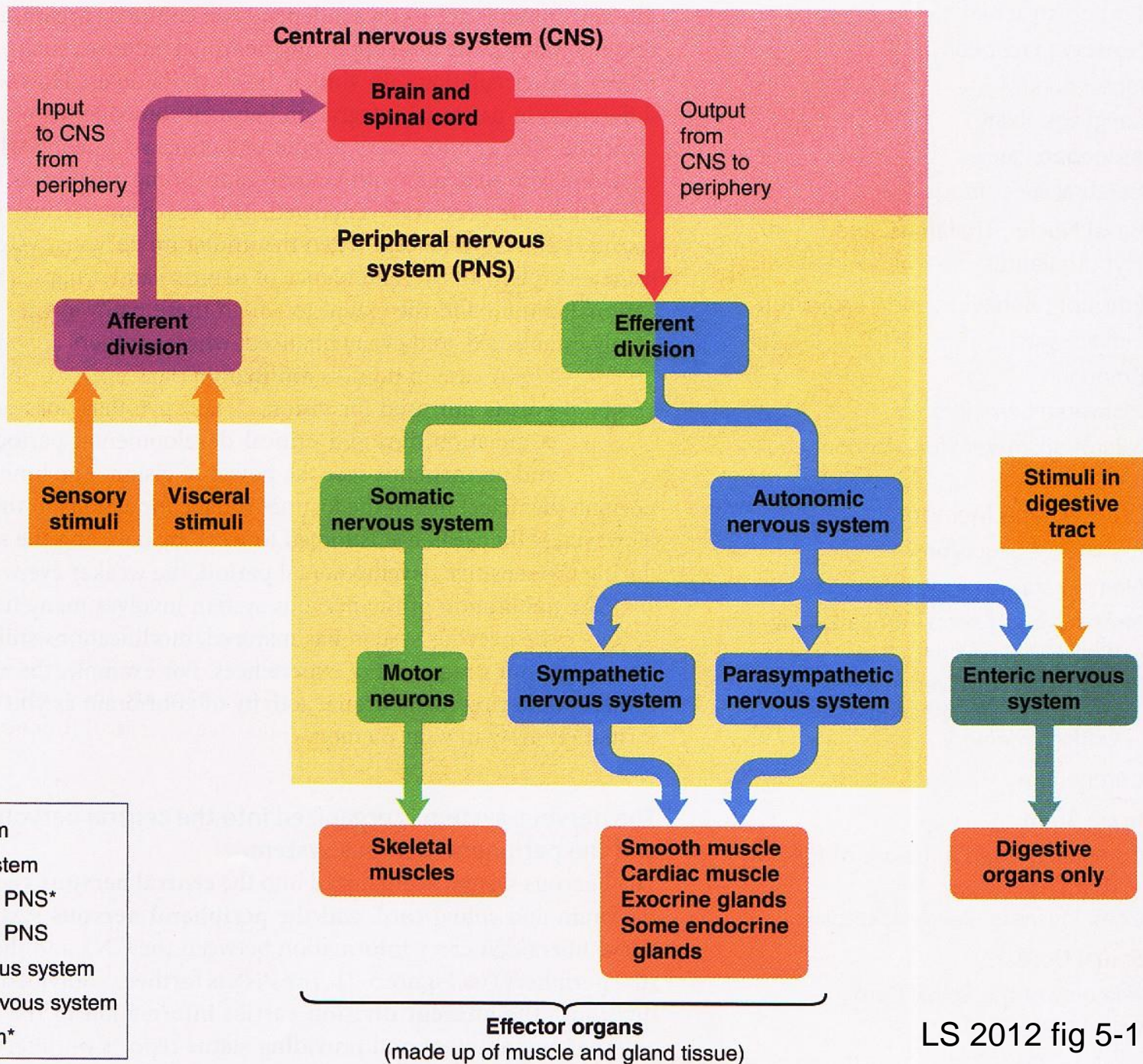
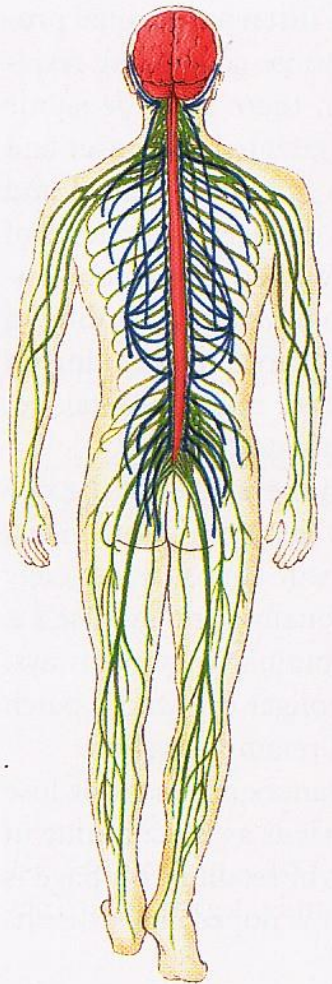
Questions + Discussion

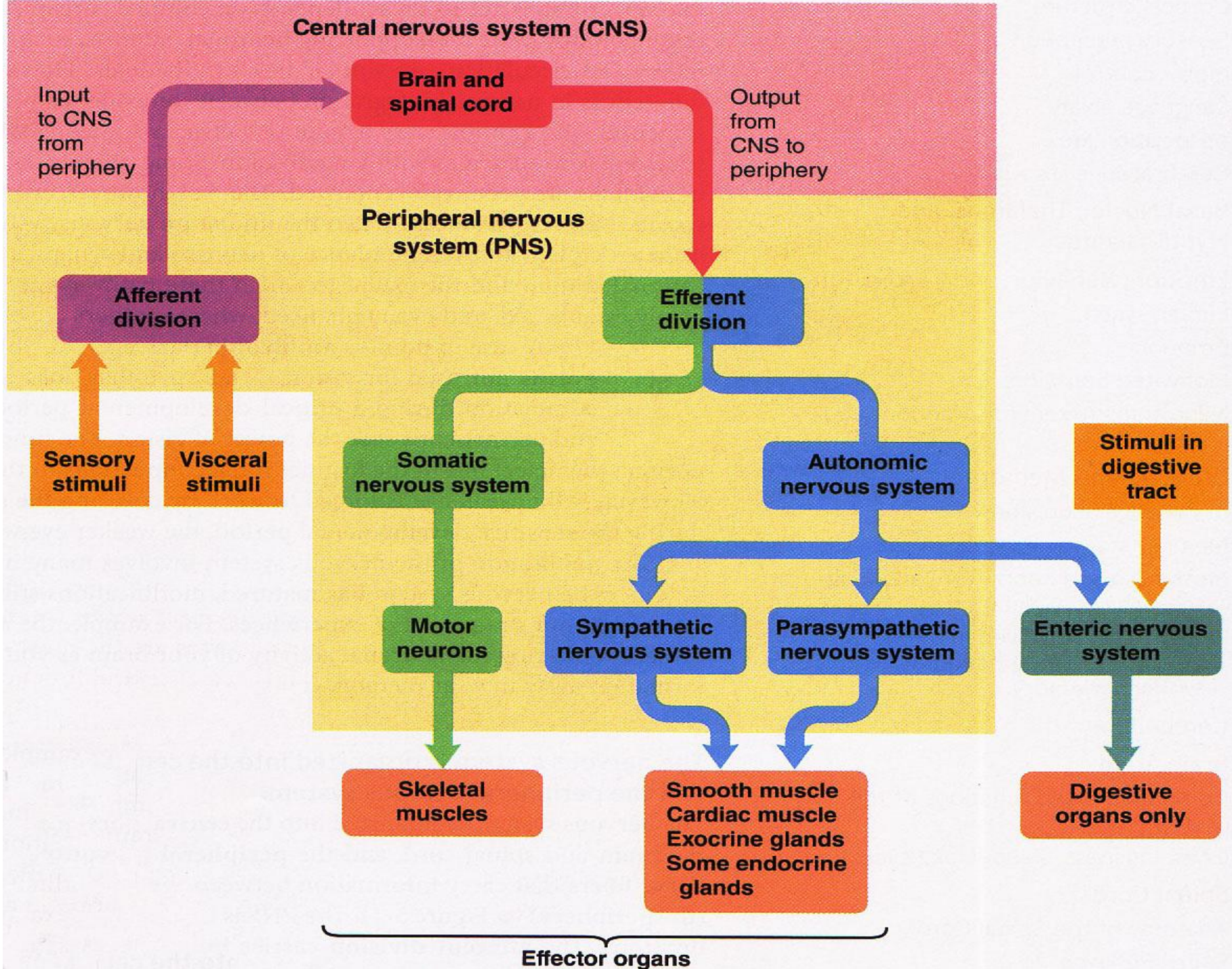


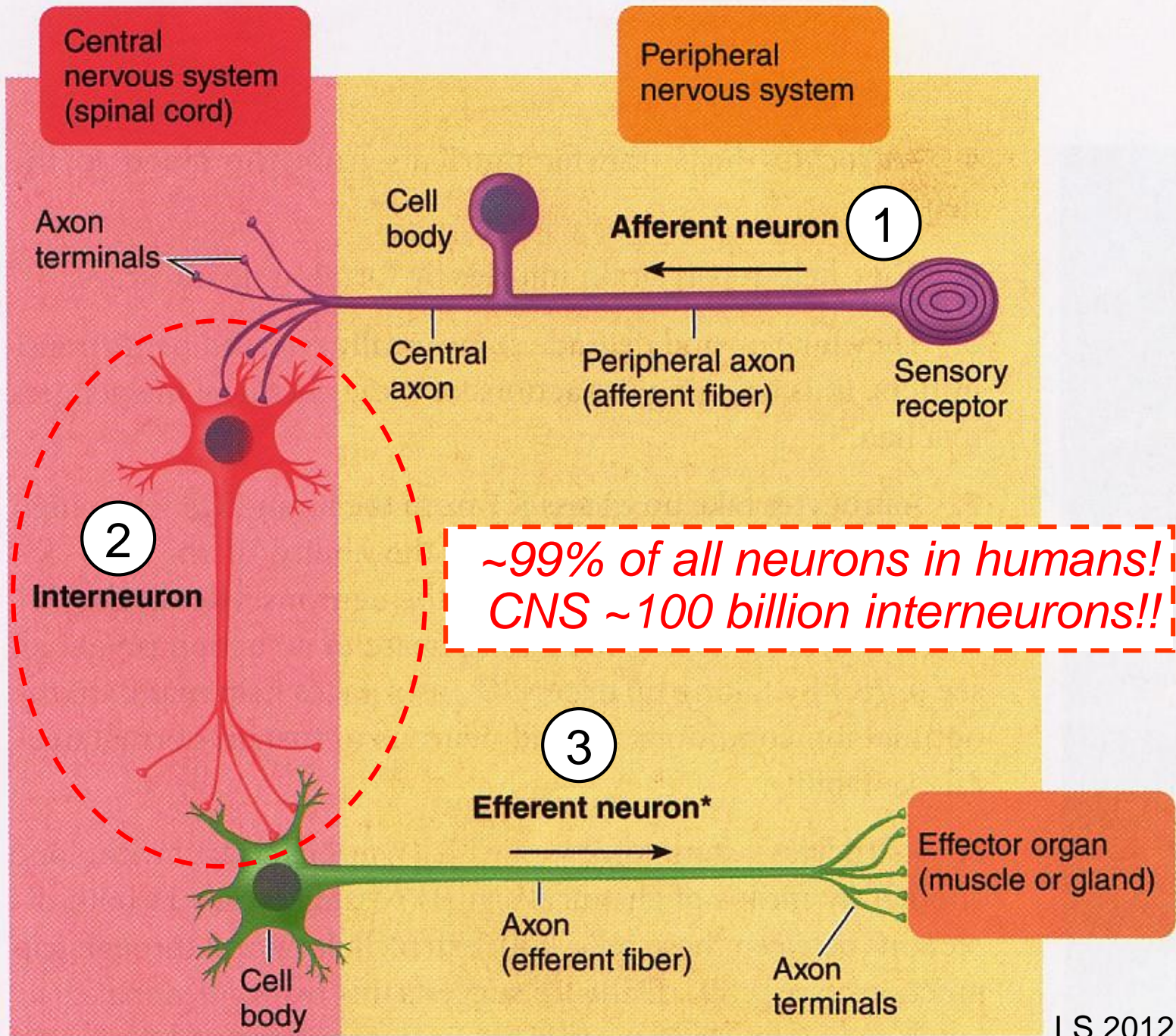
Nervous System



https://www.youtube.com/watch?v=uU_4uA6-zcE&vl=ko



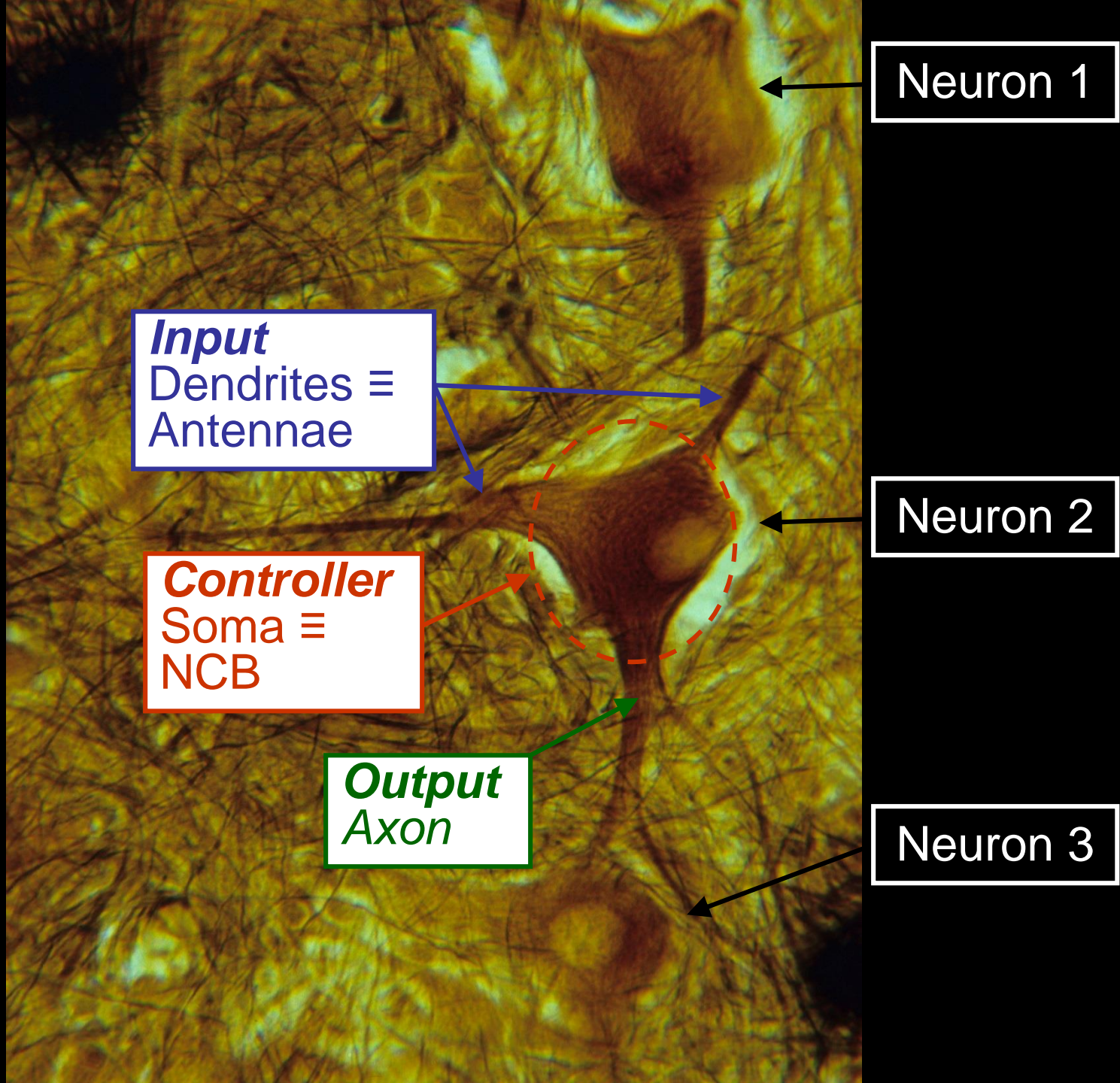




~ 90% of Cells w/in CNS are not neurons but glial cells \equiv neuroglia or nerve glue!

Astrocytes

A fluorescence micrograph showing several astrocytes. The cells are stained with a red dye that highlights their complex, branching cytoplasmic processes. The cell bodies are stained with a purple dye. The background is dark, with some blue-stained nuclei visible. Two white arrows point from the text 'Astrocytes' to two of the red-stained cells.



Neuron 1

Input
Dendrites ≡
Antennae

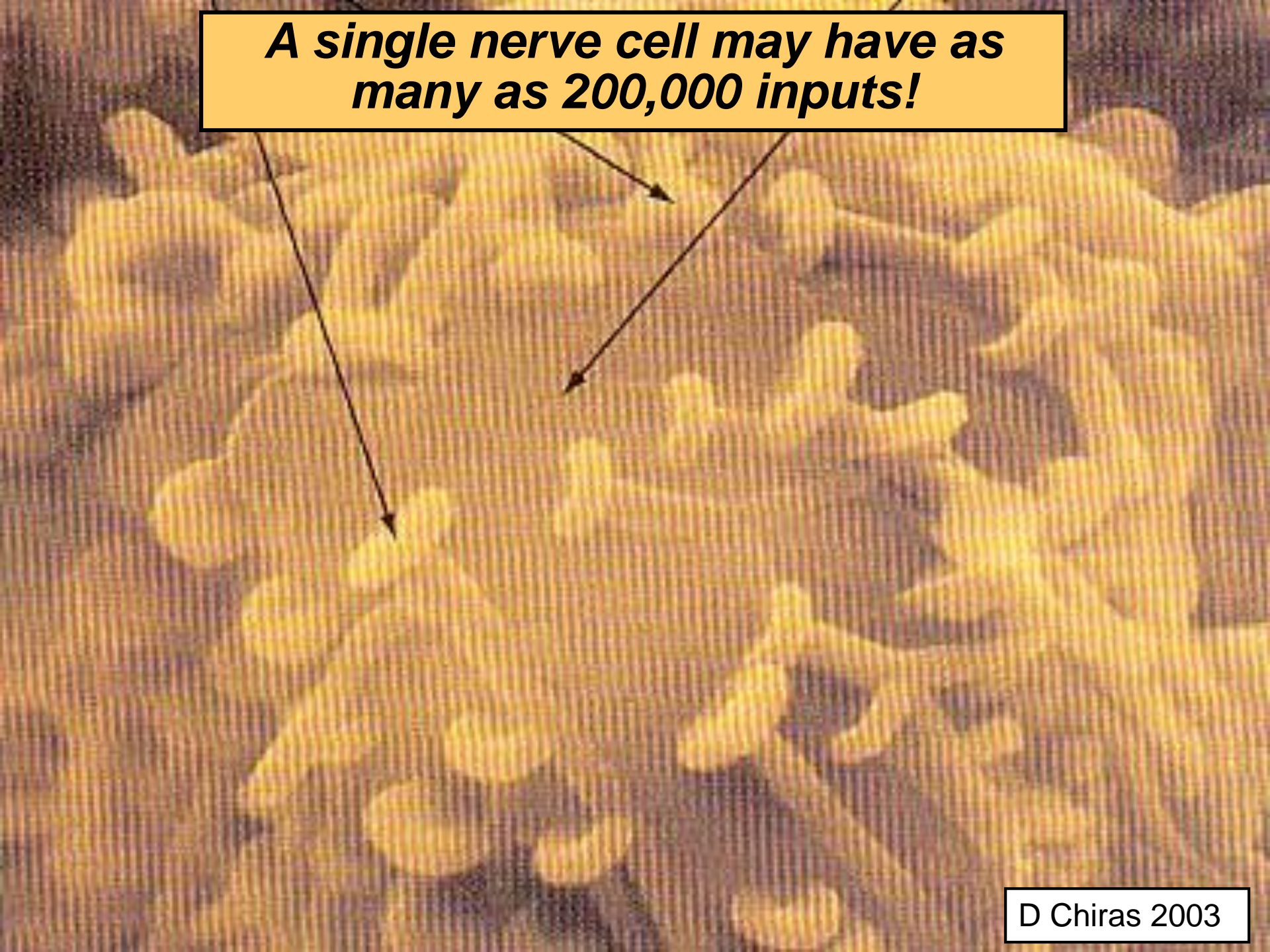
Neuron 2

Controller
Soma ≡
NCB

Output
Axon

Neuron 3

A single nerve cell may have as many as 200,000 inputs!

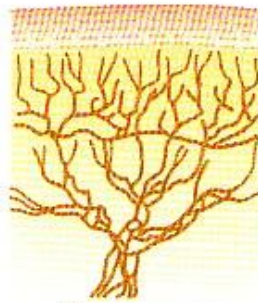


***Nerve cell with multiple axons grown by adding
a mitogen/neurogen \equiv nerve growth factor!***



Courtesy Fengquan Zhou
UNC Chapel Hill

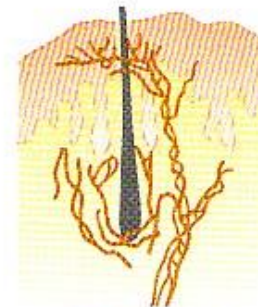
**Sensory
nerves
especially,
come in all
shapes &
sizes!**



Free nerve endings



Expanded tip receptor



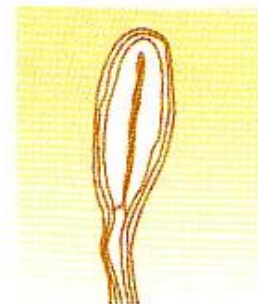
Tactile hair



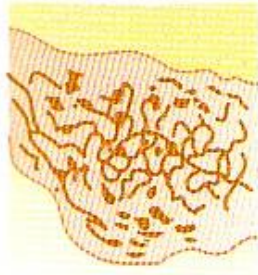
Pacinian corpuscle



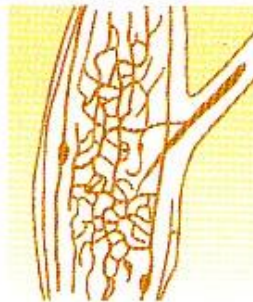
Meissner's corpuscle



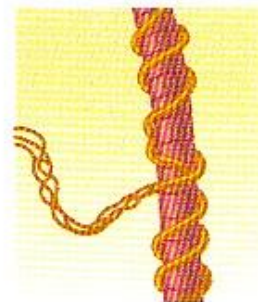
Krause's corpuscle



Ruffini's end-organ



Golgi tendon apparatus



Muscle spindle

Figure 46-1

Several types of somatic sensory nerve endings.

Nerve Extremes: Far ends of the Continuum

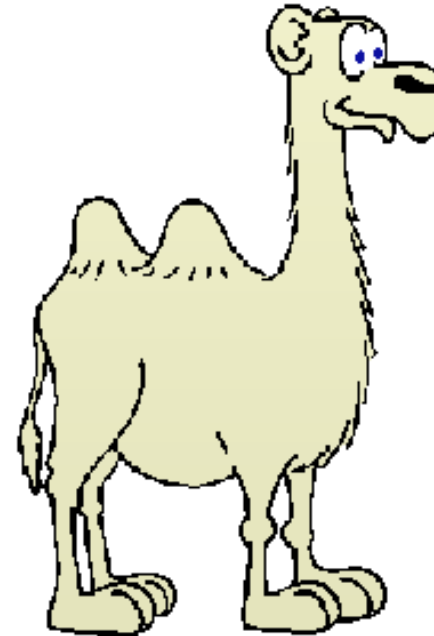
A = Large to medium
myelinated, up to
(120 m/sec)

$\alpha, \beta, \gamma, \delta$

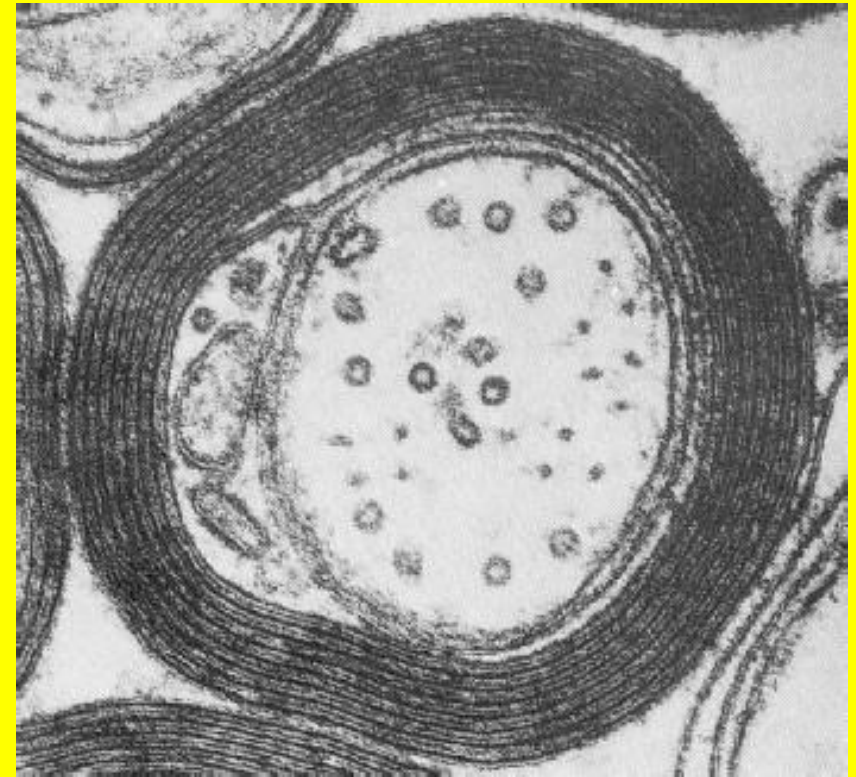
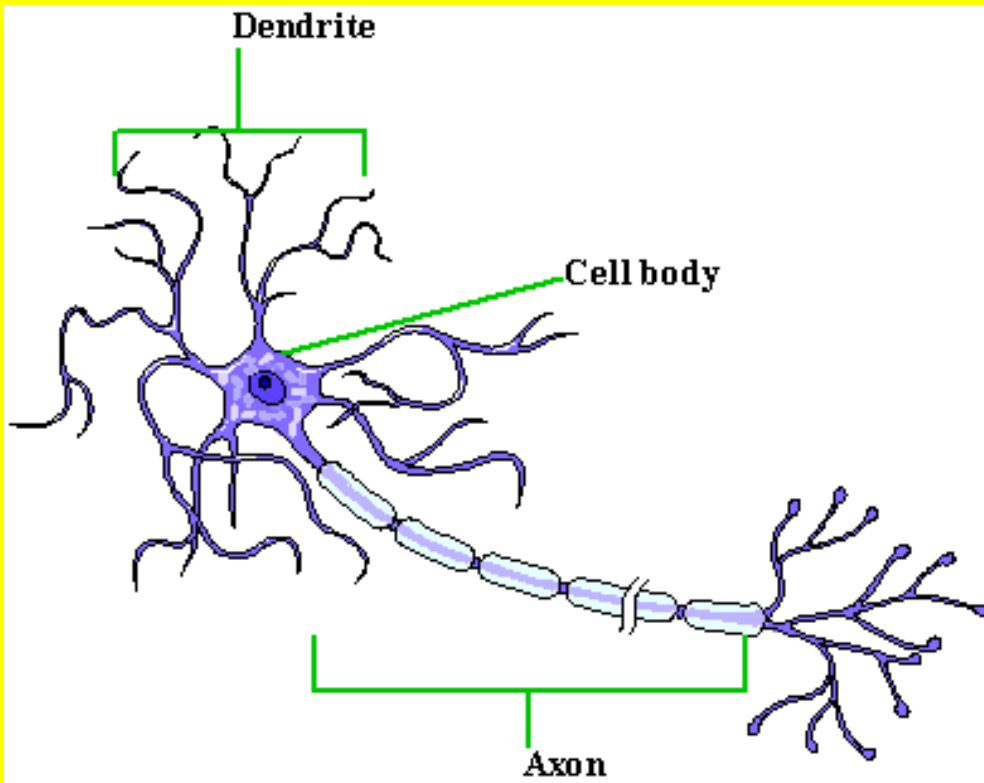


C = Small
unmyelinated,
(0.25 m/sec)

IV

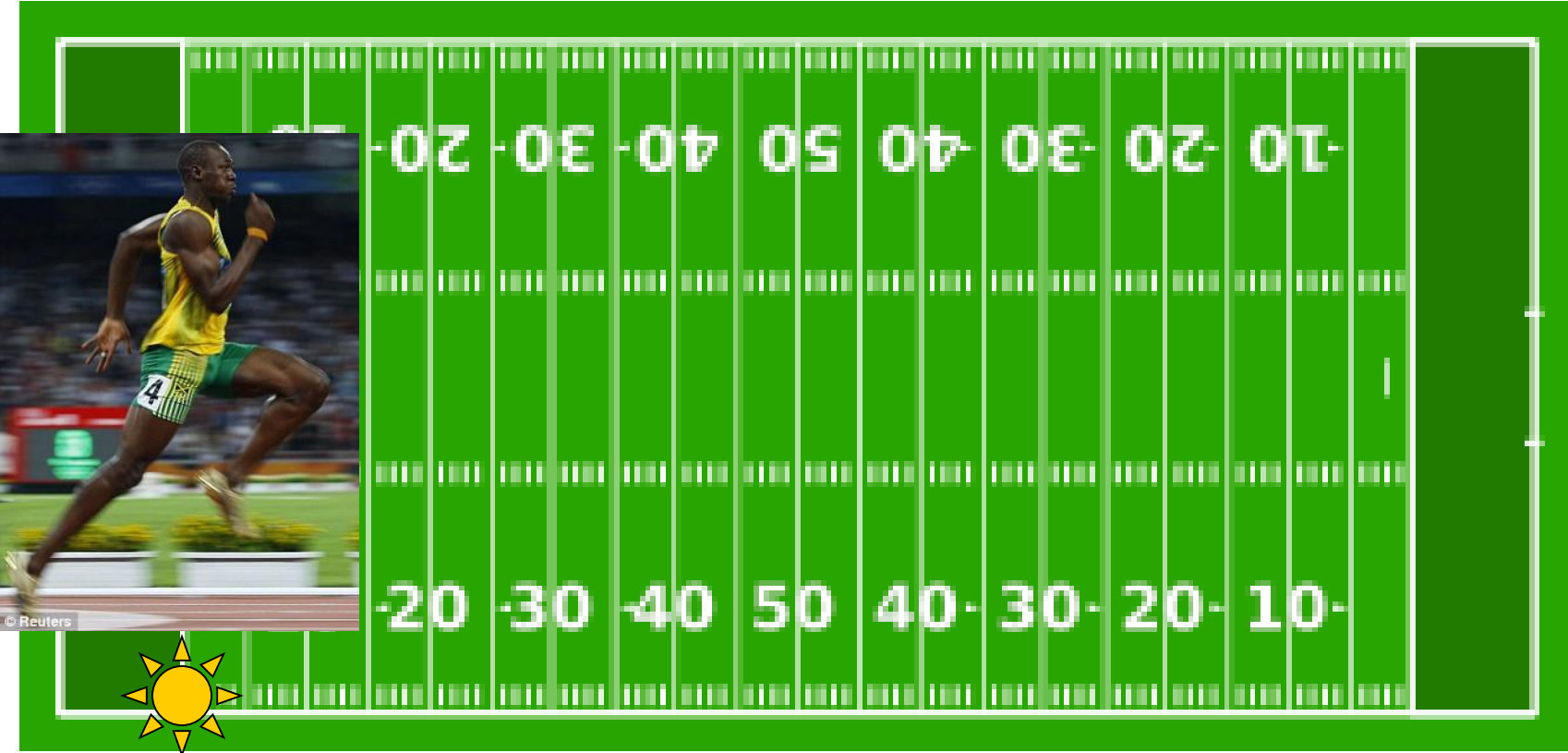


What is myelin? Why is it important?

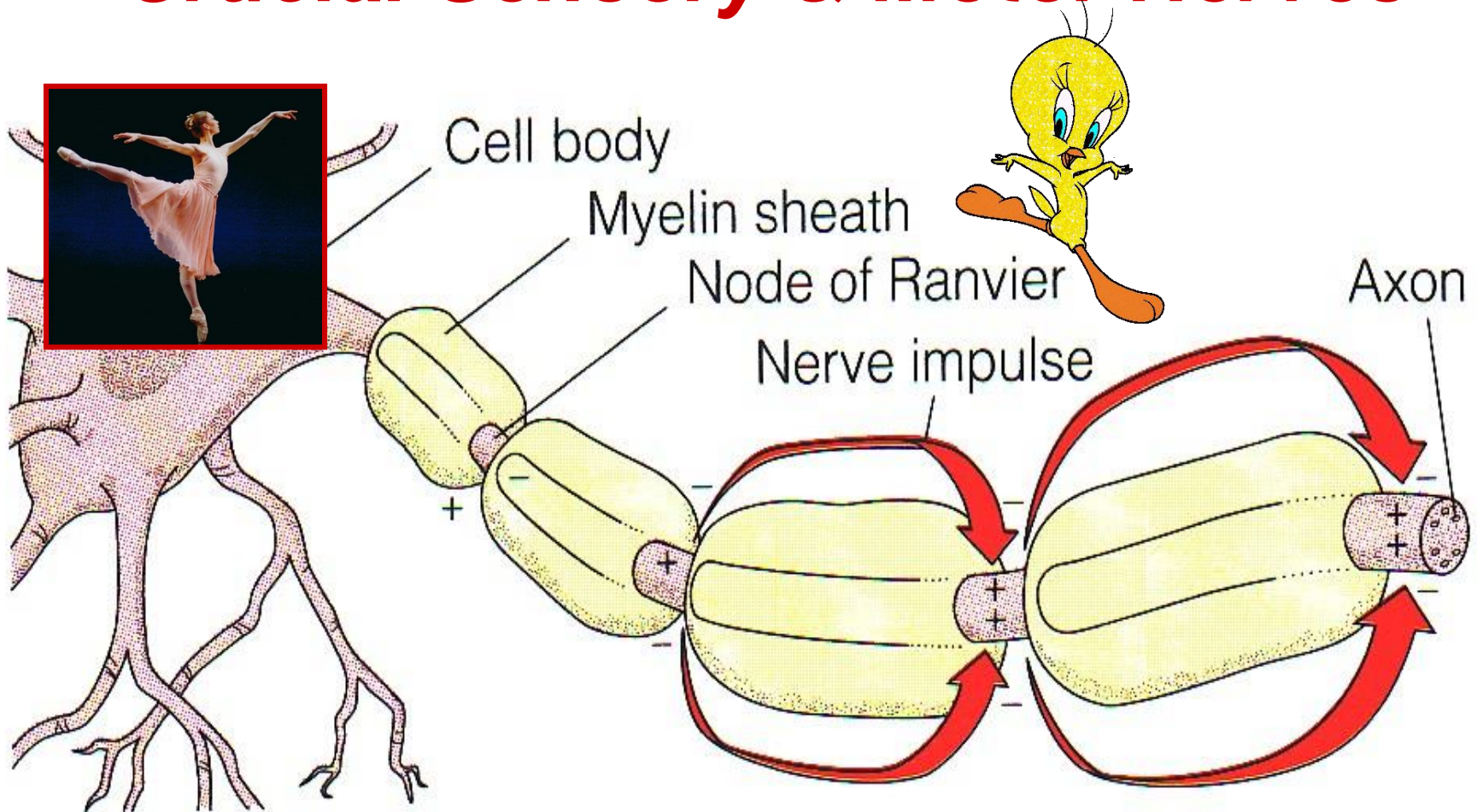


Lipid insulative coat
 $\uparrow \vec{v}$, *conserves ions & ATP*

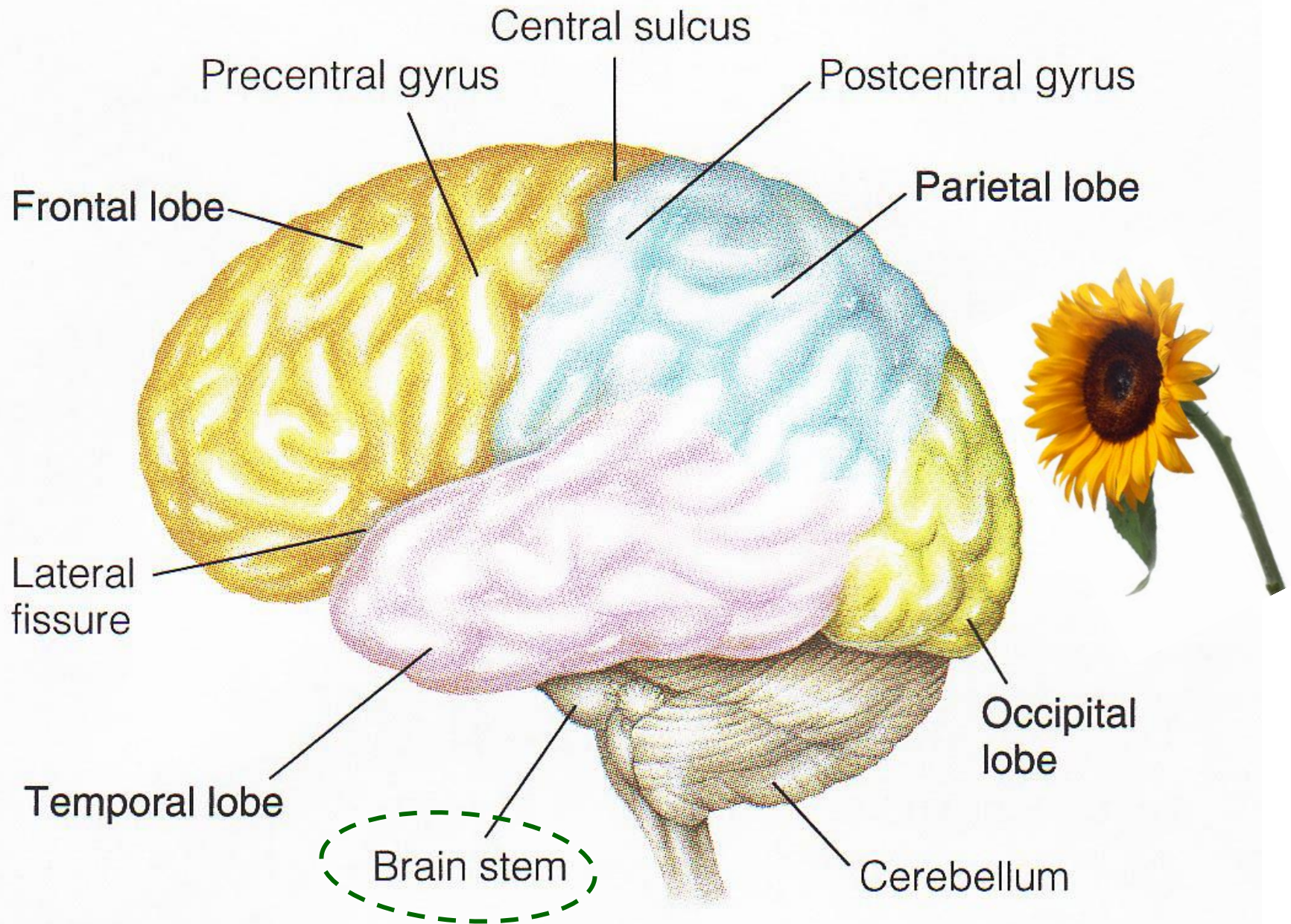
A large myelinated "survival" nerve can conduct impulses the length of football field in < 1 second!

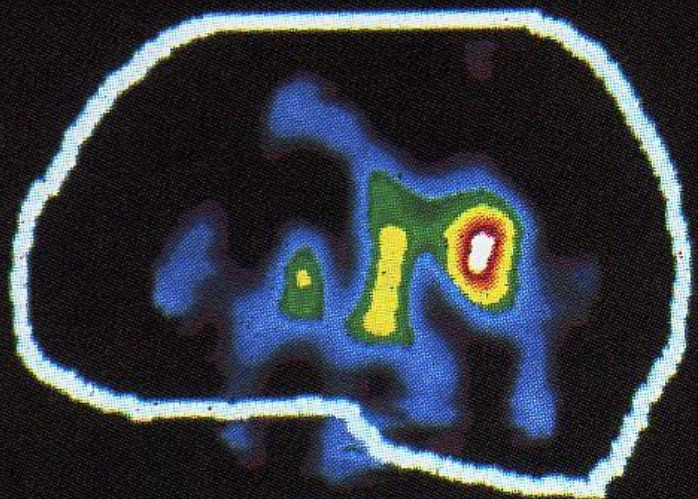


Saltatory/Leaping Conduction! *Crucial Sensory & Motor Nerves*

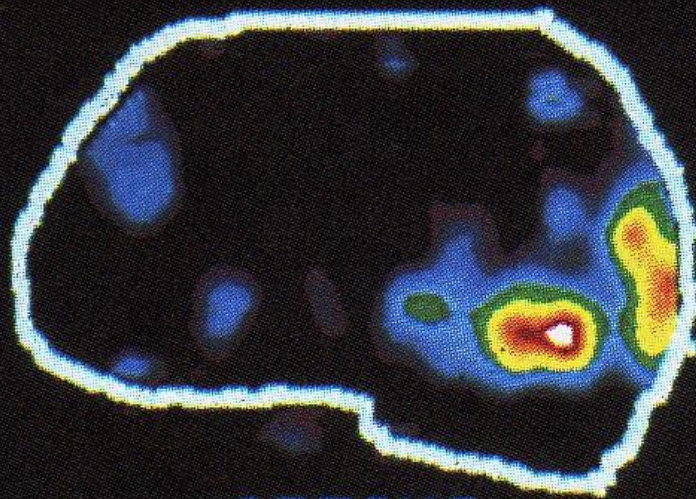


L. saltare to hop or leap! Fr. salt, sautier, sauté, leap, high air, vault

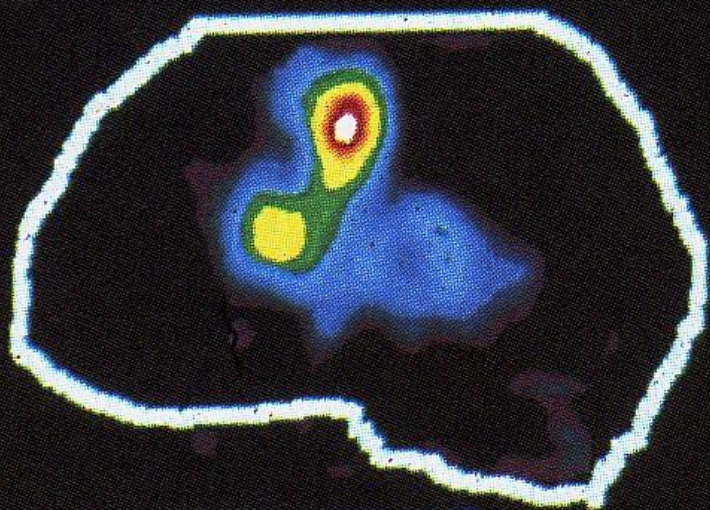




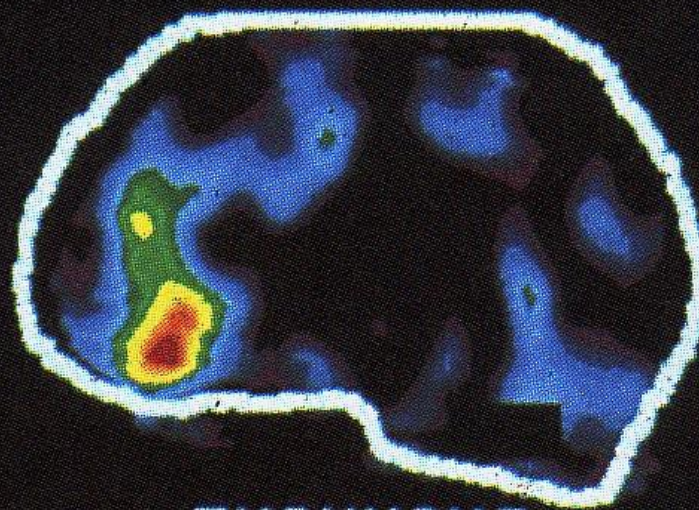
HEARING



SEEING

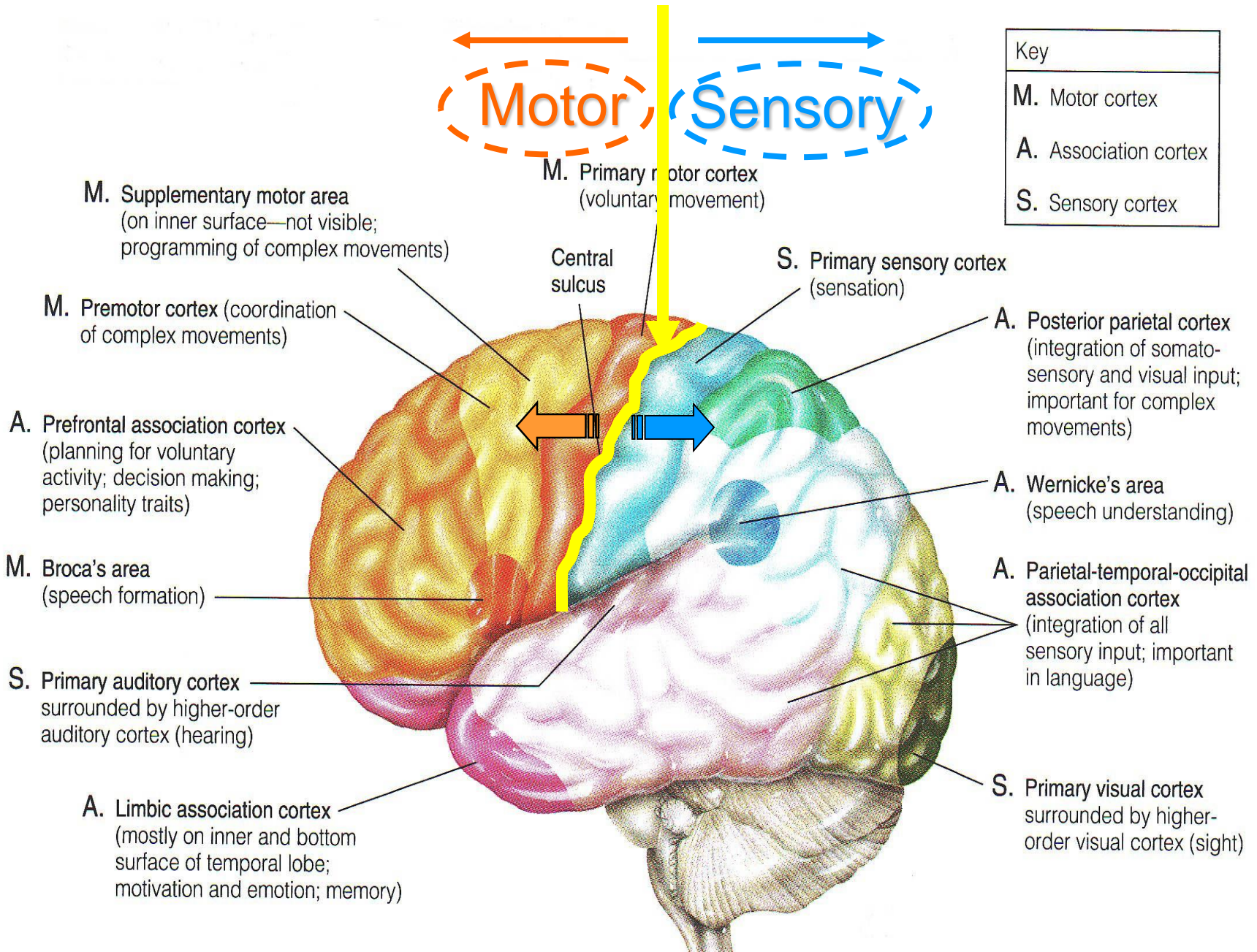


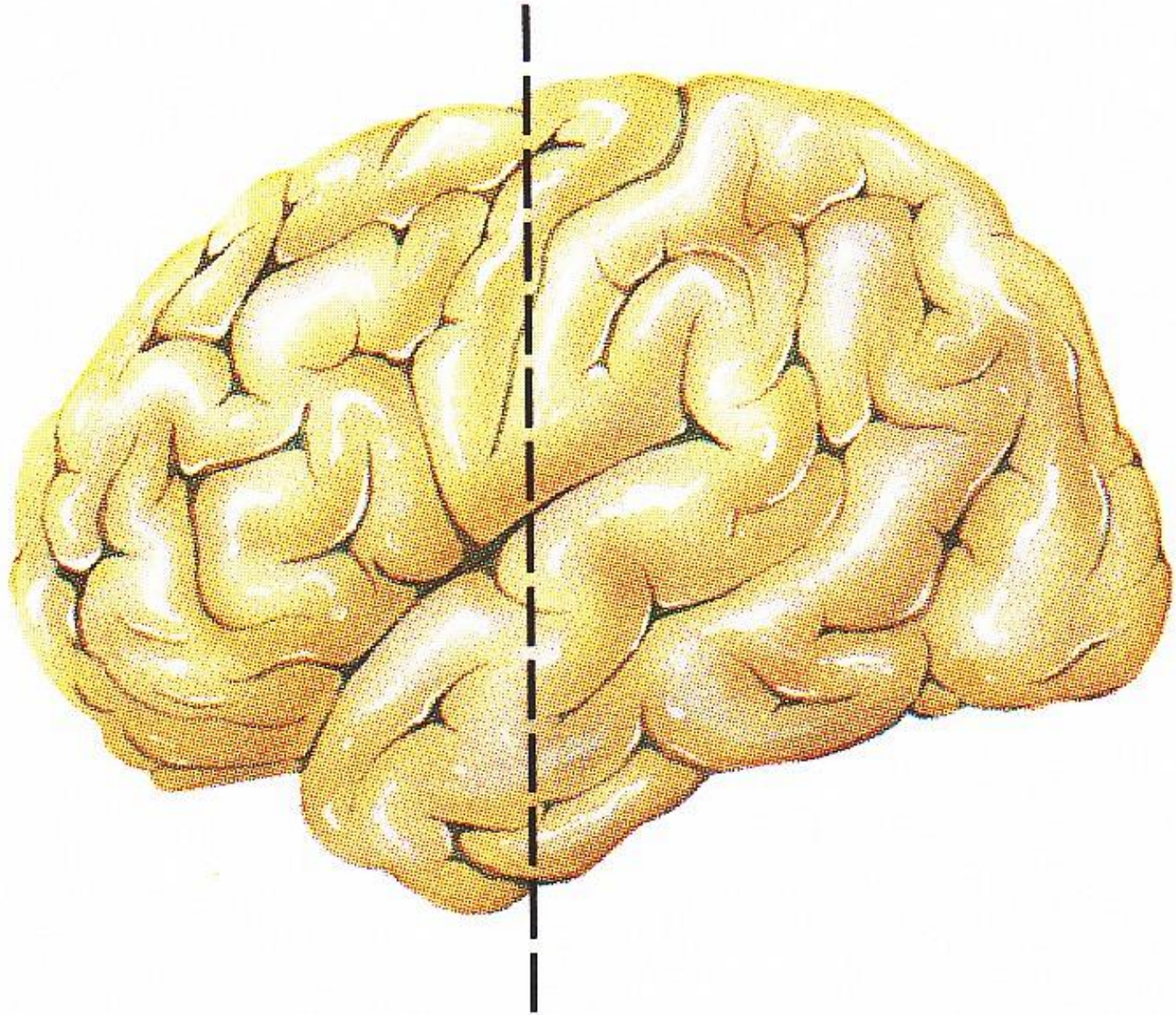
SPEAKING

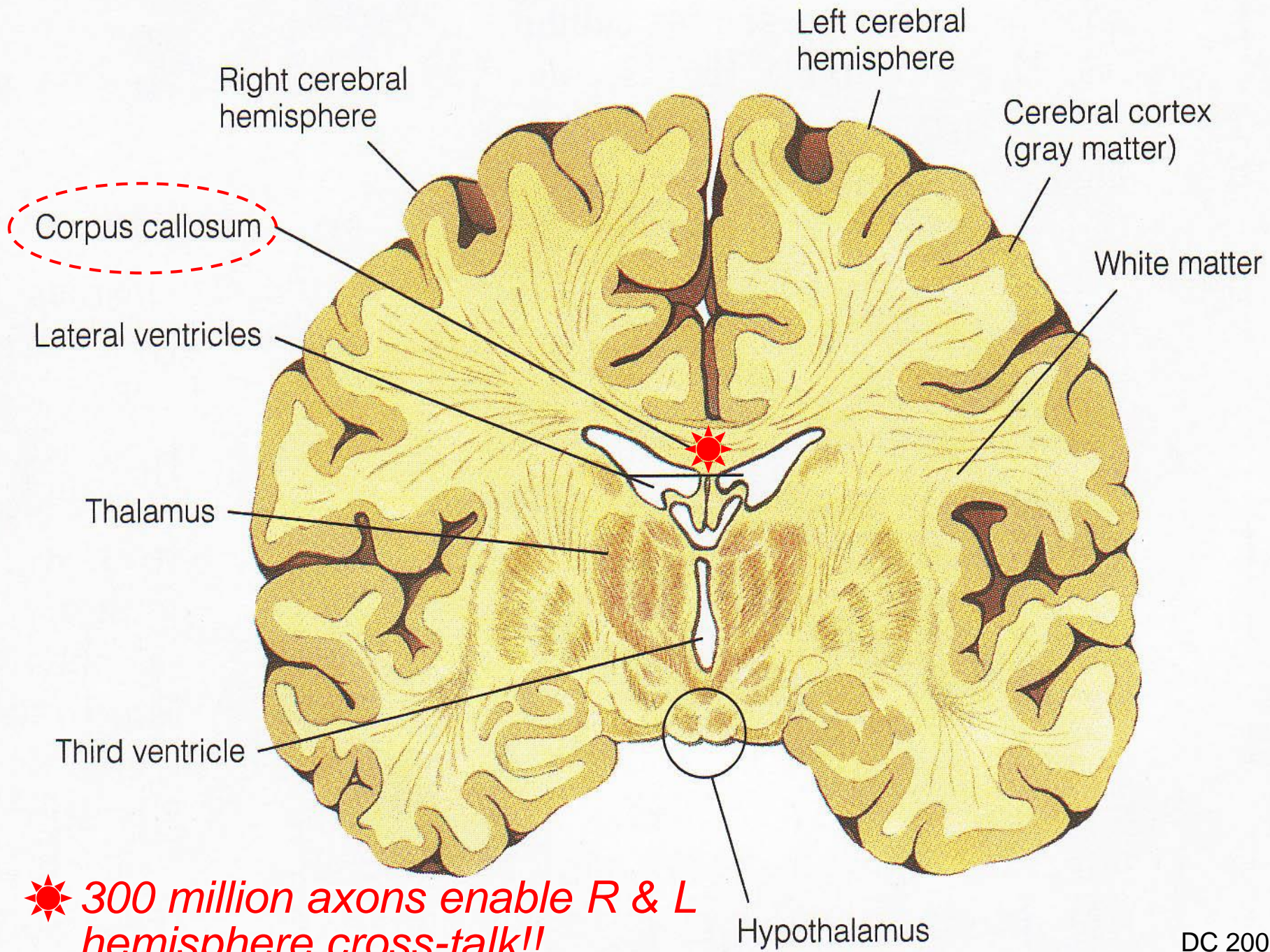


THINKING

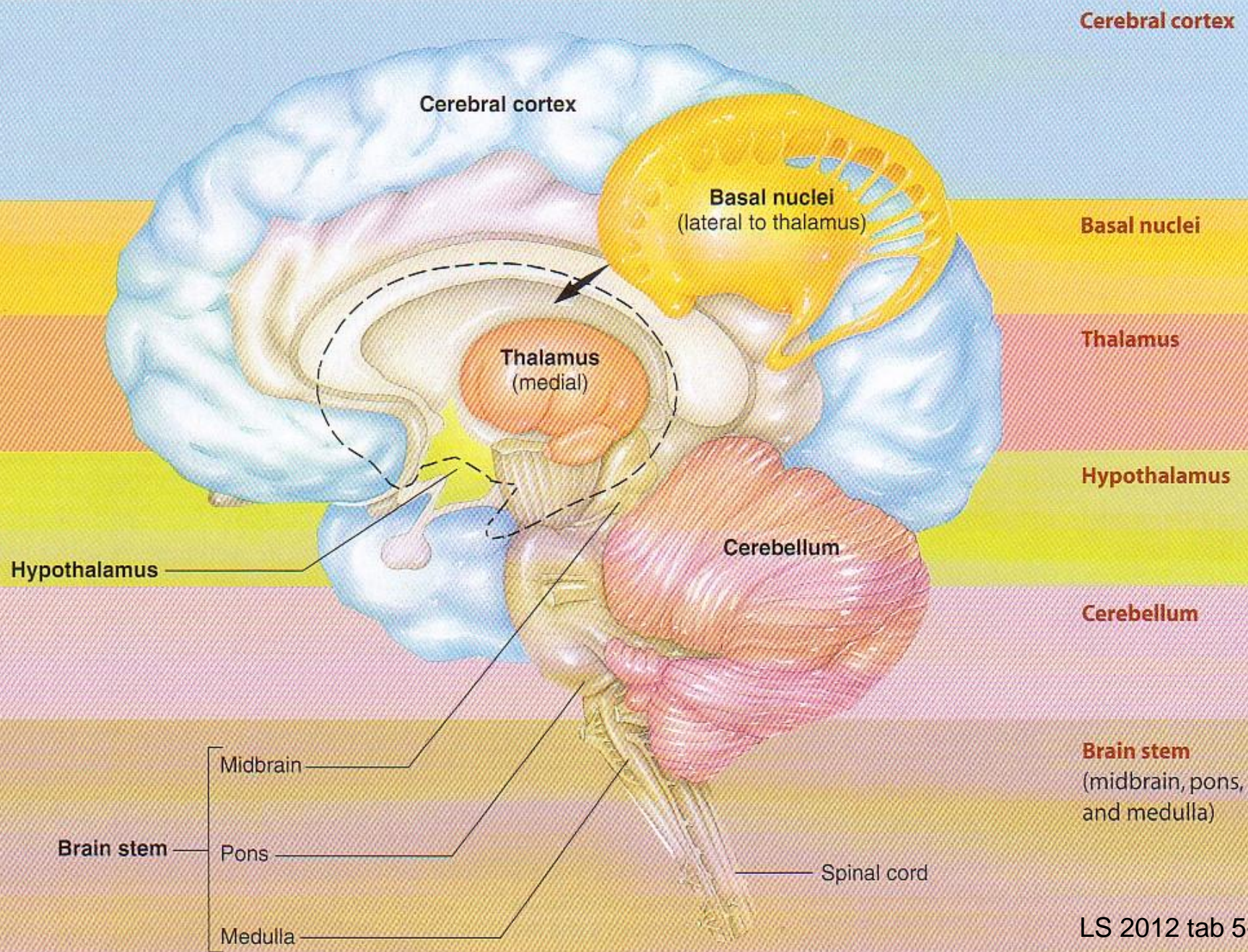




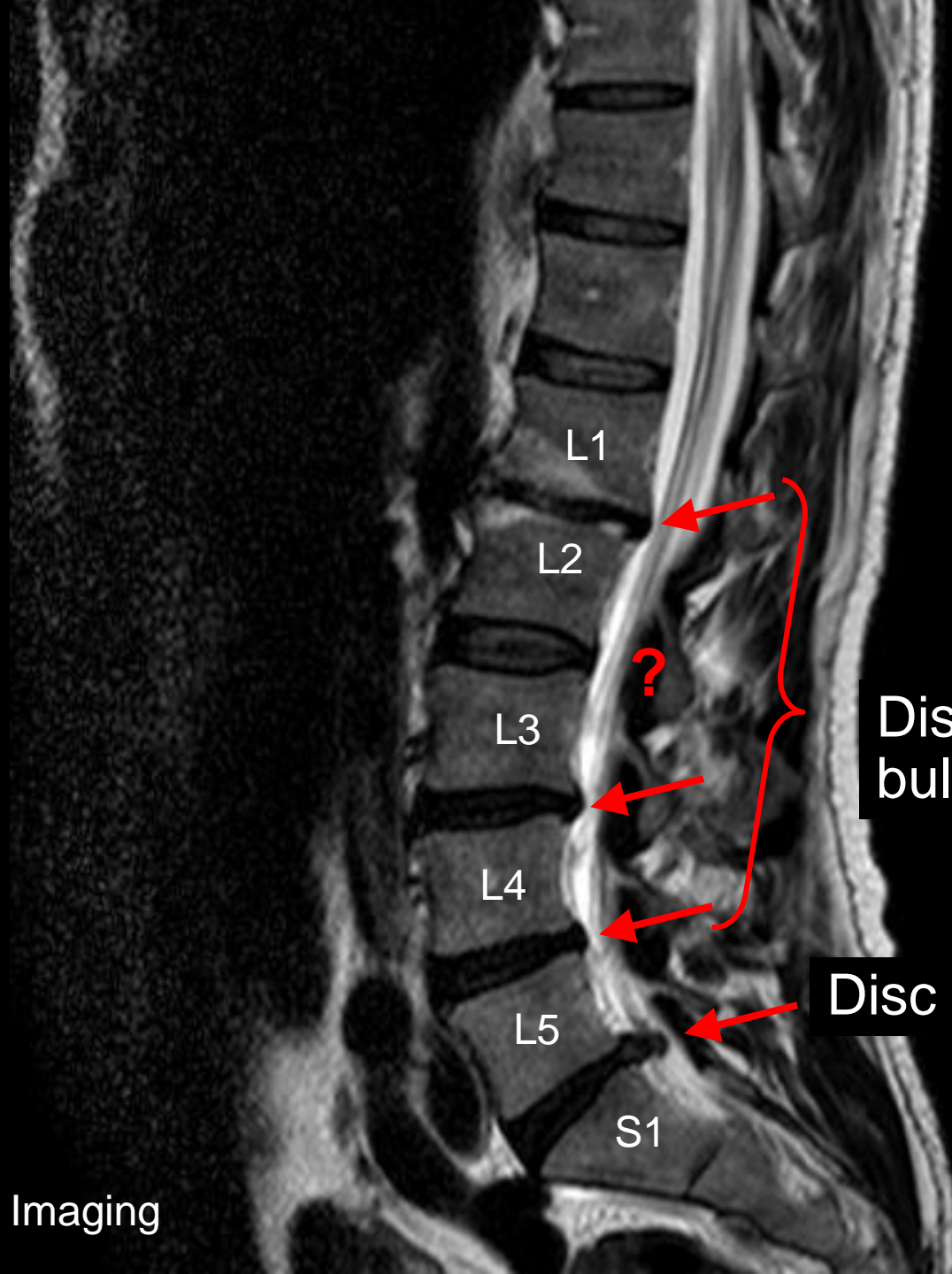




★ 300 million axons enable R & L hemisphere cross-talk!!



MRI 061307
Lumbar spine
Lateral view



L1

L2

L3

L4

L5

S1

?

Discs
bulging

Disc herniation



MRI 061307
Lumbar spine
Axial view

Oregon Imaging

9.4 x 8.1 mm
Protrusion



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.



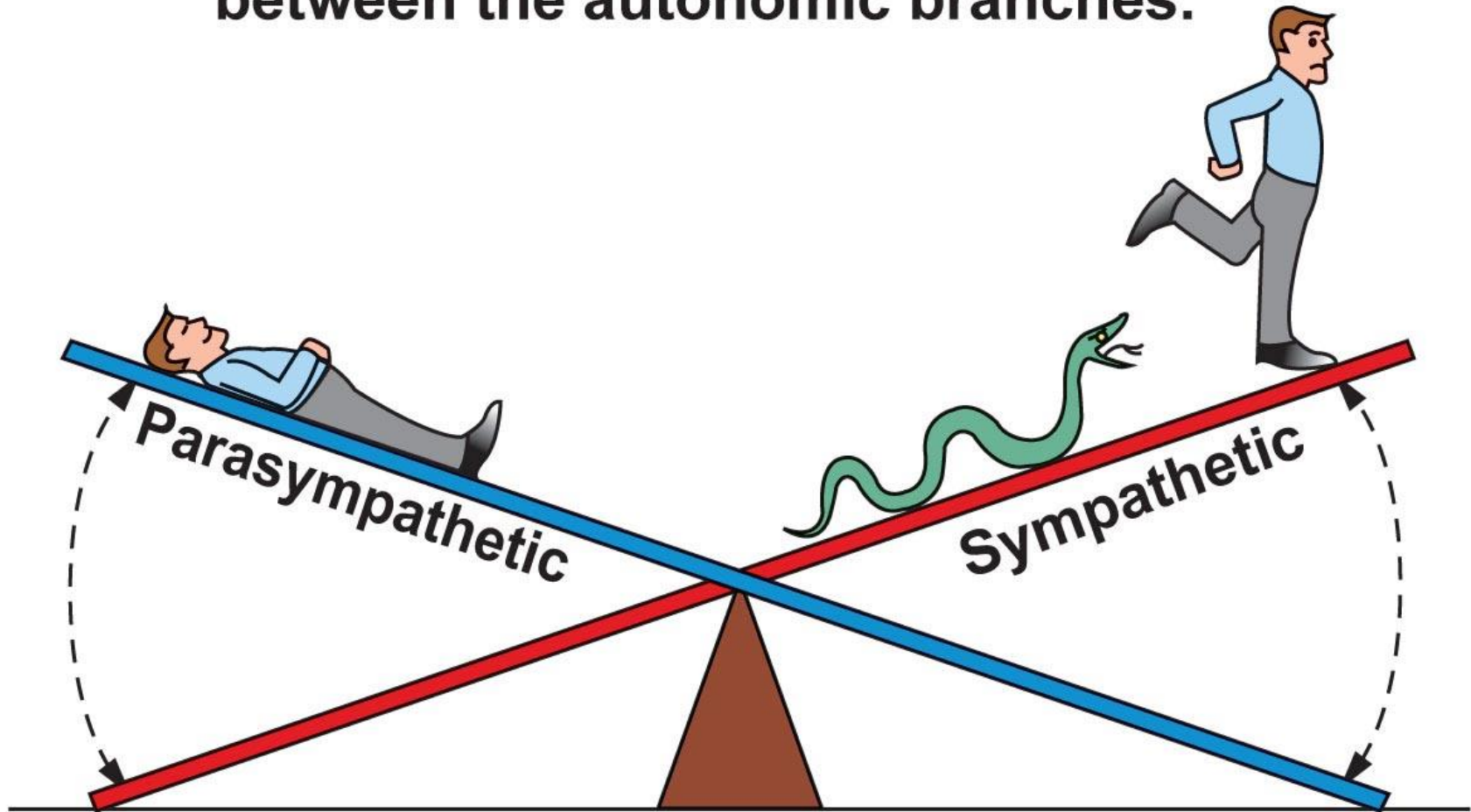
Hey, I'm alive because I wore a helmet!!



Stories, Discussion, Questions or Comments!



Homeostasis is a dynamic balance between the autonomic branches.



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

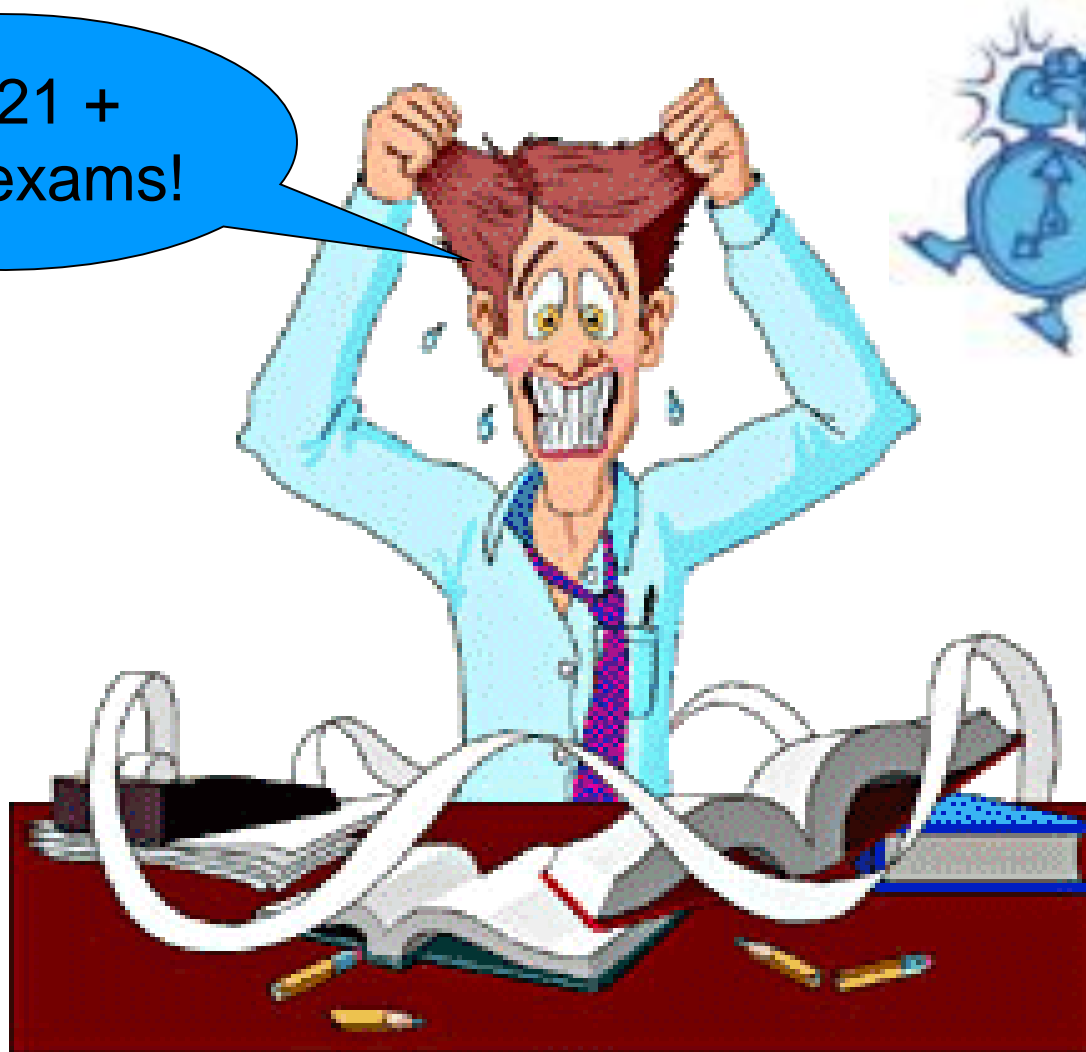
**Fight-or-flight:
Sympathetic activity
dominates.**

PARASYMPATHETIC = RESTING, DIGESTIVE,
HOUSEKEEPING FUNCTIONS



FIGHT/FLIGHT/ALARM REACTION!!

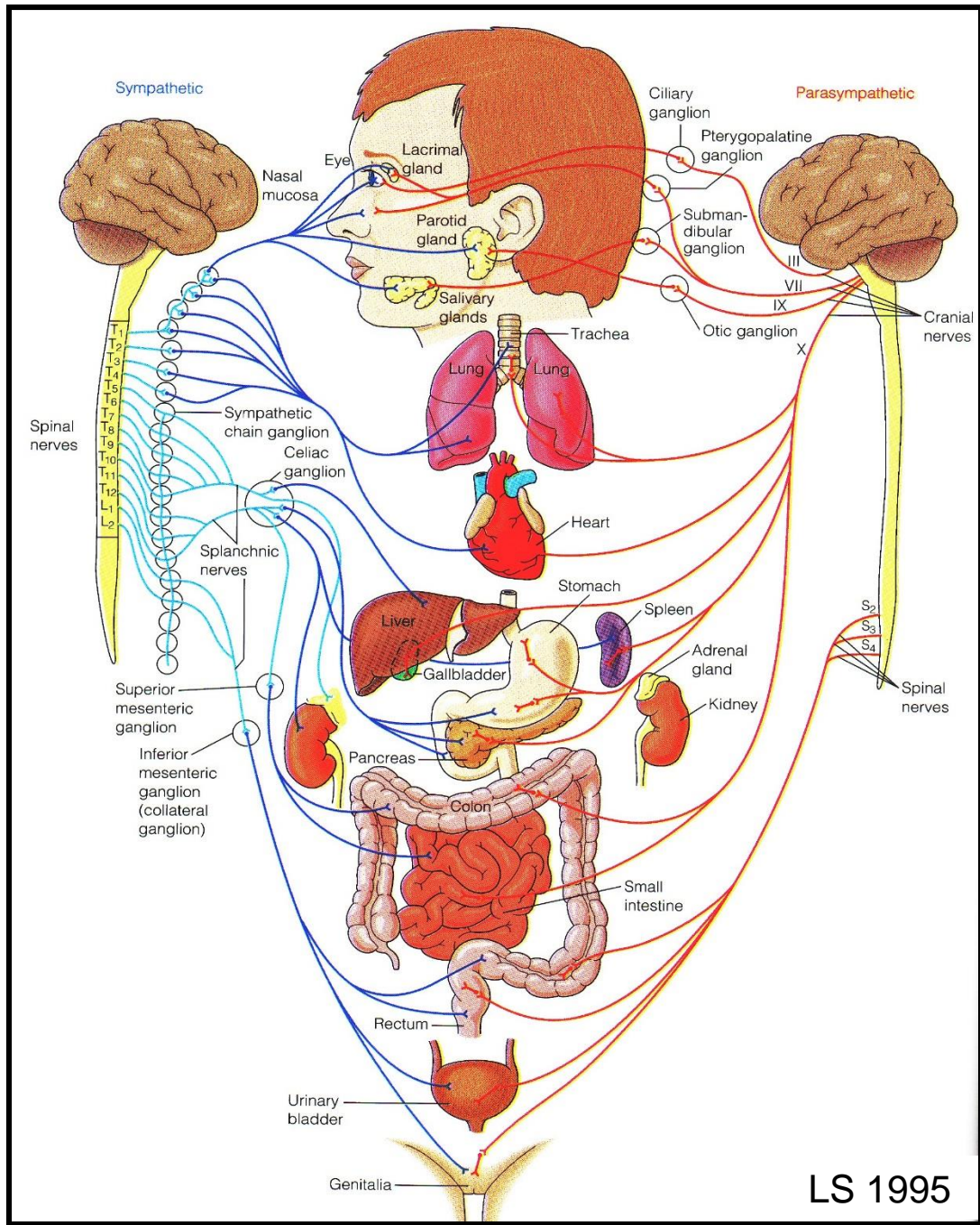
BI 121 +
other exams!



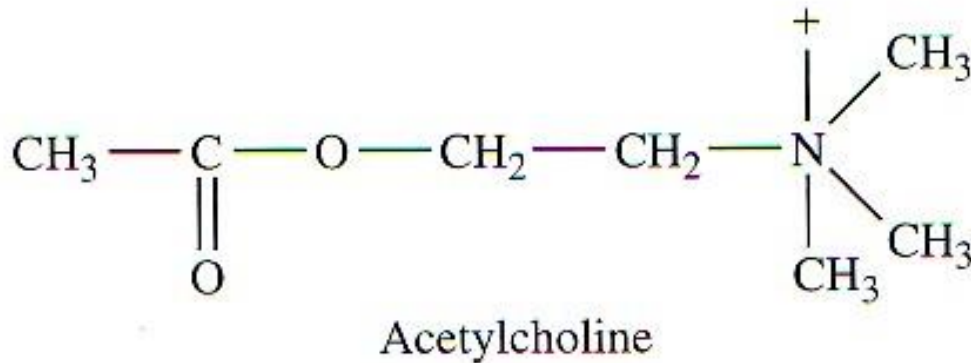
Autonomic Nervous System

Why overlap or dual innervation?

Fine-tune control & safety!



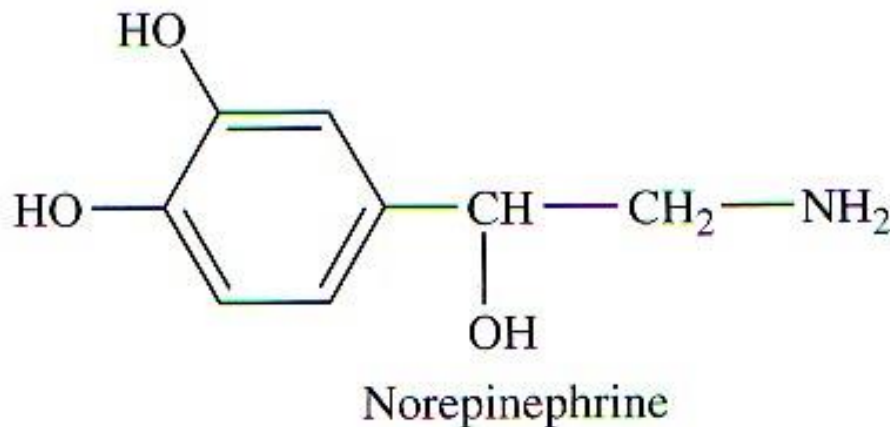
Autonomic Neurotransmitters & Receptors



Cholinergic

Nicotinic

Muscarinic

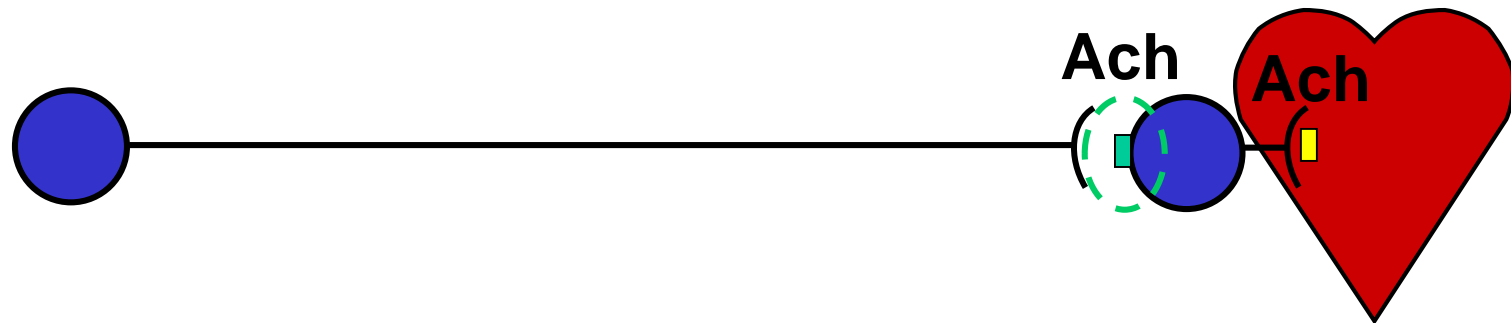


Adrenergic

α = Alpha

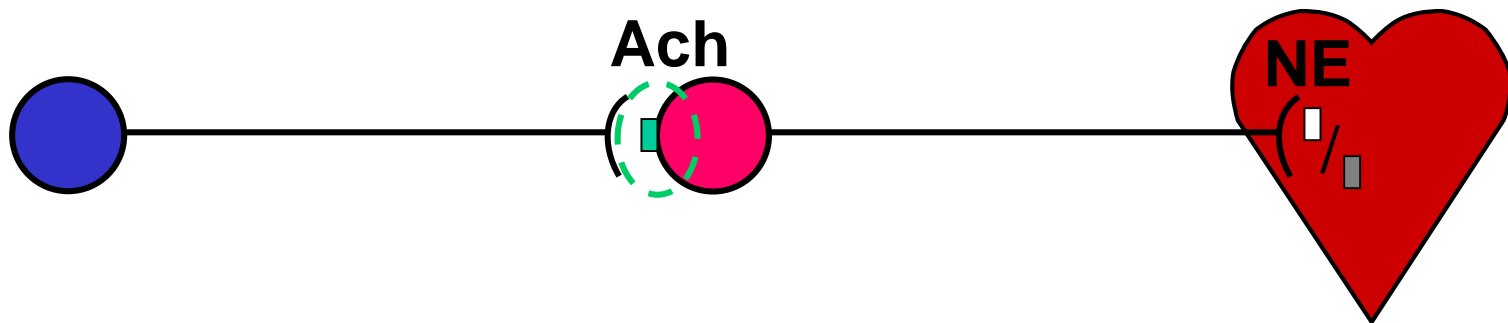
β = Beta

Parasympathetic



Ach = Acetylcholine
■ = Nicotinic Receptor
■ = Muscarinic Receptor

Sympathetic



NE = Norepinephrine
□ = α Receptor (α_1 , α_2)
■ = β Receptor (β_1 , β_2)

Nicotine activates both Sympathetic & Parasympathetic post-ganglionic neurons!

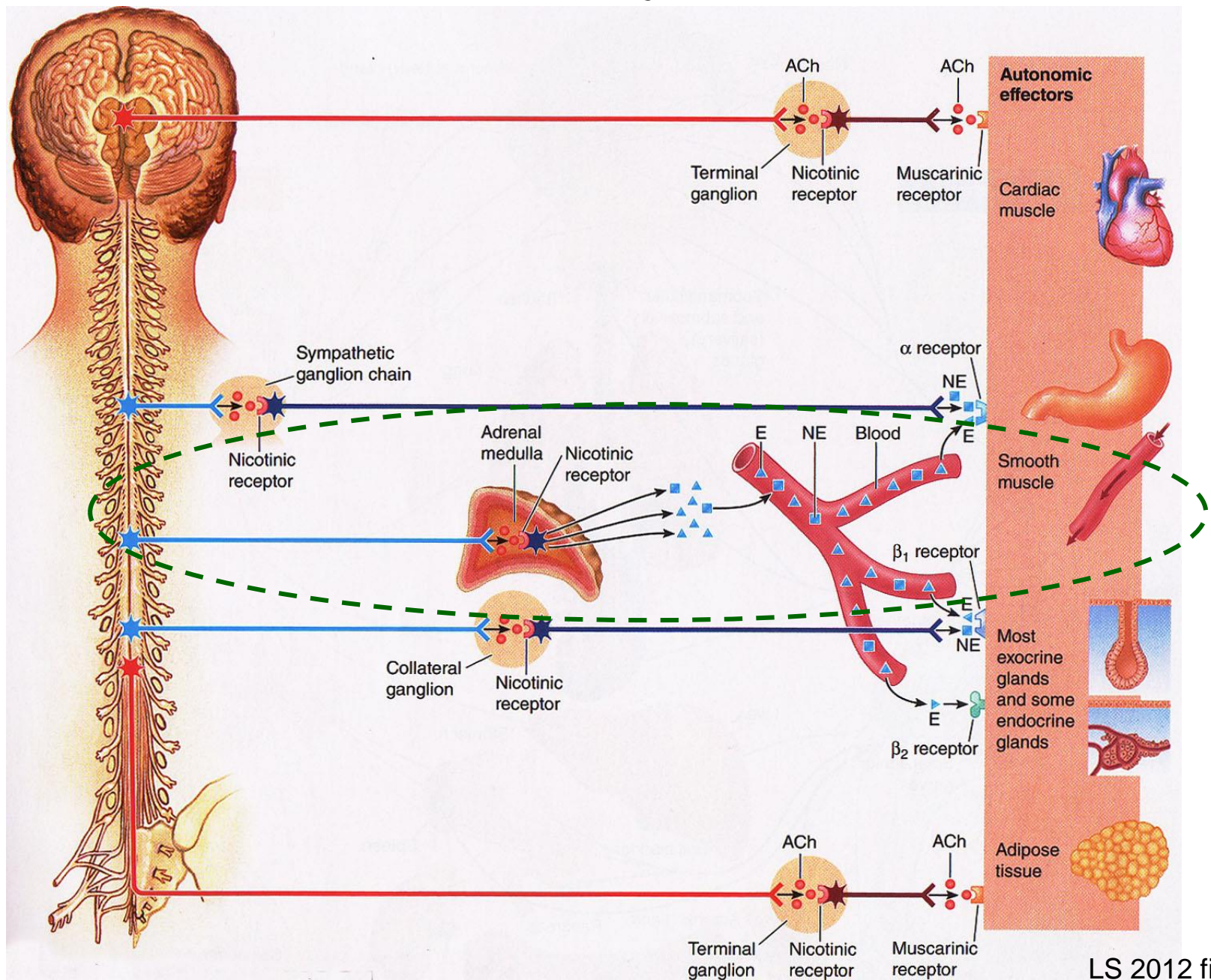
Problem?



Like hammering the gas pedal & brake at the same time!!



Autonomic Nervous System Innervation



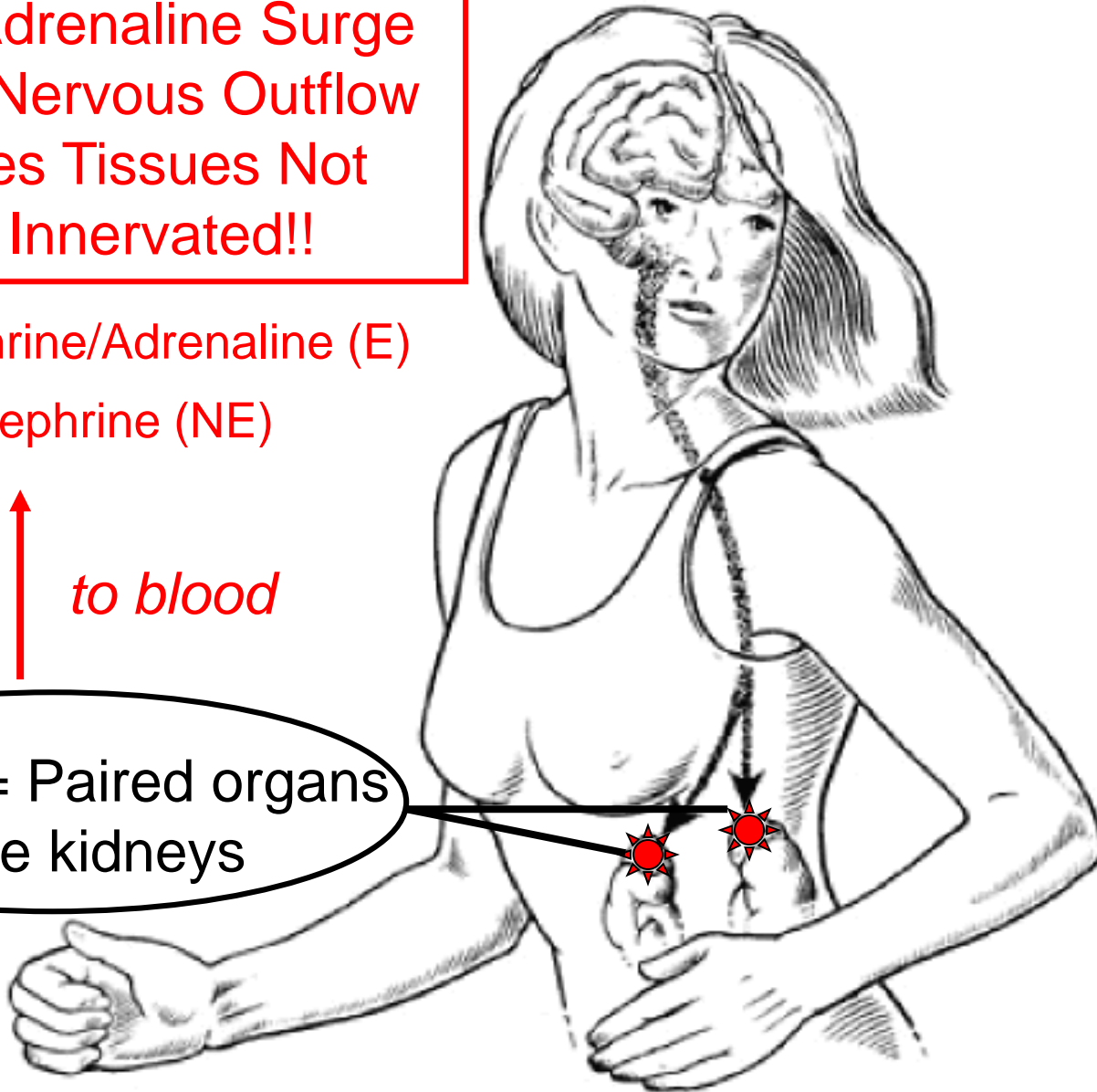
In Sympathetic
Fight-or-Flight why
is it important to
activate the
adrenals?

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

Fight-or-Flight Stories!



or



...choose this!!

