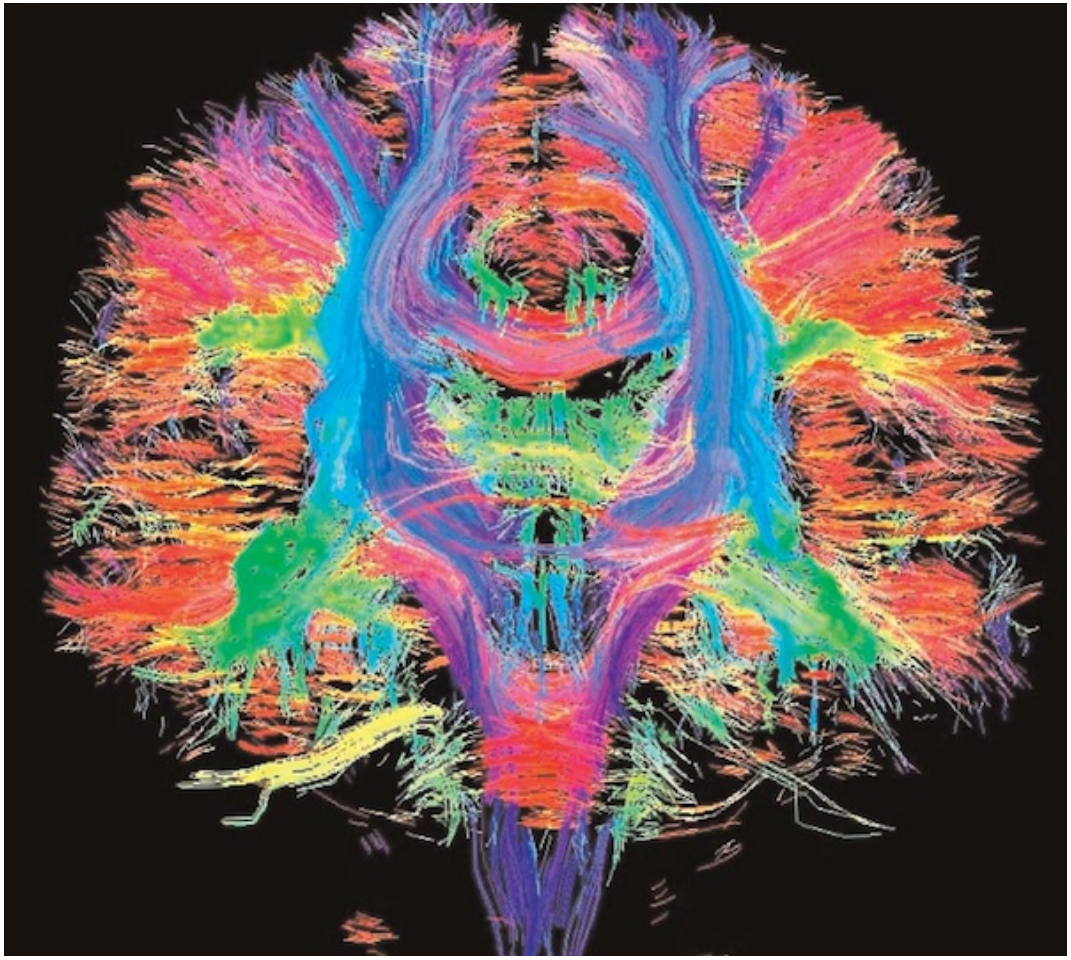
LEC 1B

ANATOMY OF THE NERVOUS SYSTEM



Cogs 17 * UCSD

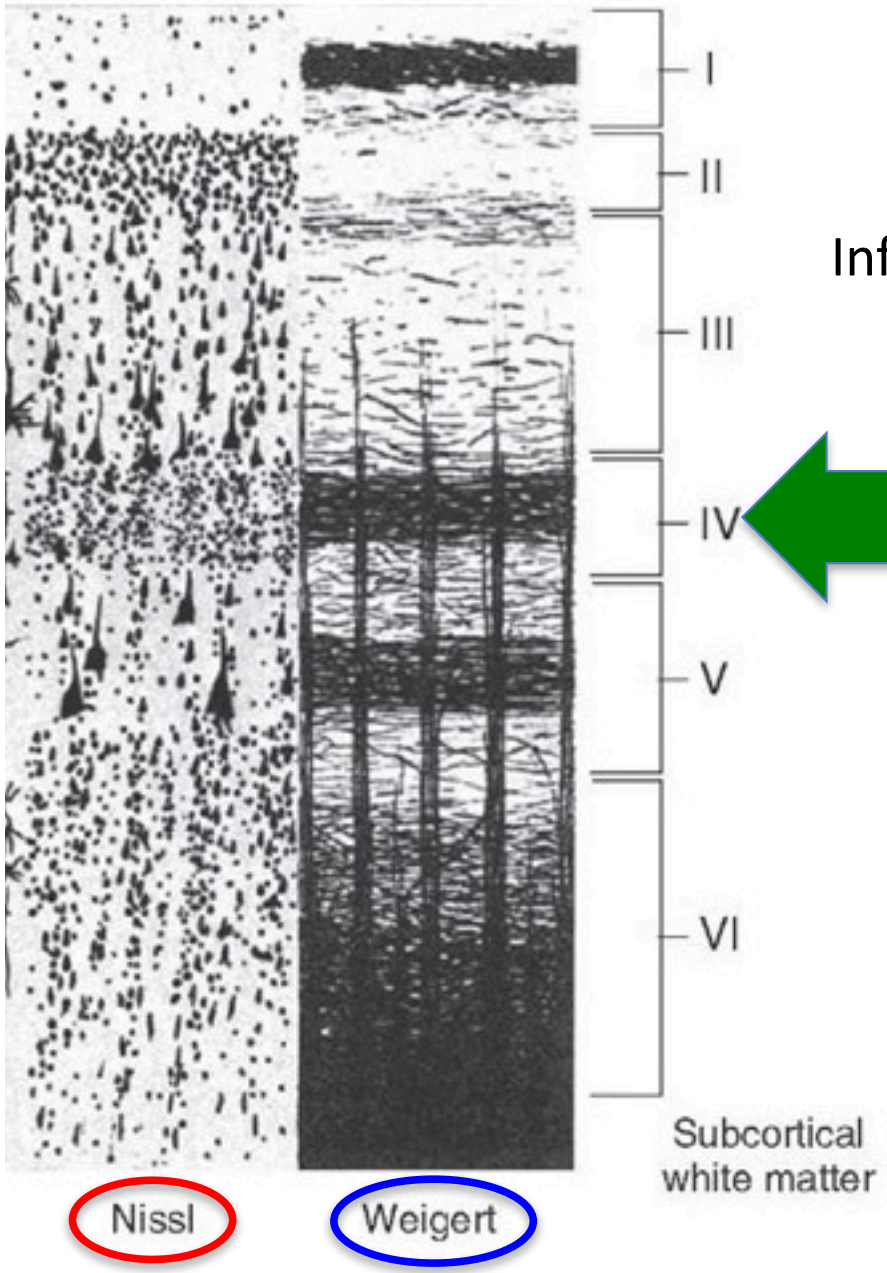
Cerebral Cortex

A 6-layer sheet of cells, unfolded = < 1 m square X 3 mm thick

Cortex – 6 layers of cells

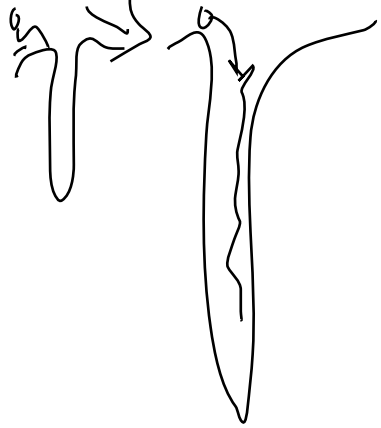
Nissl Stain for Cell Bodies

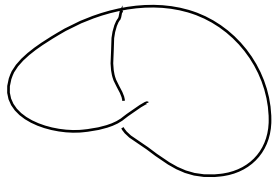
Weigert Stain for Fibers



Info projected to cortex enters at Level 4

Convoluted (folded) Cortex





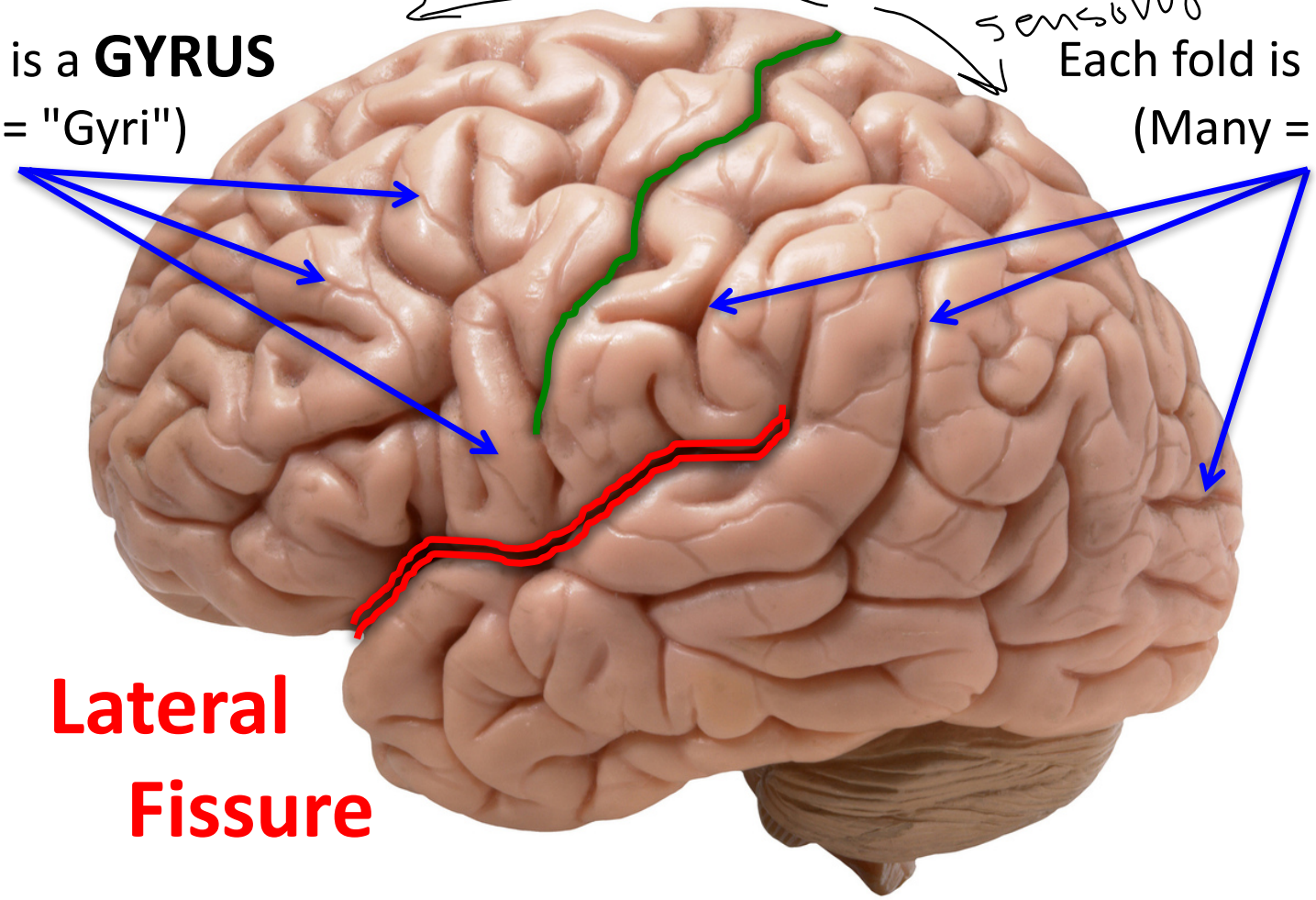
motor

sensory

Central Sulcus

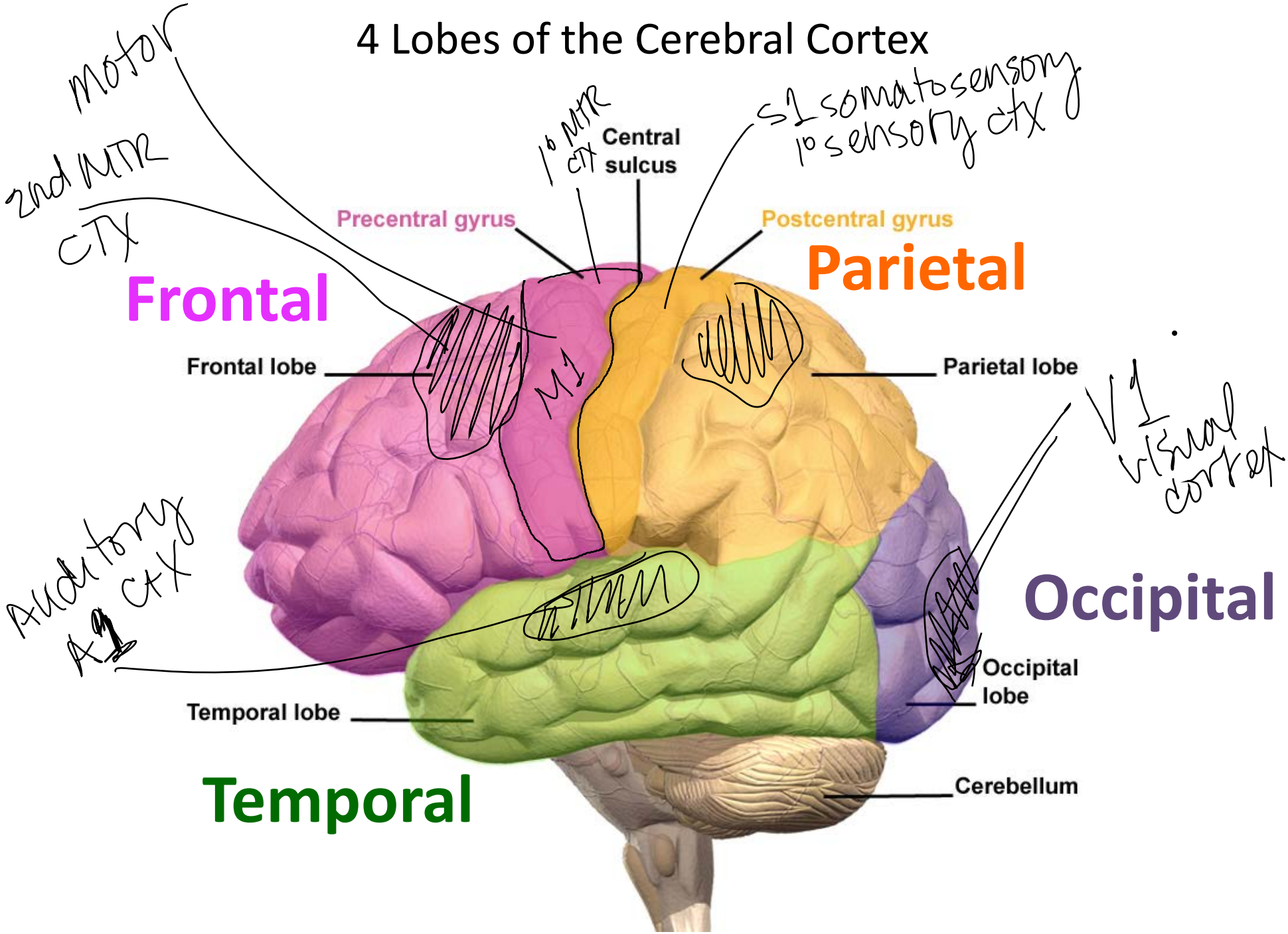
Each bulge is a **GYRUS**
(Many = "Gyri")

Each fold is a **SULCUS**
(Many = "Sulci")

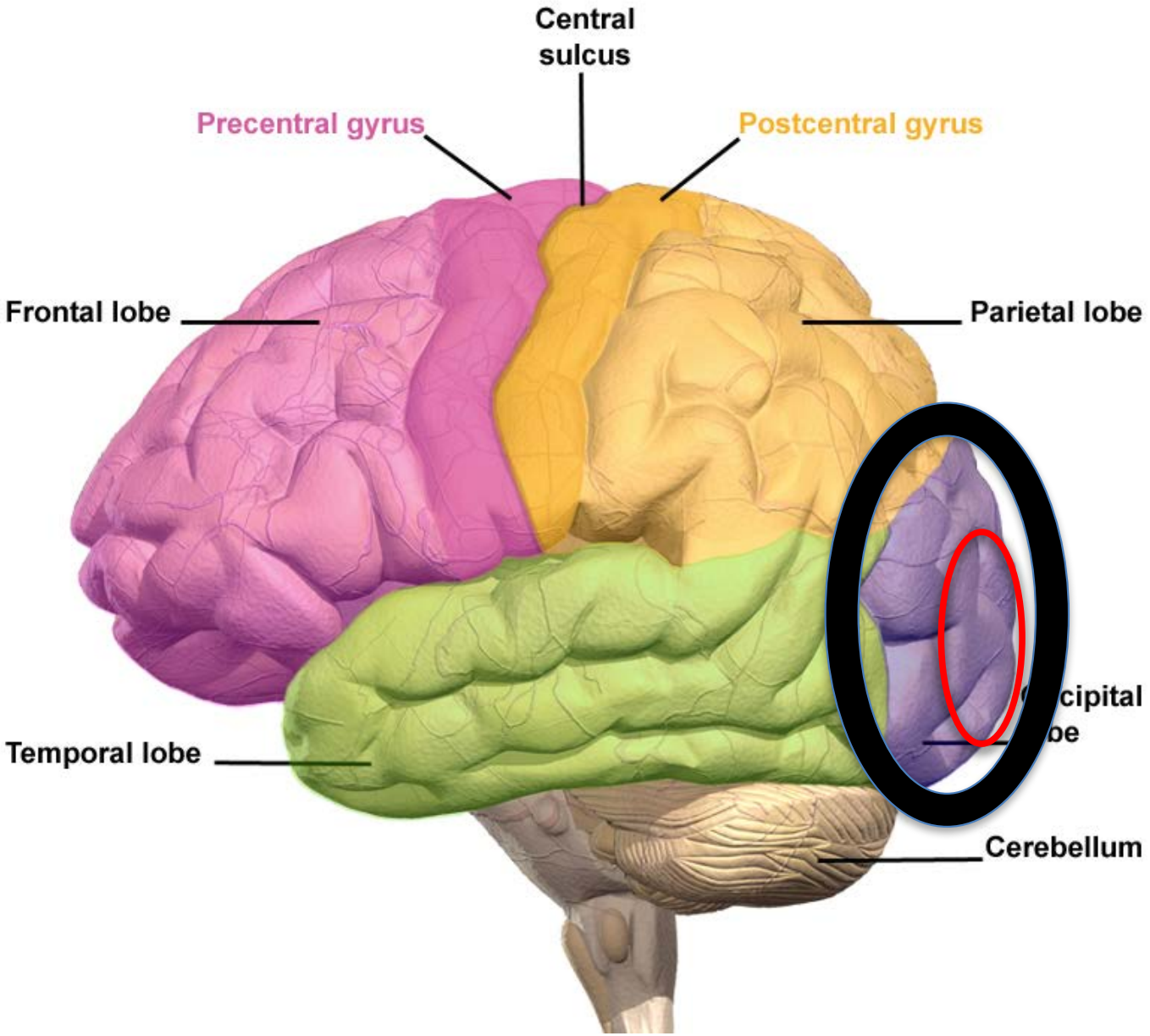


Lateral Fissure

4 Lobes of the Cerebral Cortex



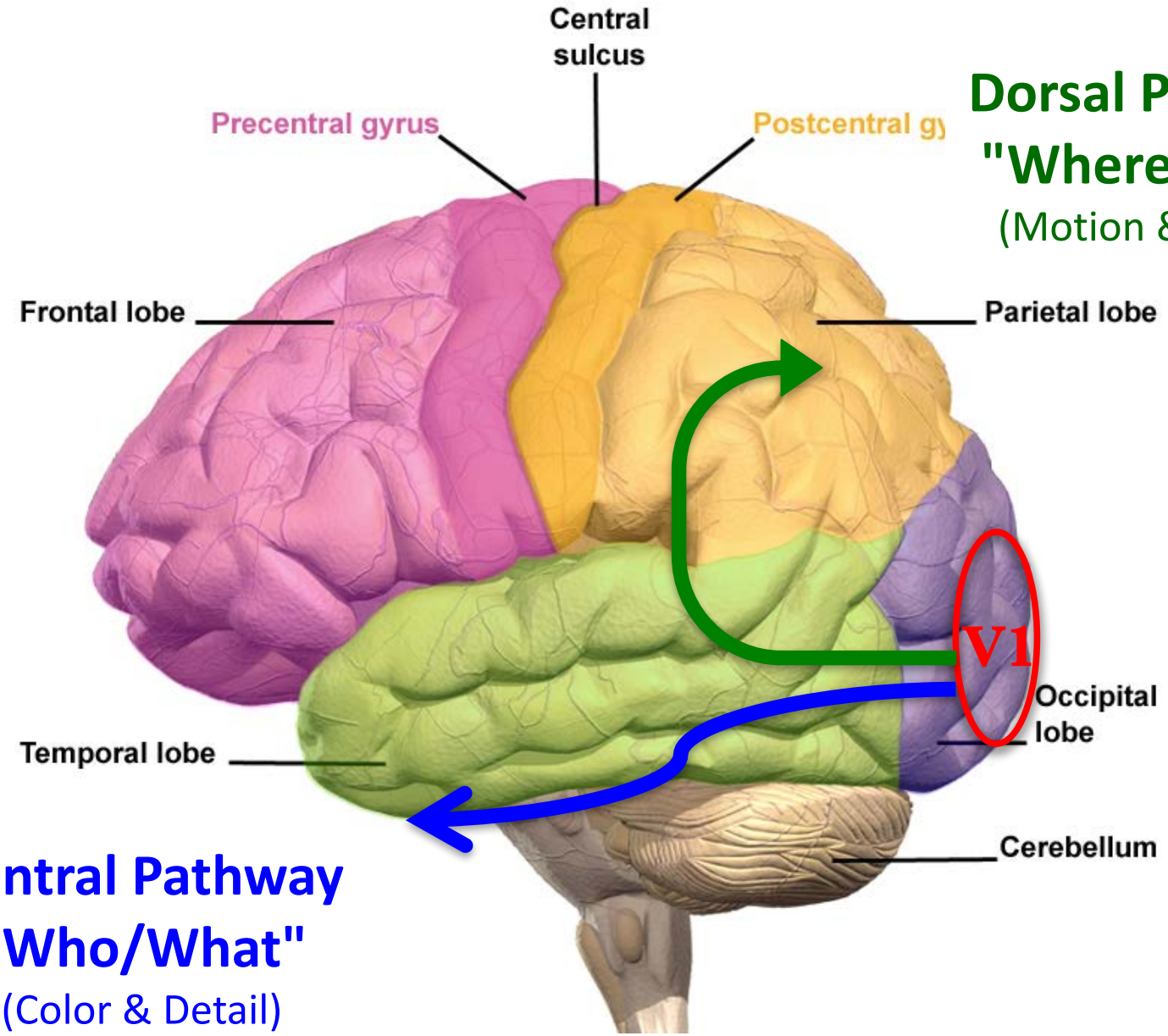
Occipital Lobe - Vision



V1

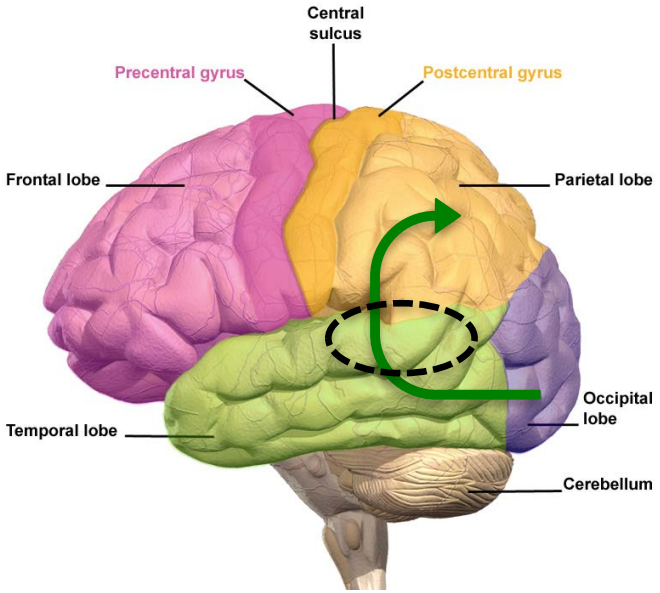
Primary Projection Area, from Thalamus

Major Visual Pathways



Dorsal Pathway
"Where/How"
(Motion & Depth)

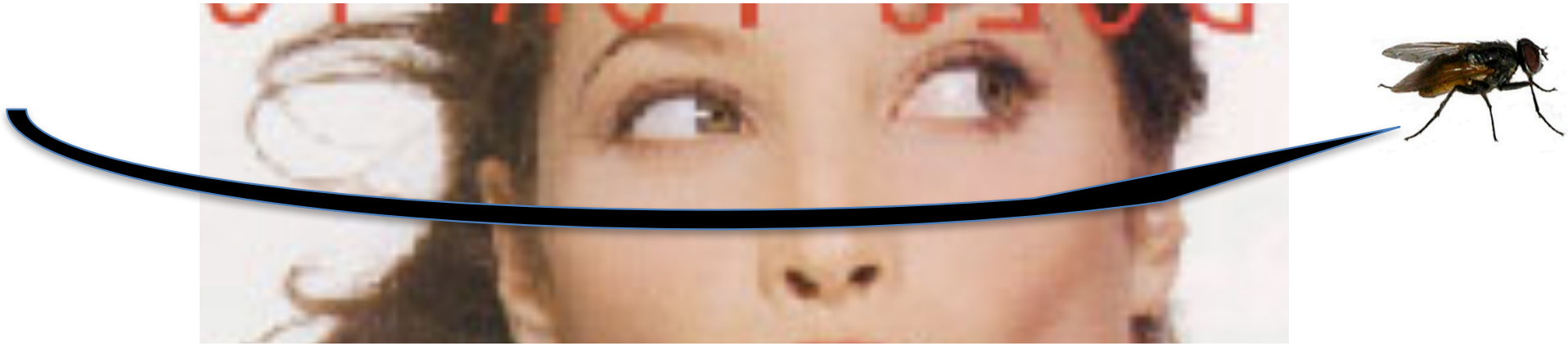
Ventral Pathway
"Who/What"
(Color & Detail)



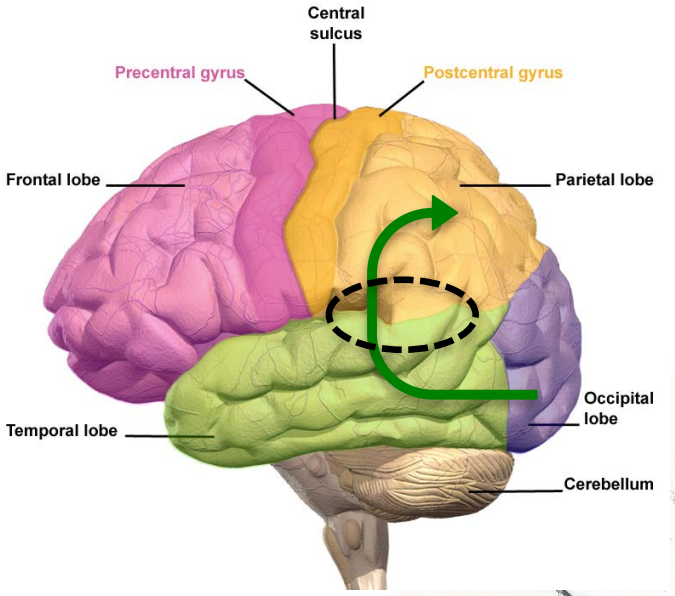
(▬▬▬ = Medial, NOT on outer surface)

MT (Medial Temporal)

Along "*Where/How*"
Visual pathway to Parietal



Includes Direction-Sensitive
Motion Detectors



MST (Medial Superior Temporal)

Includes "Optic Flow" Detectors

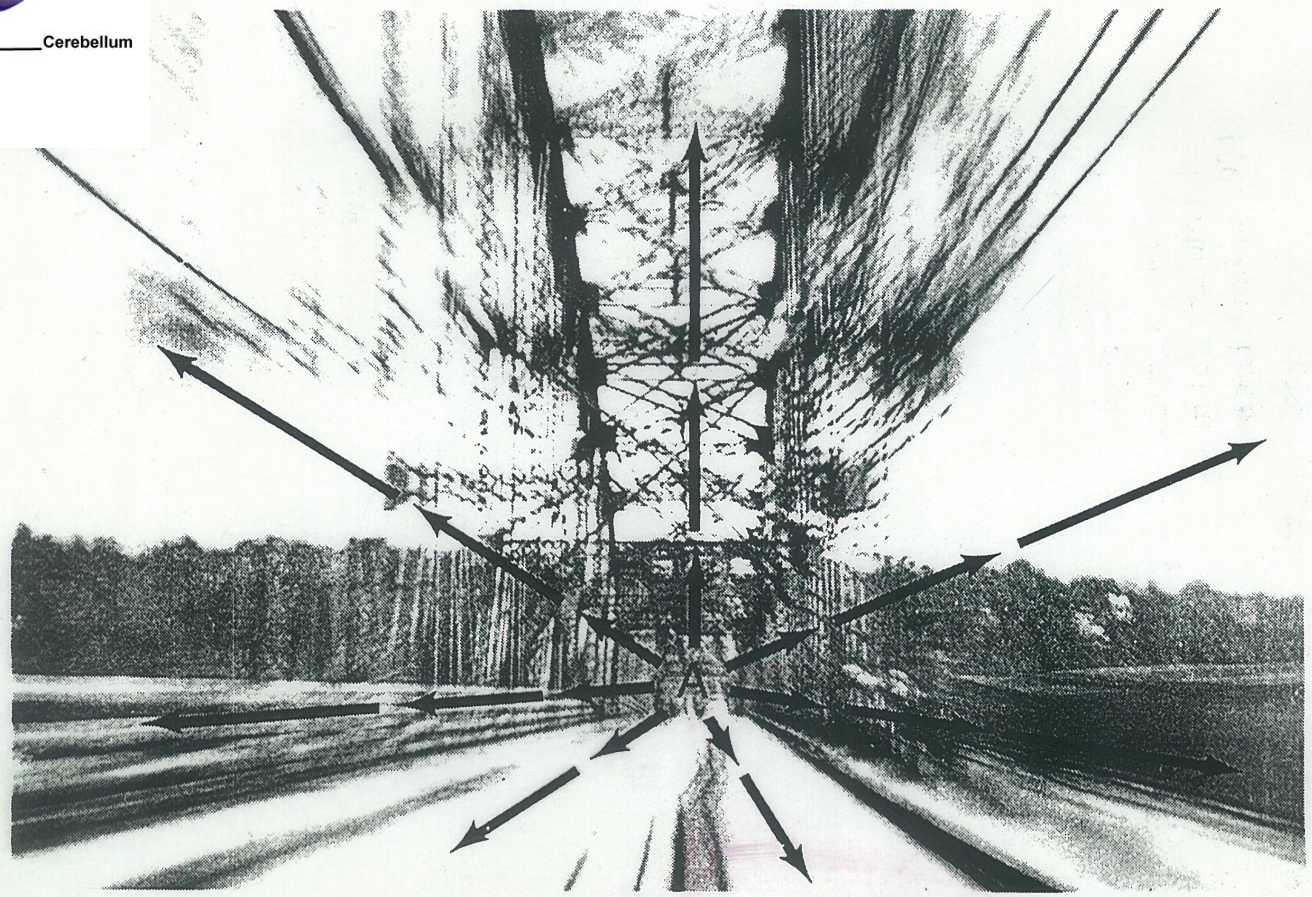
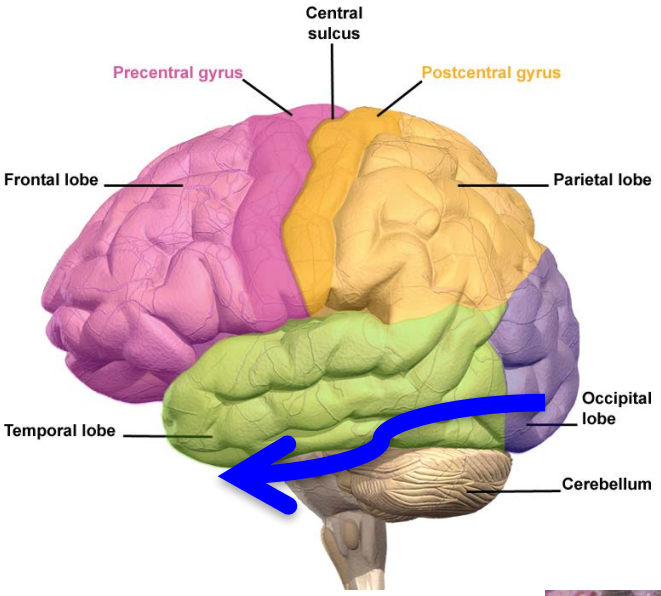
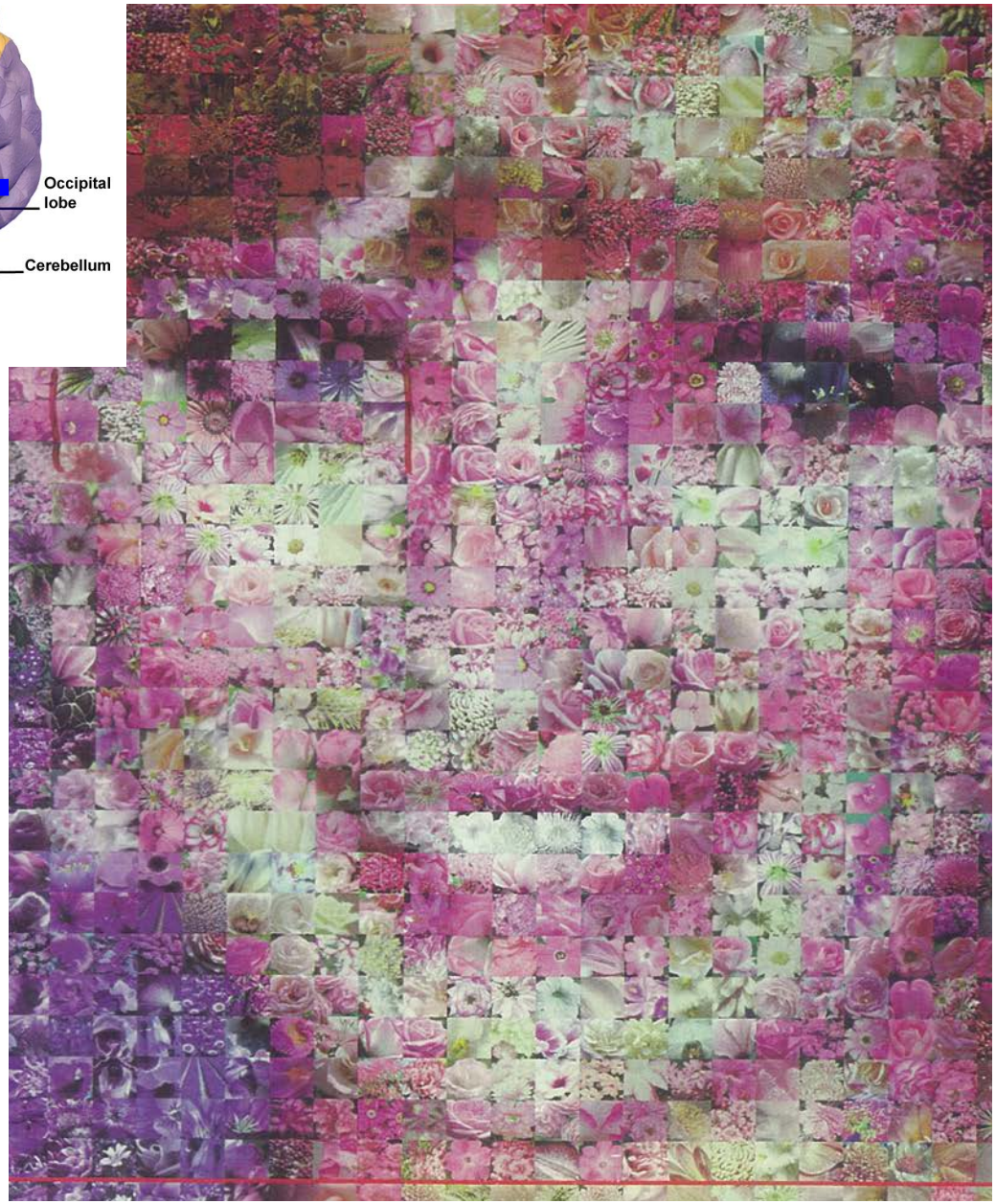


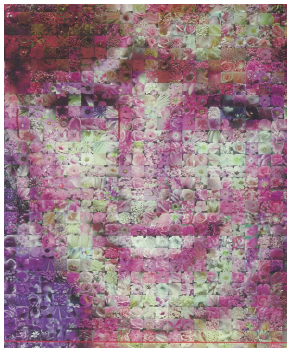
FIGURE 8.49 The flow of the environment as seen from a car speeding across a bridge toward point A. The flow, shown by the arrows, is more rapid closer to the car (as indicated by the increased blur) but occurs everywhere except A, the focus of expansion, toward which the car is moving. (Also see Figure 8.48a)

Ventral Visual Pathway

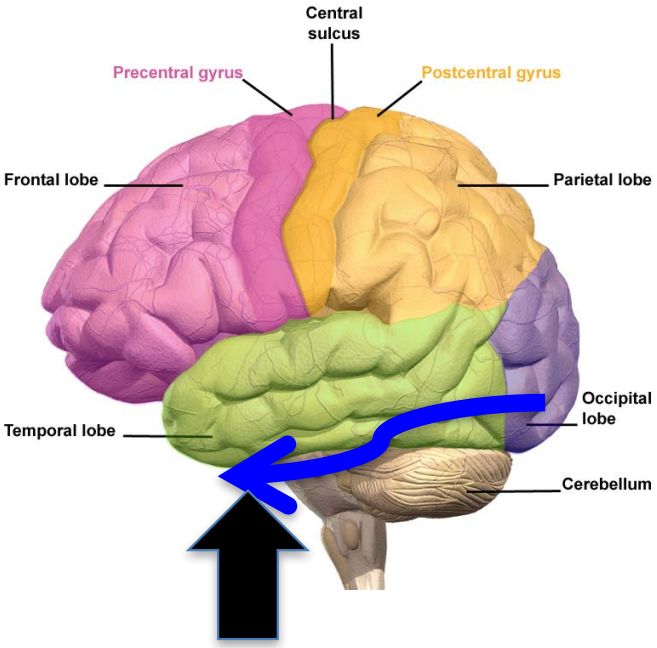




Color and Detail



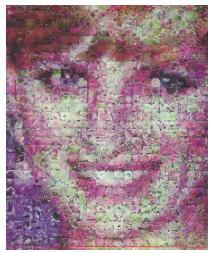
Ventral Visual Pathway



Terminates at

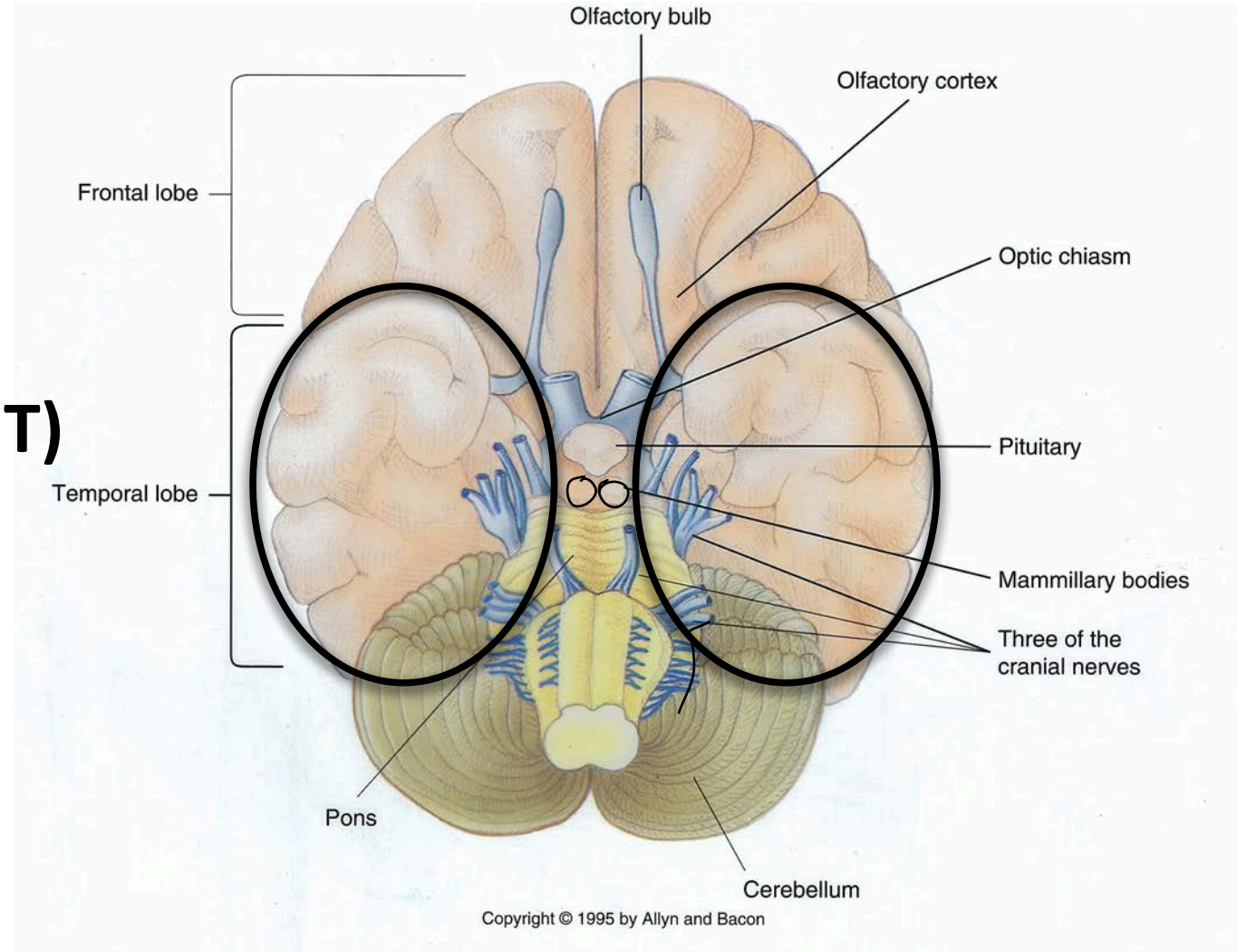
Inferior Temporal (IT)

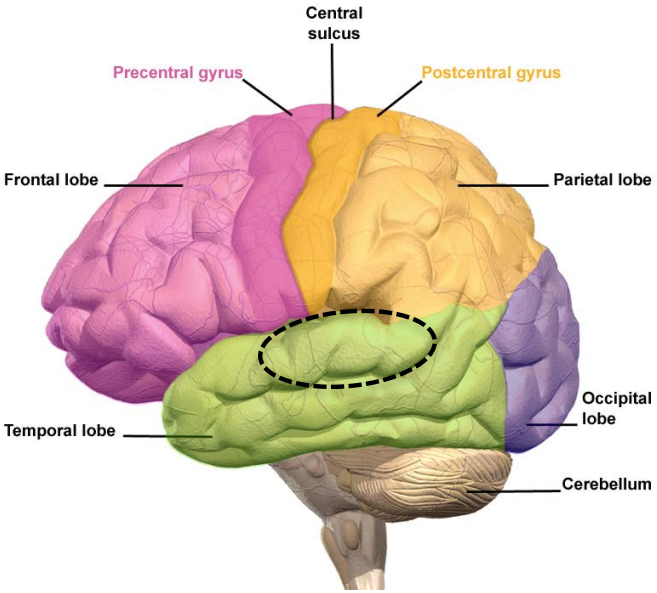
Higher Visual Cortex



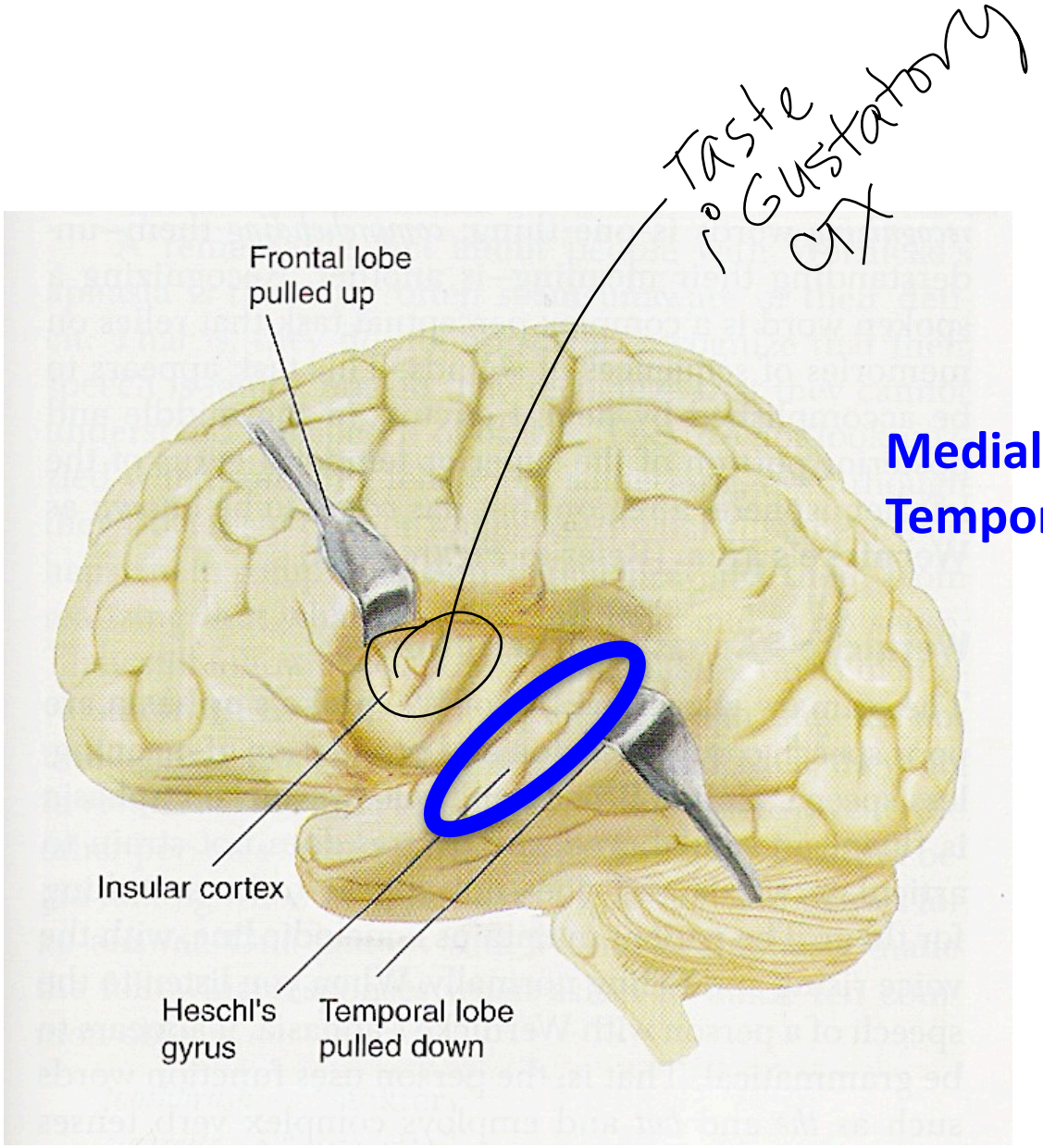
includes

Face Cells





Temporal Lobe - Audition

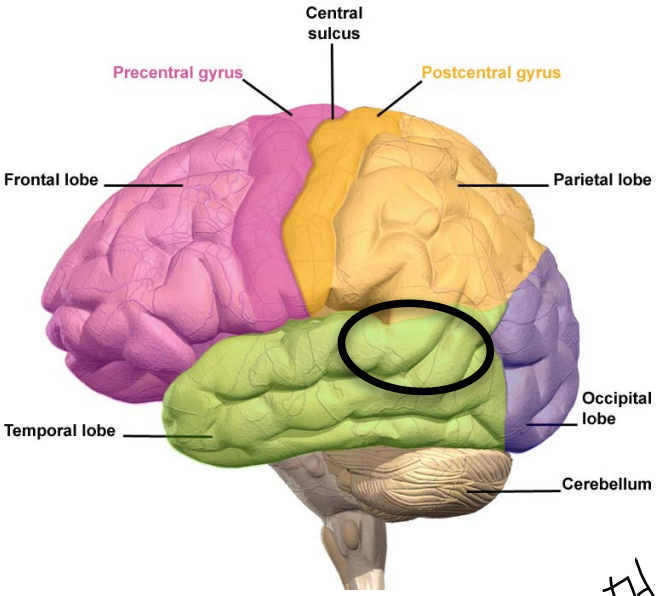


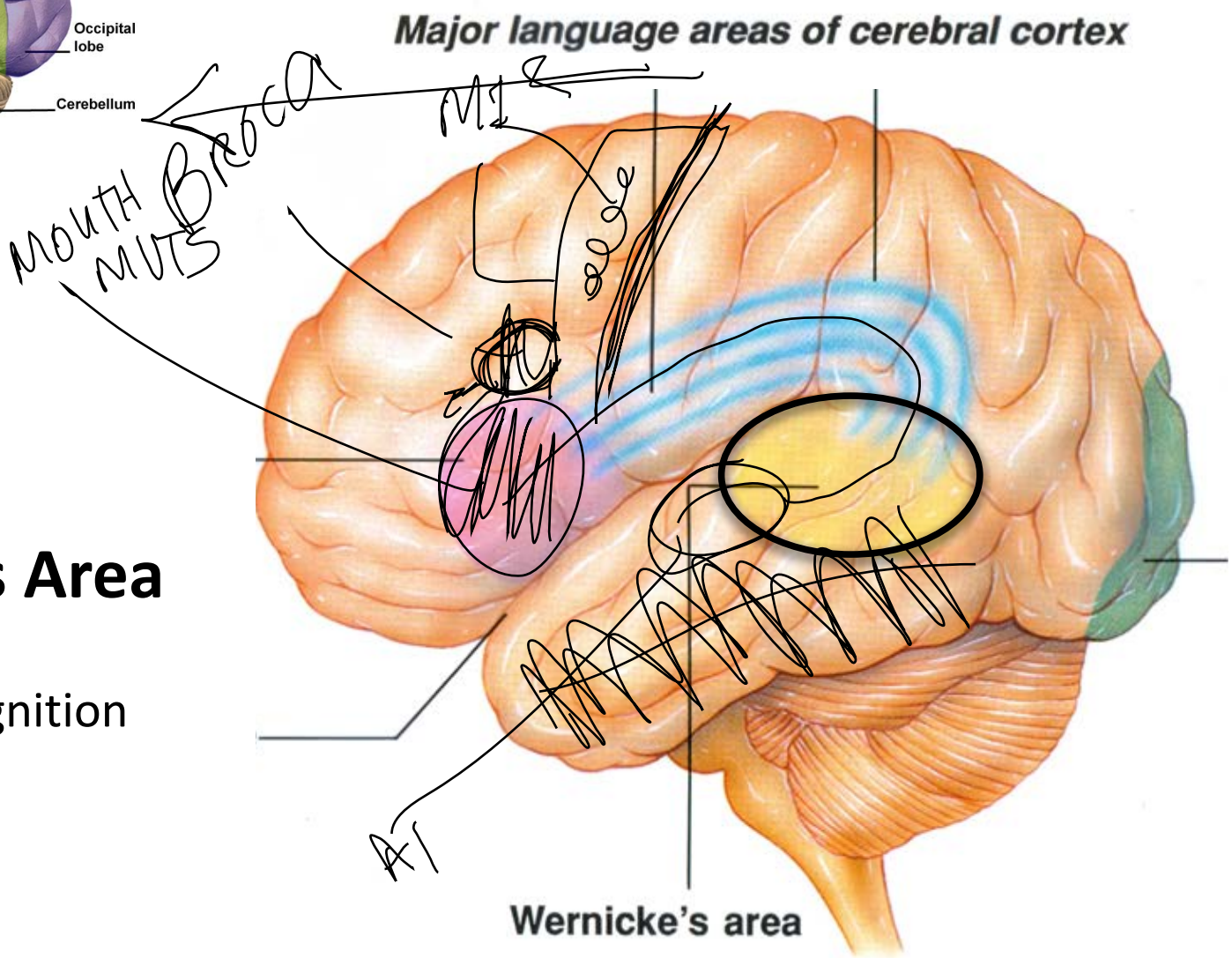
Medial face of Temporal Lobe

A1

Primary Projection Area for Audition, from Thalamus

Higher Auditory Cortex

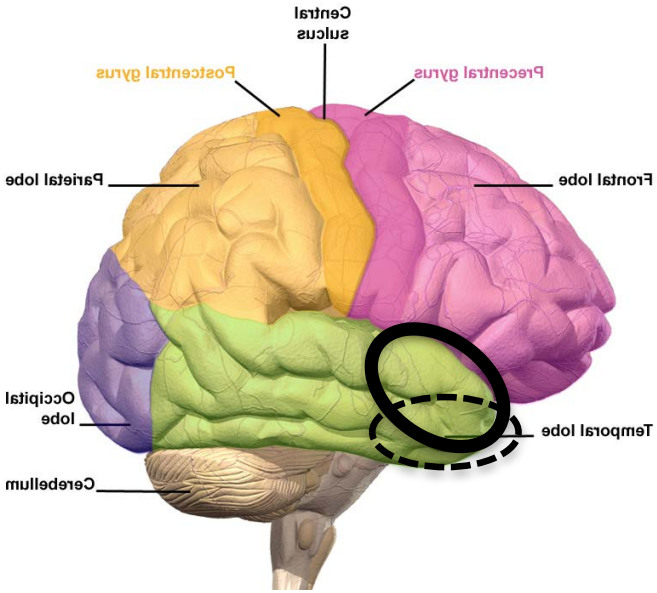




Wernicke's Area

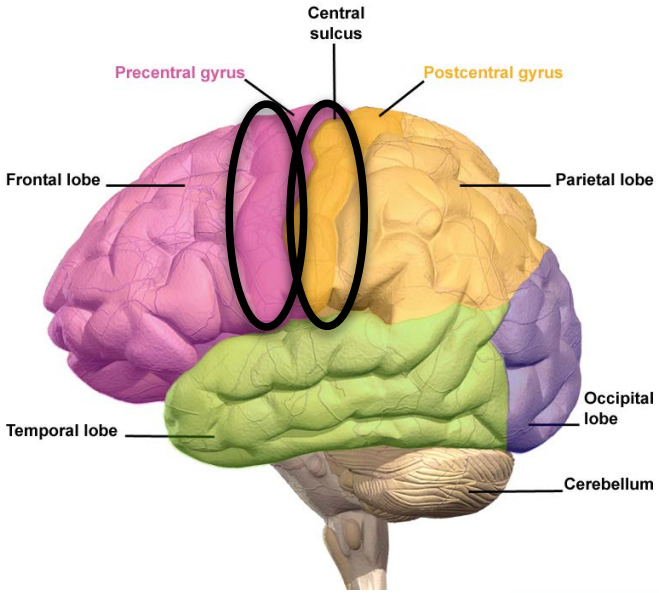
for

Speech Recognition



Emotional Expression & Interpretation

Right Hemisphere dominant



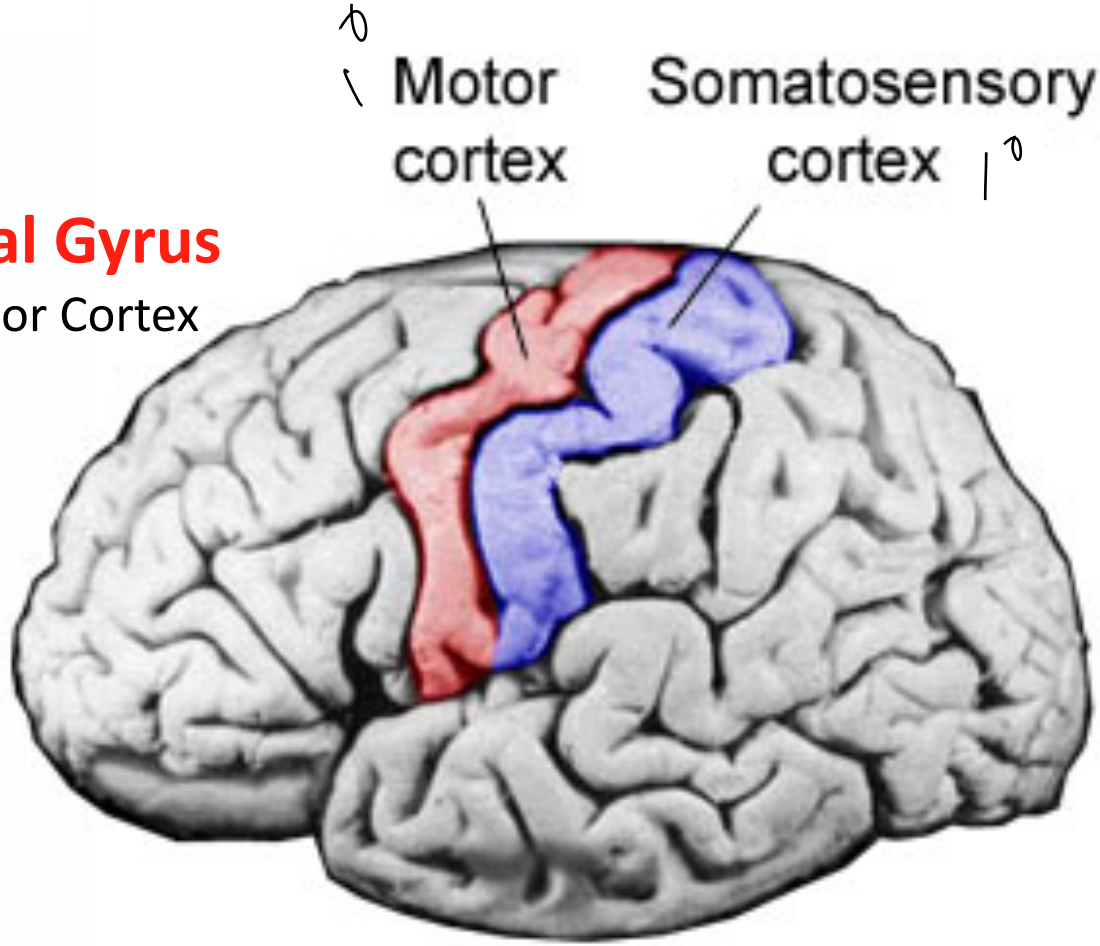
Parietal (Somatosensory) & Frontal (Motor) Cortex

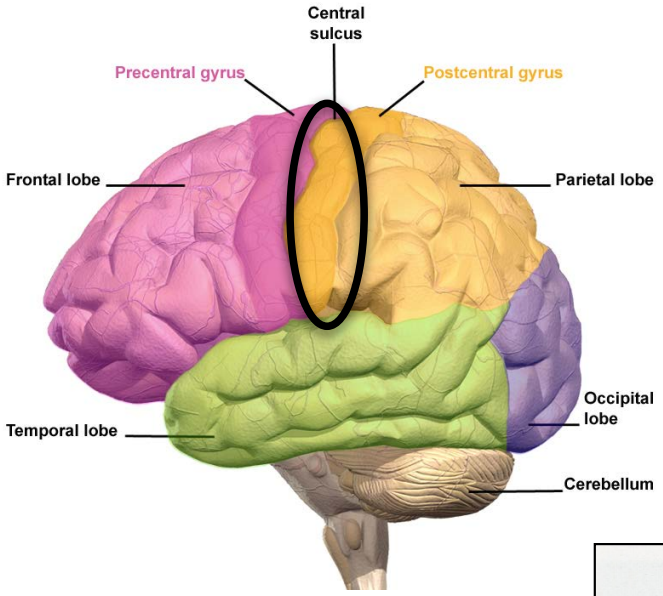
Post-Central Gyrus (S1)

Primary Projection area for Somatosensory info

Pre-Central Gyrus

Primary Motor Cortex

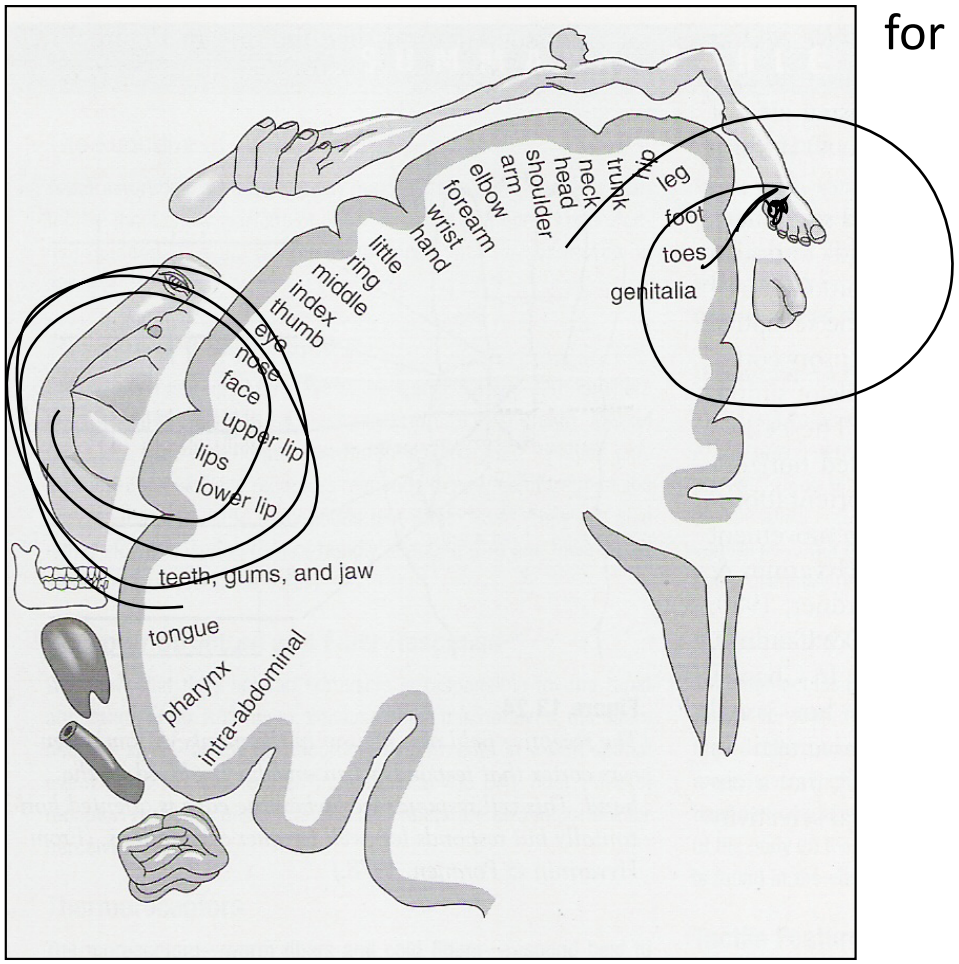


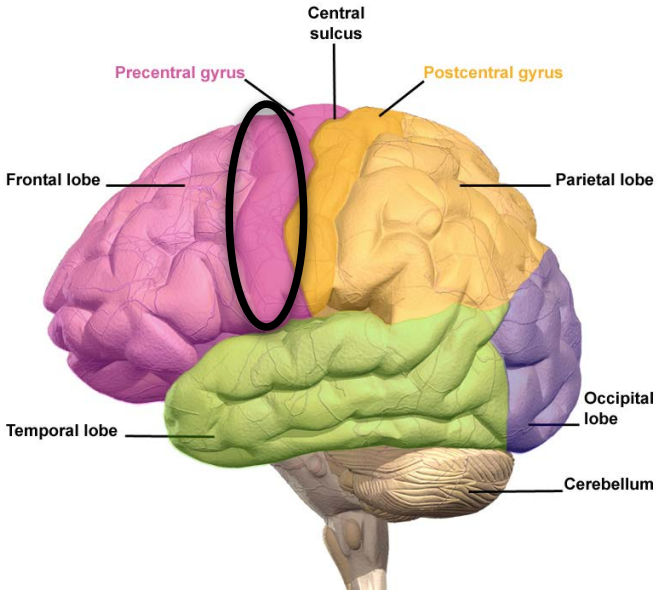


Parietal (Somatosensory) & Frontal (Motor) Cortex

Post-Central Gyrus (S1)

Primary Projection area for Somatosensory info

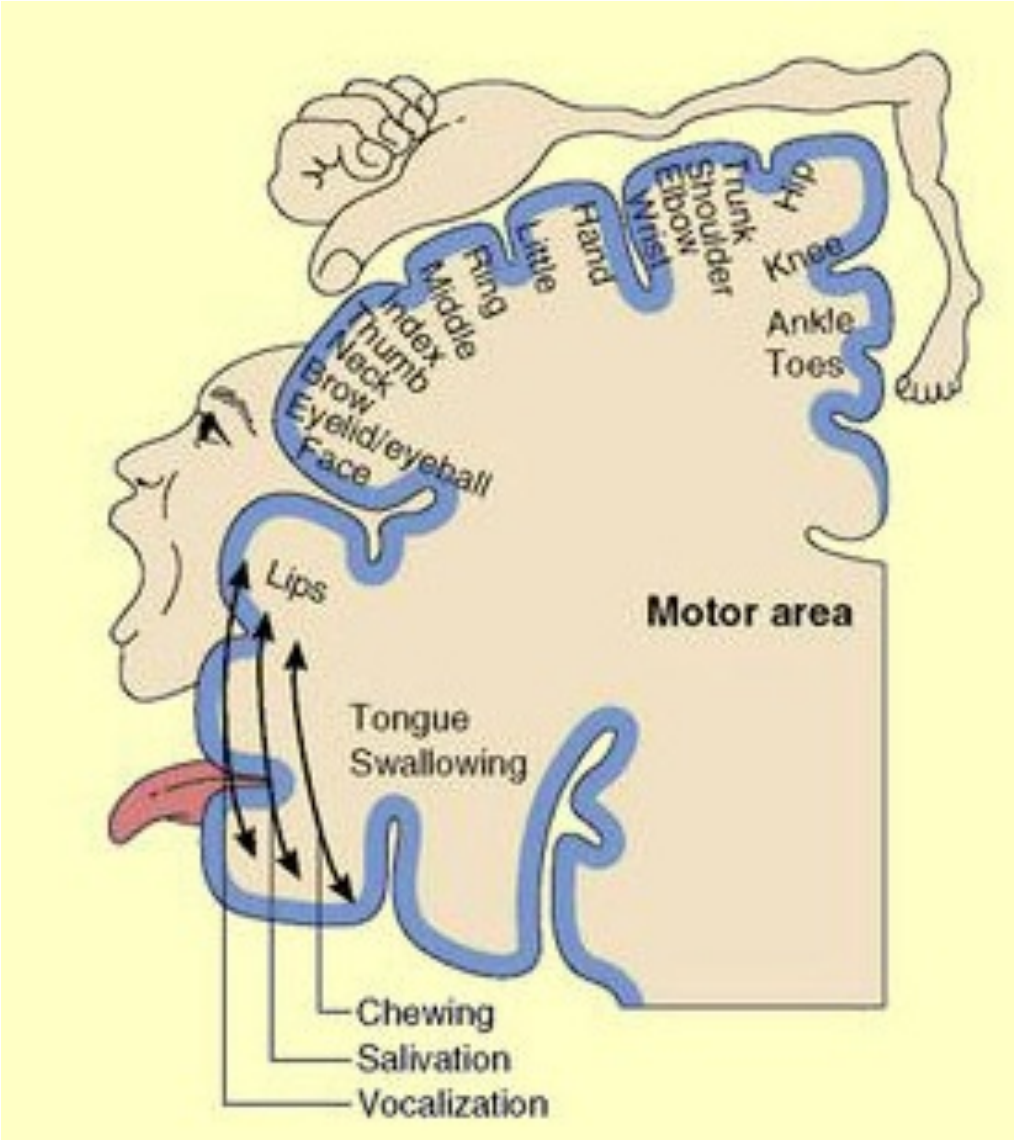


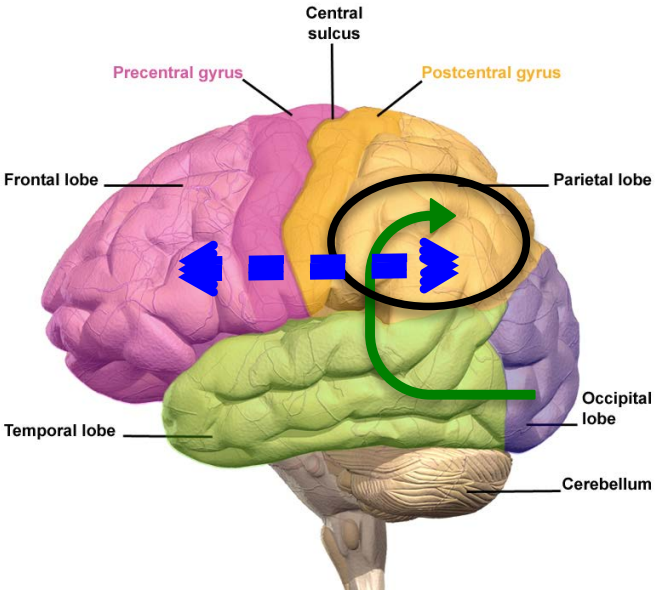


Parietal (Somatosensory) & Frontal (Motor) Cortex

Pre-Central Gyrus

Primary Motor Cortex





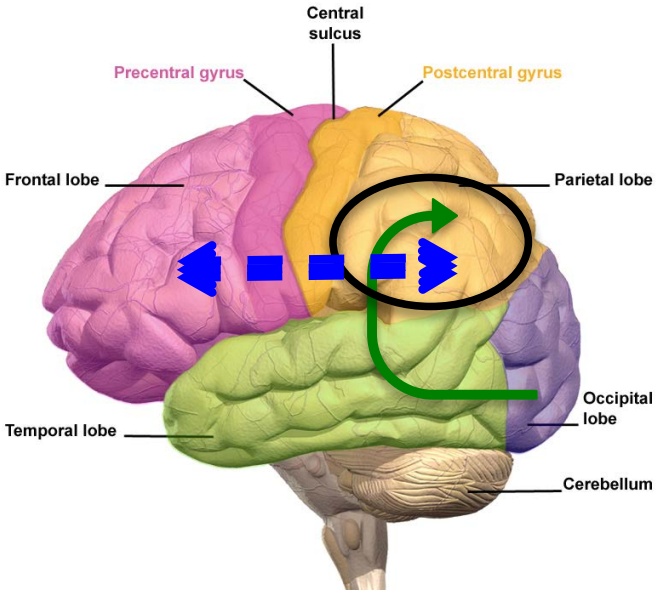
Parietal Lobe

Dorsal Visual Pathway "Where/How"
- integrated w/ Tactile & Proprioception

Activity reverberates w/Premotor Cortex, to shape how hand approaches

Canonical Cells

Respond to "affordances" of objects



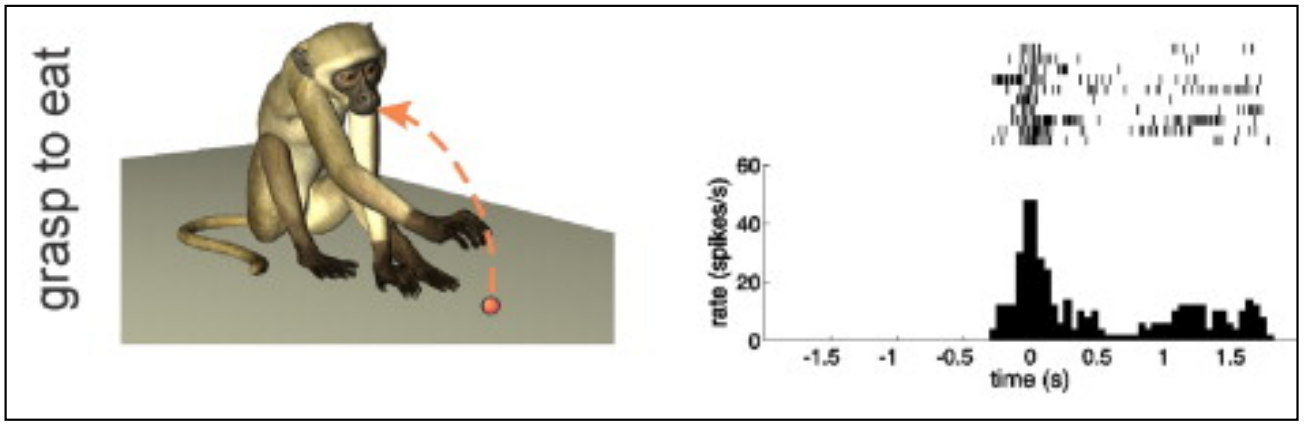
Parietal Lobe

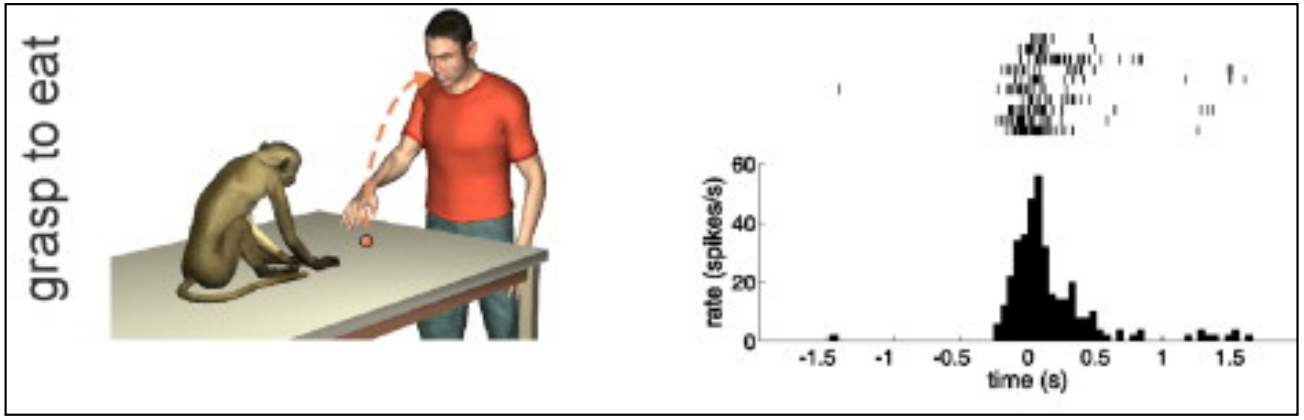
Mirror Cell System

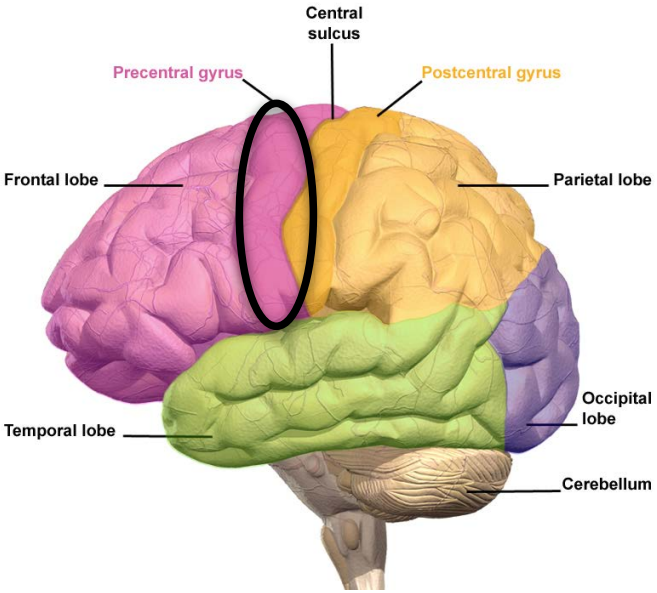
Respond to seeing self,
or other,
perform and action.

Activity reverberates with Mirror Cells in Premotor Cortex

Promotes Imitation



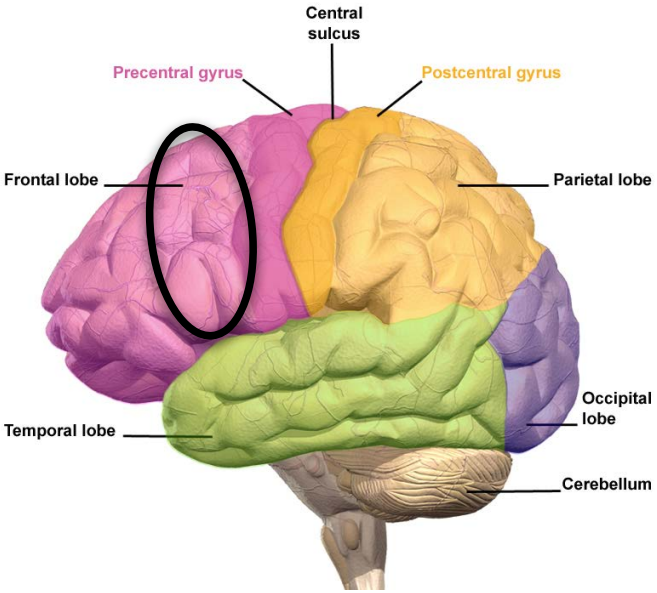




Frontal Lobe

Primary Motor Cortex

Volunrtary action



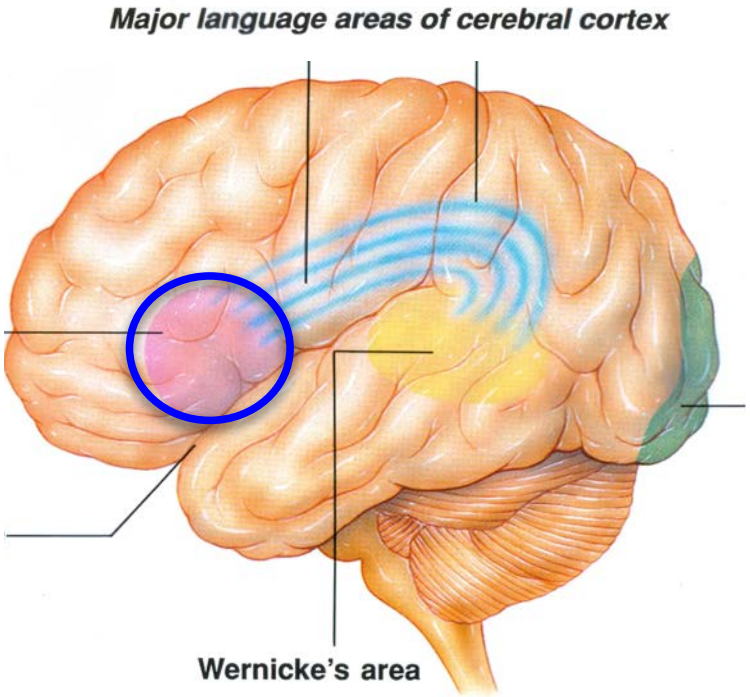
Frontal Lobe

Pre-Motor Cortex

Prepare to act;
Planning

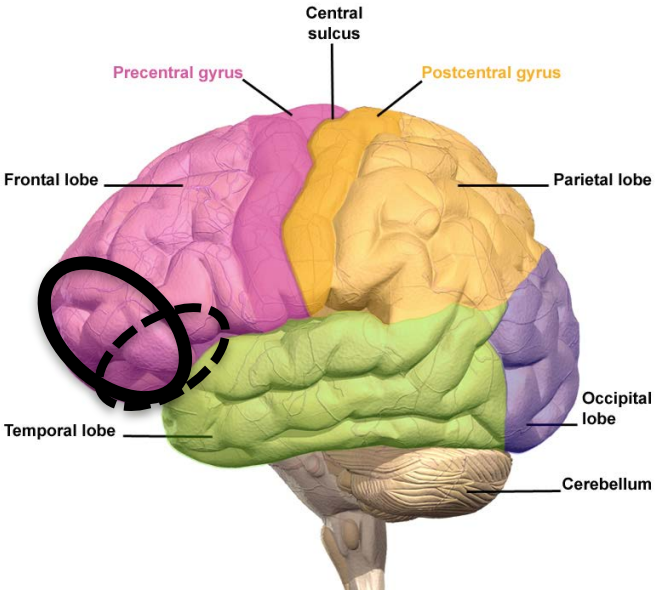
Broca's Area

Prepare to Speak



Mirror Cells

Simulation of observed action



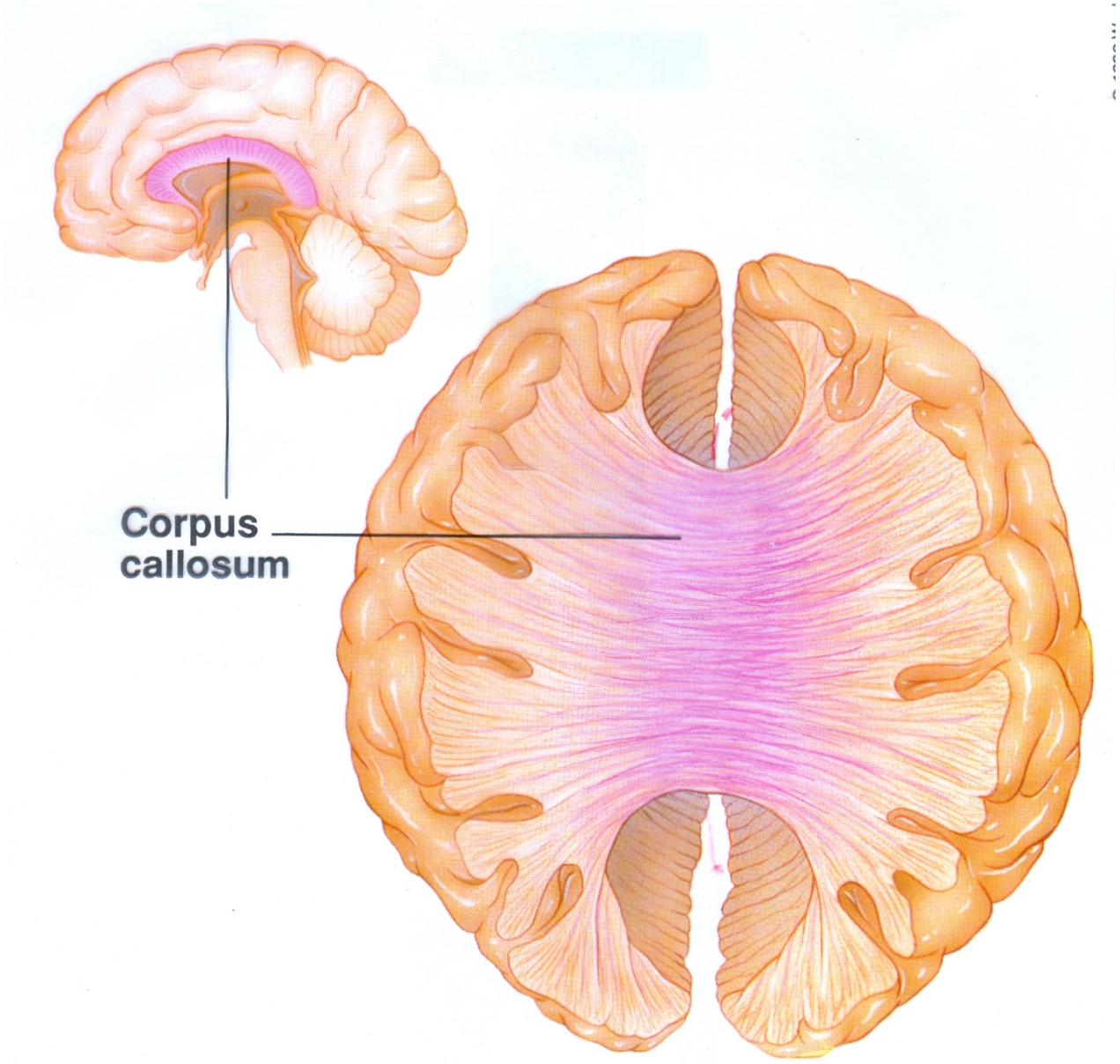
Prefrontal Cortex

Oribito-Frontal Cortex

Evaluation behavior of self and other, ToM, Social strategy

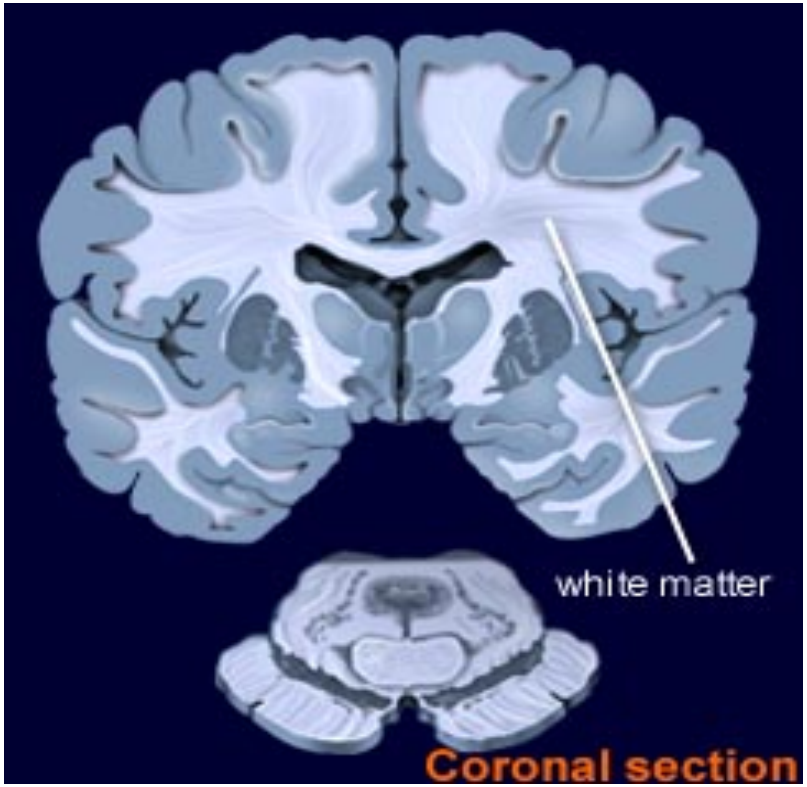
Exercising **Self Control,** delayed gratification, planning, cultural rules, etc.

Corpus callosum

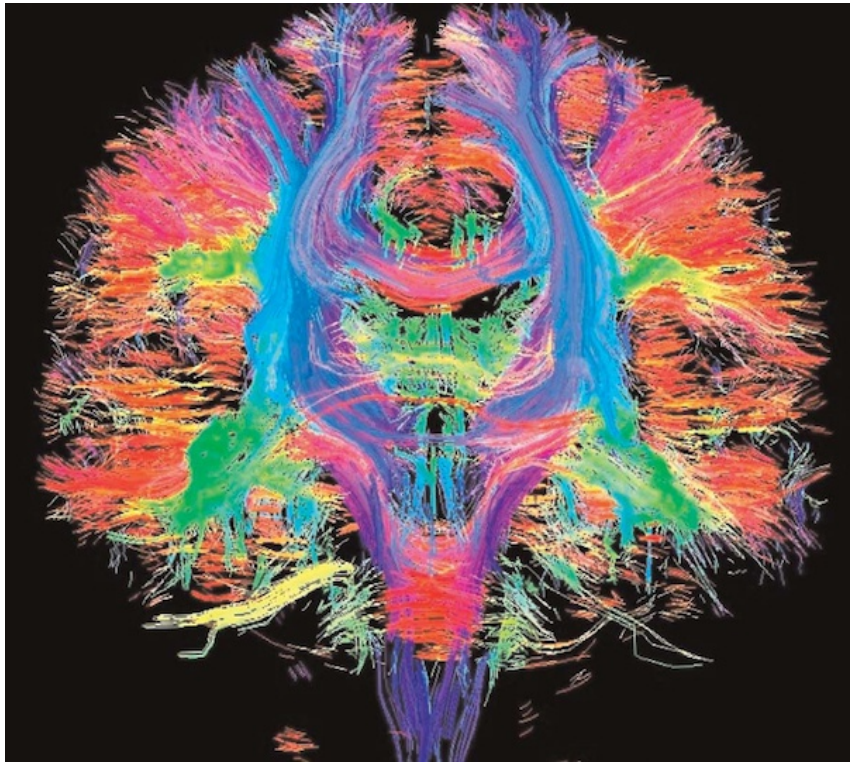


White Matter

The connections between "the little grey cells".
Consisting mainly of Myelinated axons



"Diffusion Tensor Imaging" DTI >>>>>



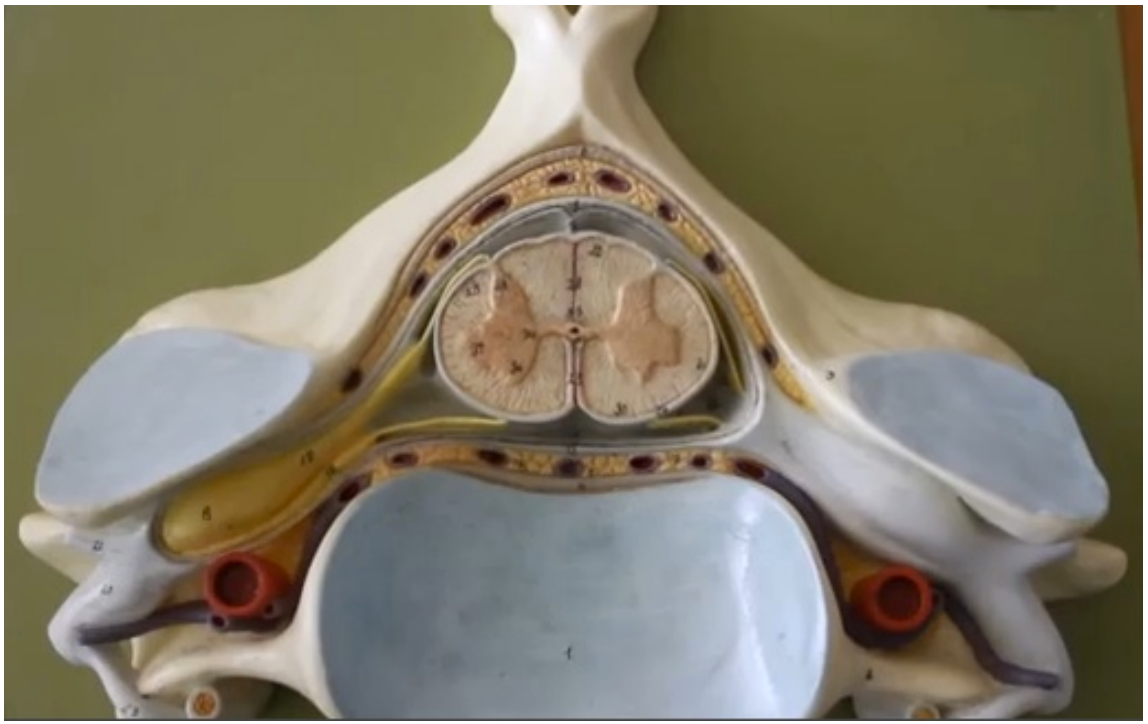
Tshibanda et al. (2009) *Progress in Brain Research,* 177:215-229.

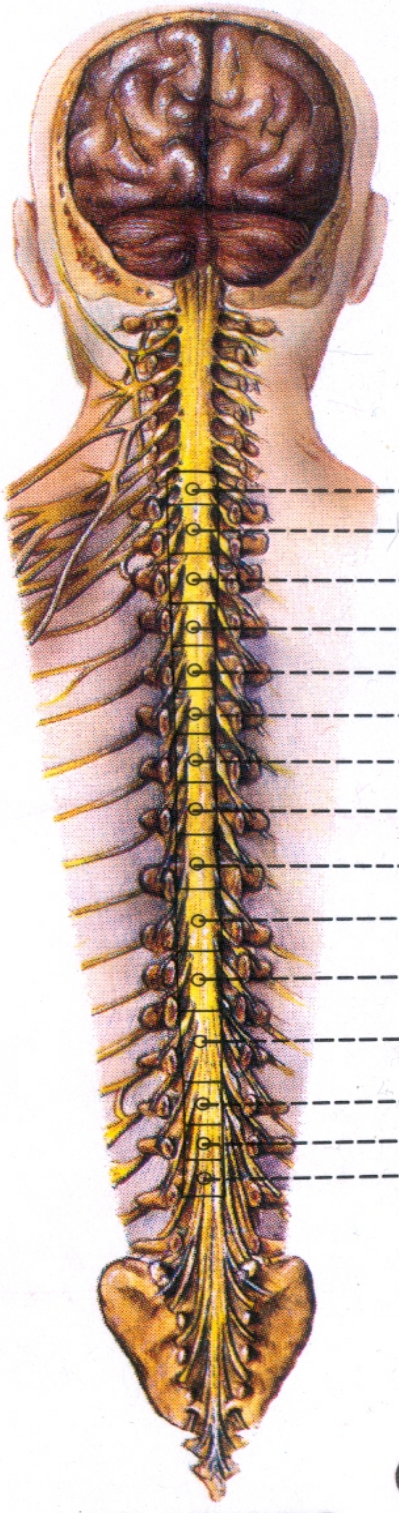
Brain = **~66% White Matter**, by volume

Spinal Cord

31 Segments

Like the brain,
encased in bone & meninges





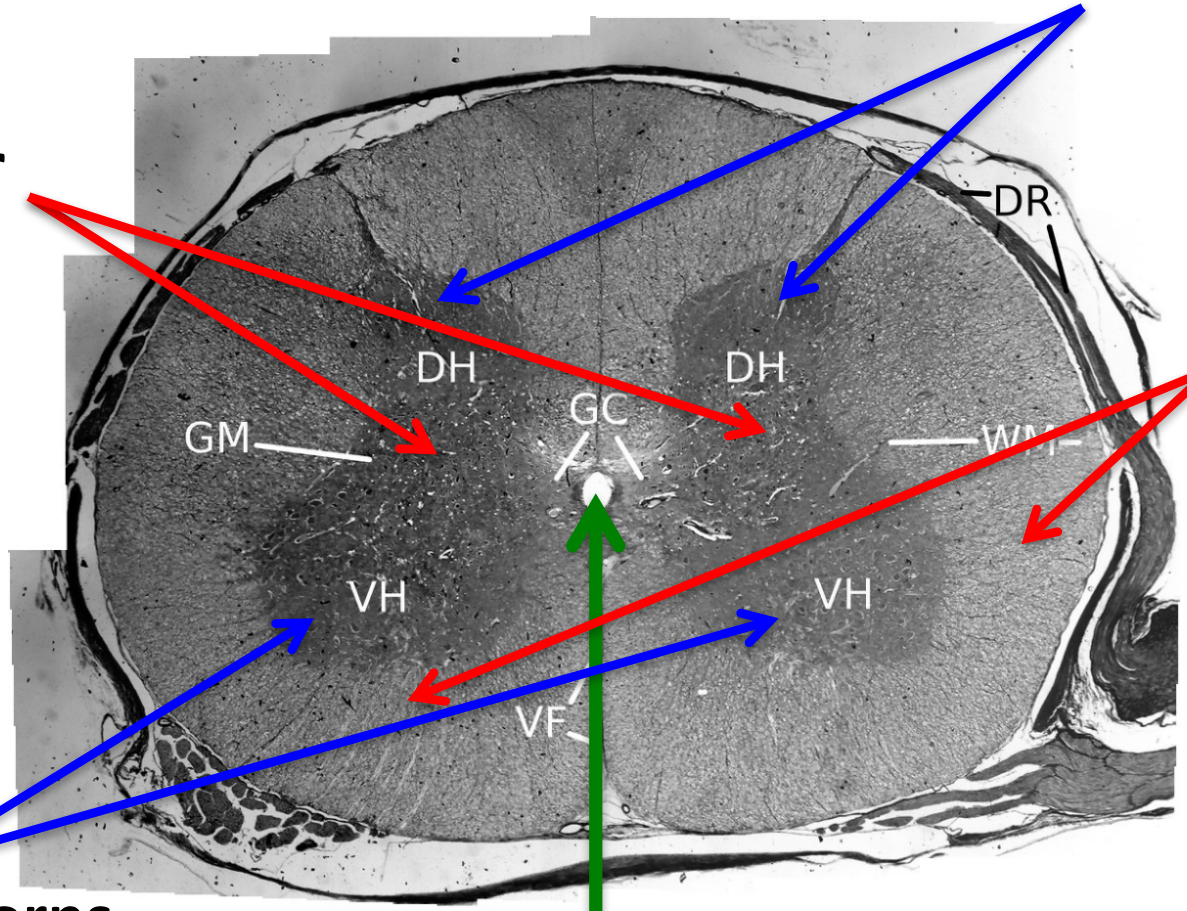
Spinal Cord

in Cross Section

Dorsal Horns

Grey Matter

Cell Bodies



White Matter

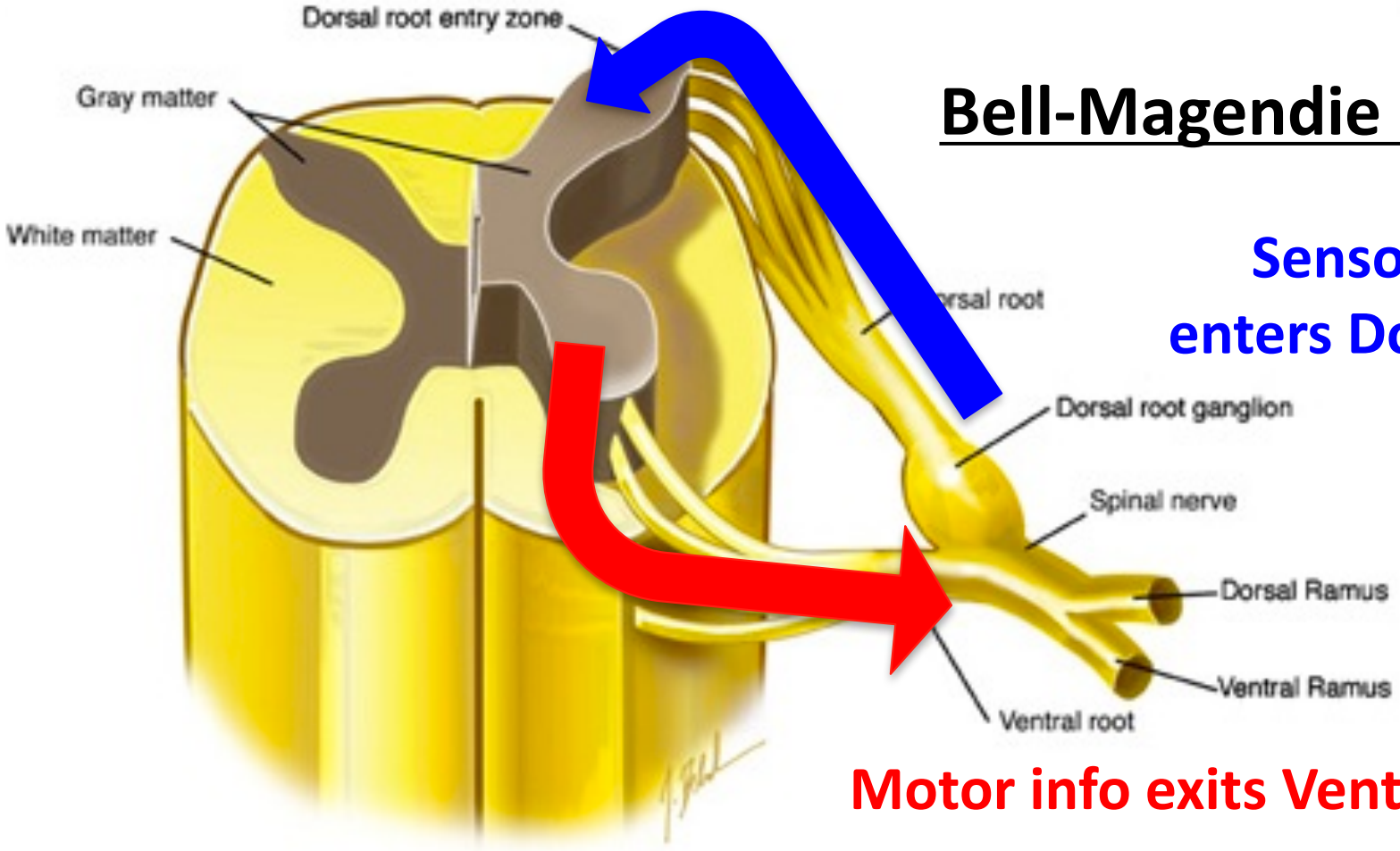
Myelinated Axons

Ventral Horns

Central Canal

w/ Cerebral Spinal Fluid

Spinal Cord



Bell-Magendie Law:

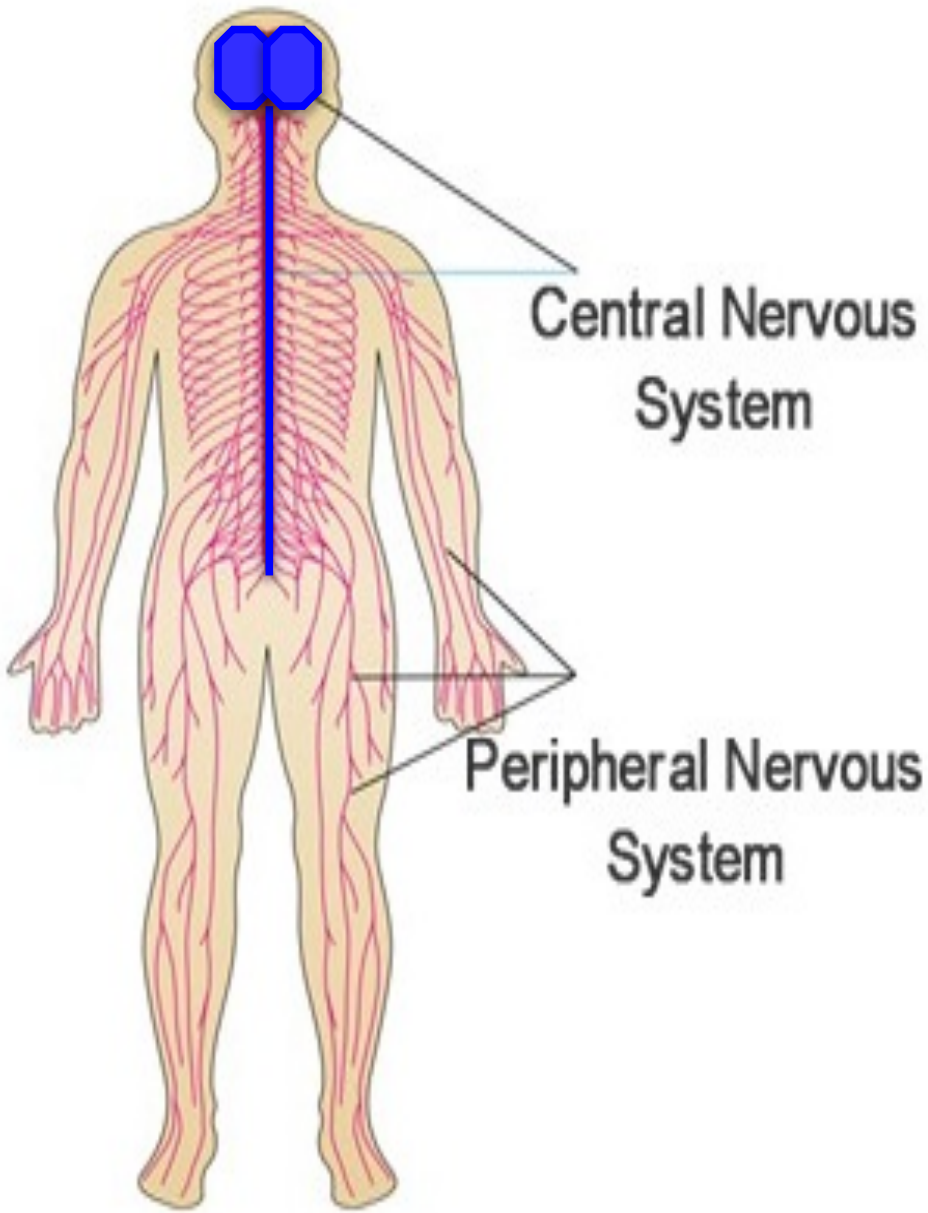
Sensory info enters Dorsal Horn

Motor info exits Vental Horn

MNEMONIC:

In the Door
and out the Vent,
that's how Spinal info's sent!

CNS & PNS



CNS

Central Nervous System

= Brain & Spinal Cord

Surrounded by bone and meninges

PNS

Peripheral Nervous System

SOMATIC System
= Interaction w/external env.

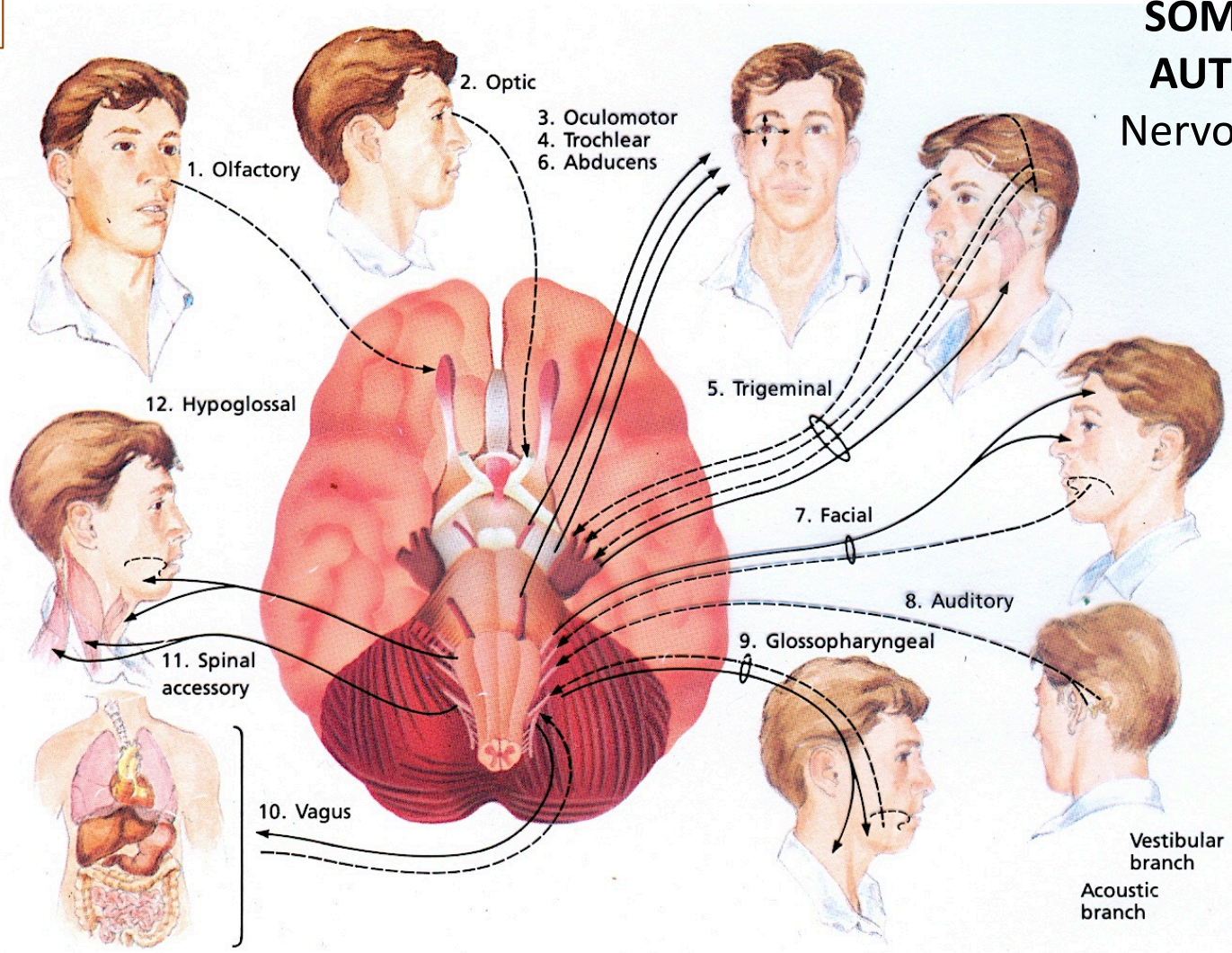
AUTONOMIC System
= Regulates internal env.

PNS includes **Cranial Nerves**

Sensory

Motor

Involved in **SOMATIC** and **AUTONOMIC** Nervous Systems



The Twelve Pairs of Cranial Nerves and the Regions They Serve

PNS – Spinal Nerves

31 Segments

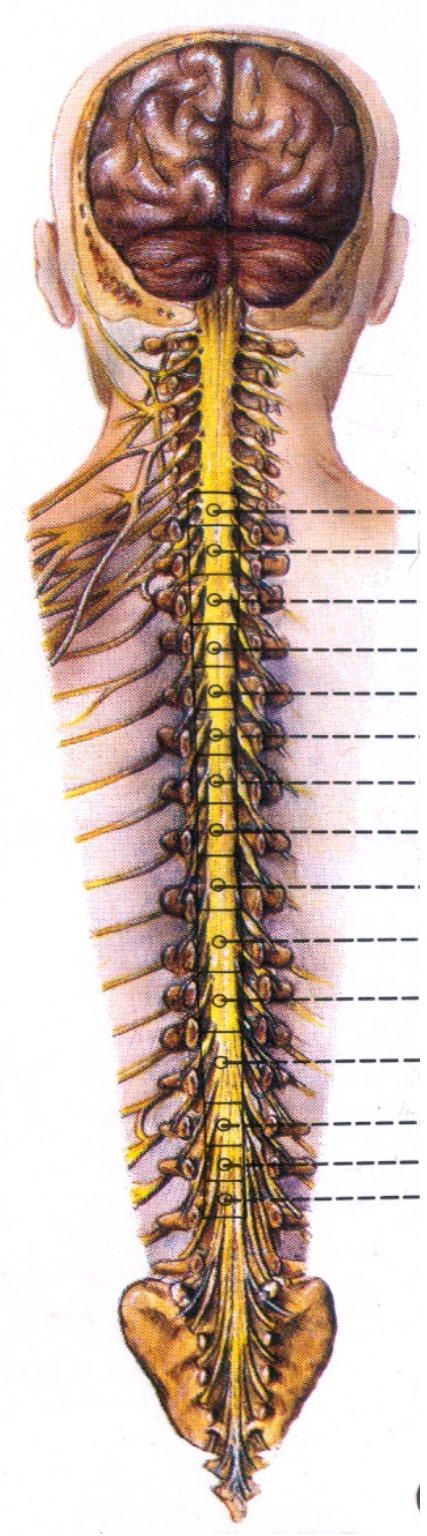
1 pair of afferent
(in-flowing)
Dorsal Root Nerves

. . .for each. . .

1 pair of efferent
(out-flowing)
Ventral Root Nerves

Many of these play crucial role in

Autonomic Nervous System

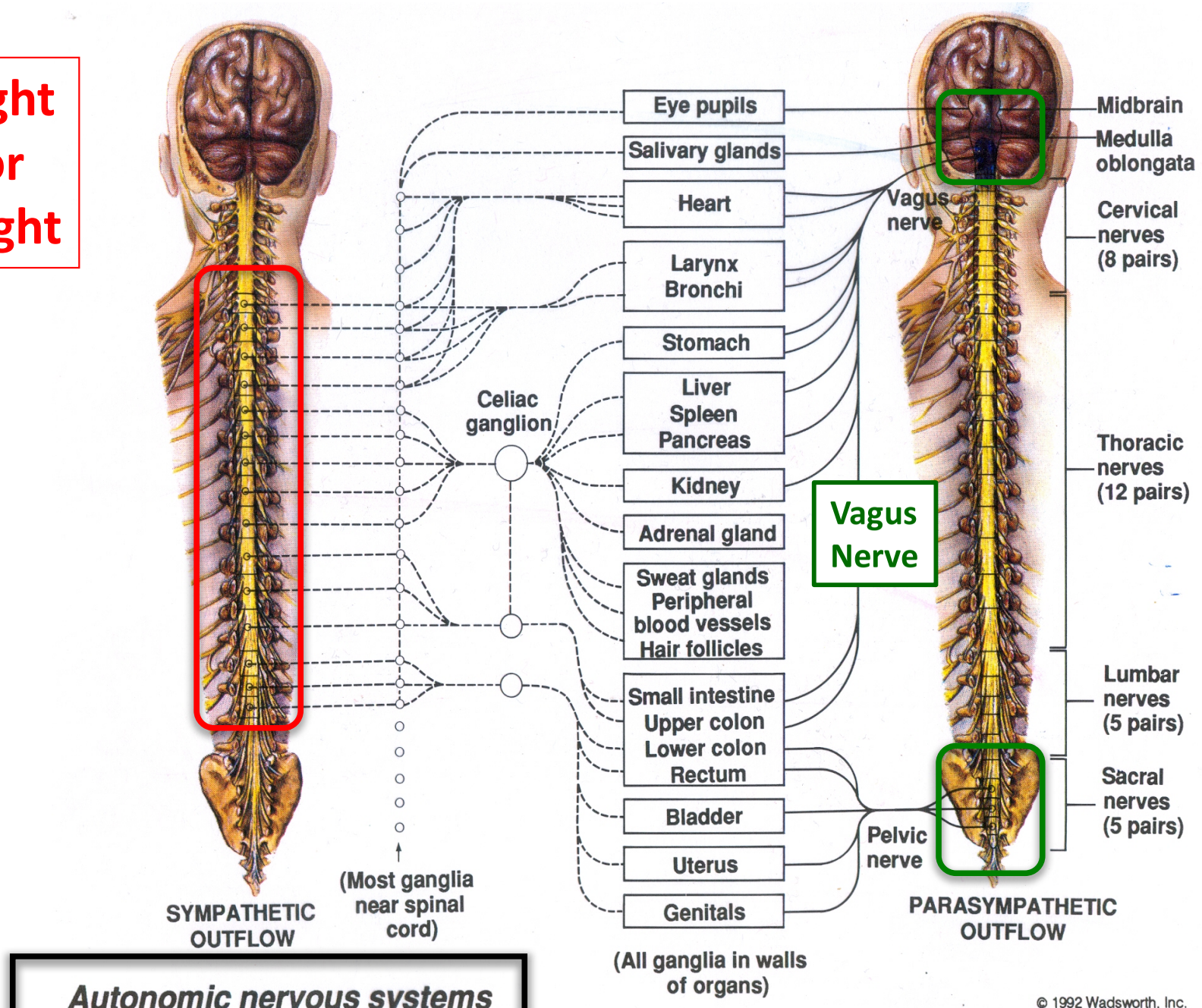


Sympathetic System

Parasympathetic System

Fight or Flight

Rest & Digest



Autonomic nervous systems

Sympathetic System

Fight or Flight

Pupils dialate

Mouth dry

Heart rate increase

Bronchi expand

Halt digestion

Liver release blood-sugar

Activate adrenal glands and sweat glands

Constrict blood vessels

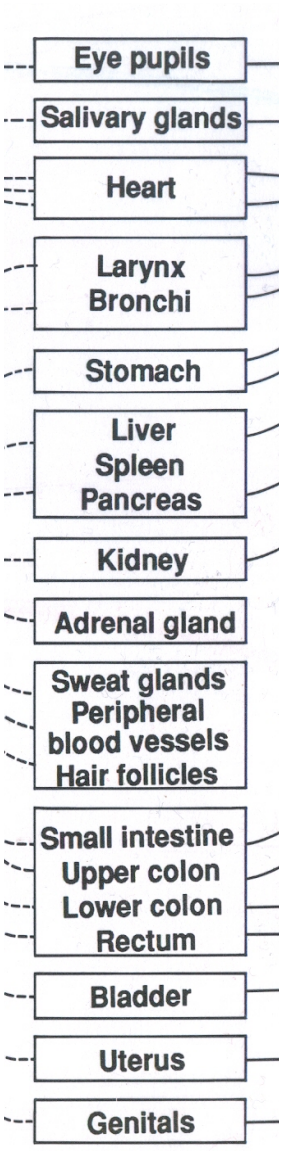
Pilo-erection

Halt digestive juices

Halt intestinal motility

Constrict bladder

Genitalia inactive (except at orgasm)



Parasympathetic System

Rest & Digest

Pupils constrict

Produce saliva

Heart rate decrease

Bronchi constrict

Promote digestion

Produce digestive juices

Increase intestinal motility

Release bladder

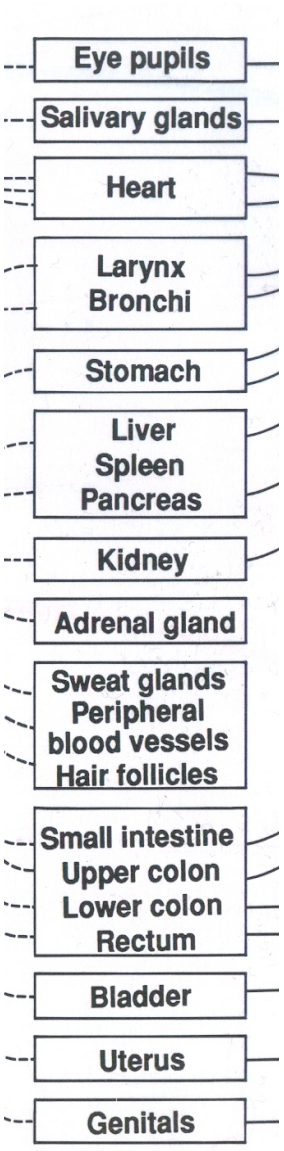
Genitalia active

Sympathetic System

Fight or Flight

When this system gives extreme reaction...

e.g. Repeated stressors. . .



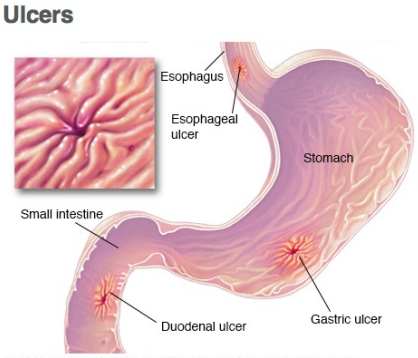
Parasympathetic System

...this system will "Rebound"

Rest & Digest

Parasympathetic Rebound

. . .lead to Ulcers



Even Voodoo death...