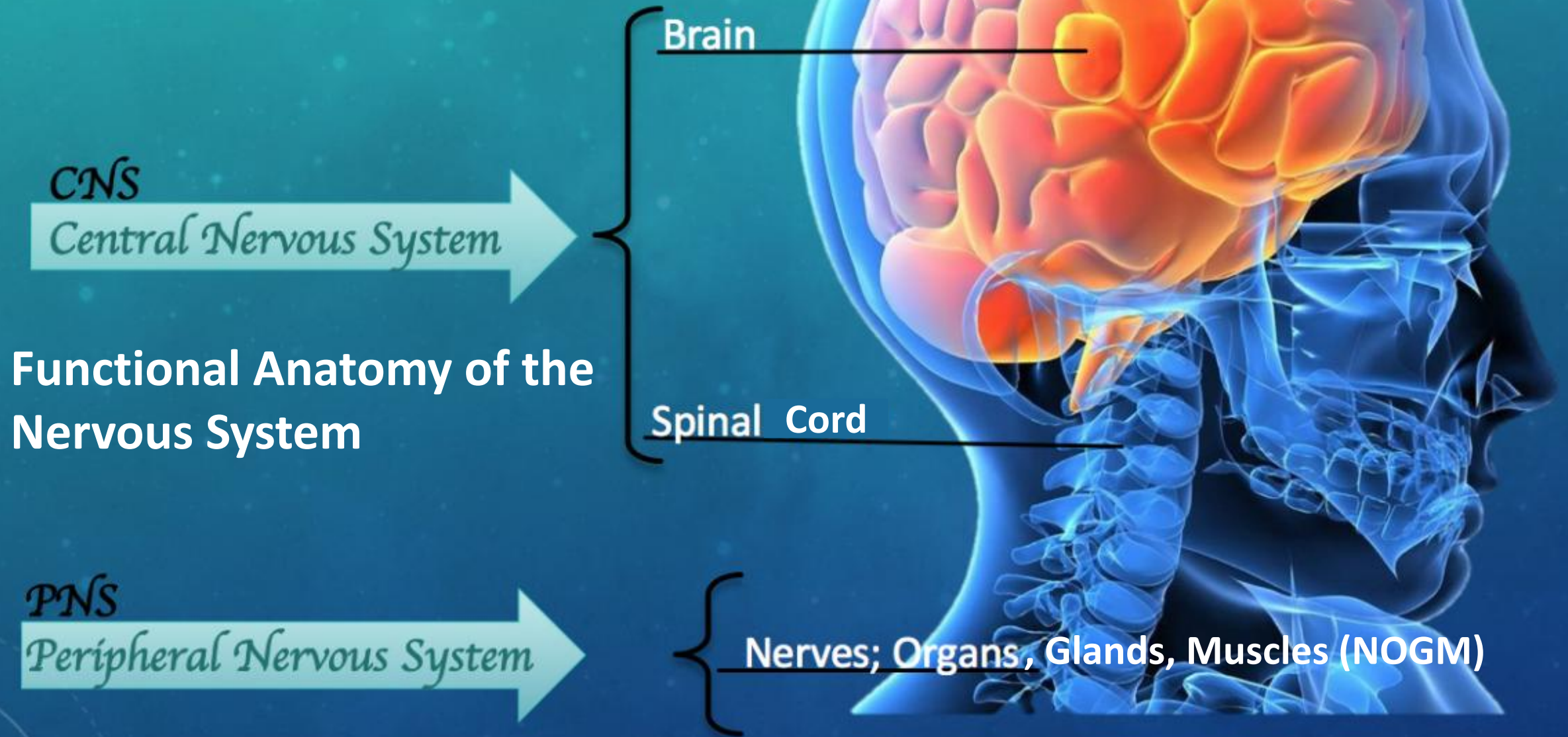
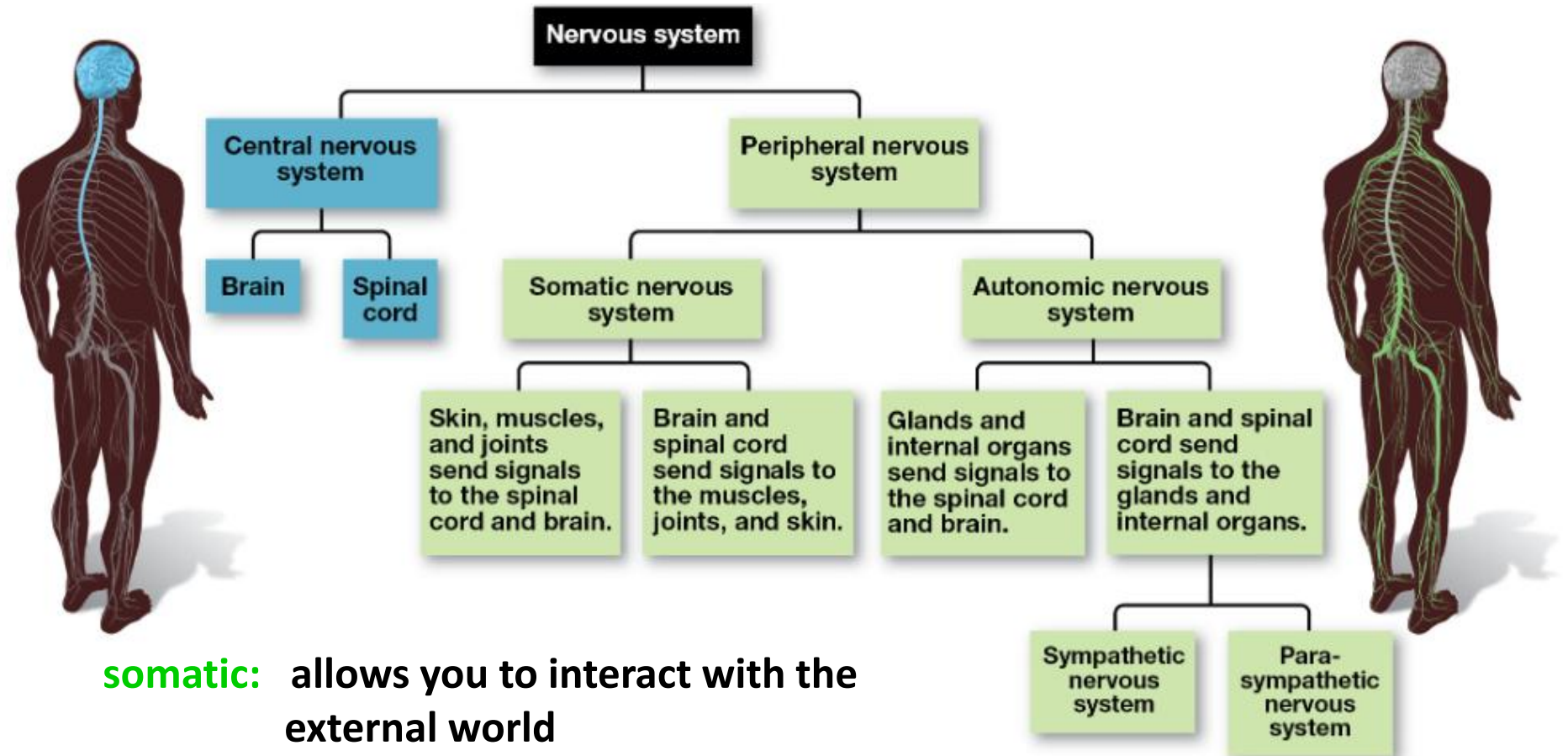


Knowledge Category 1



Divisions of the nervous system



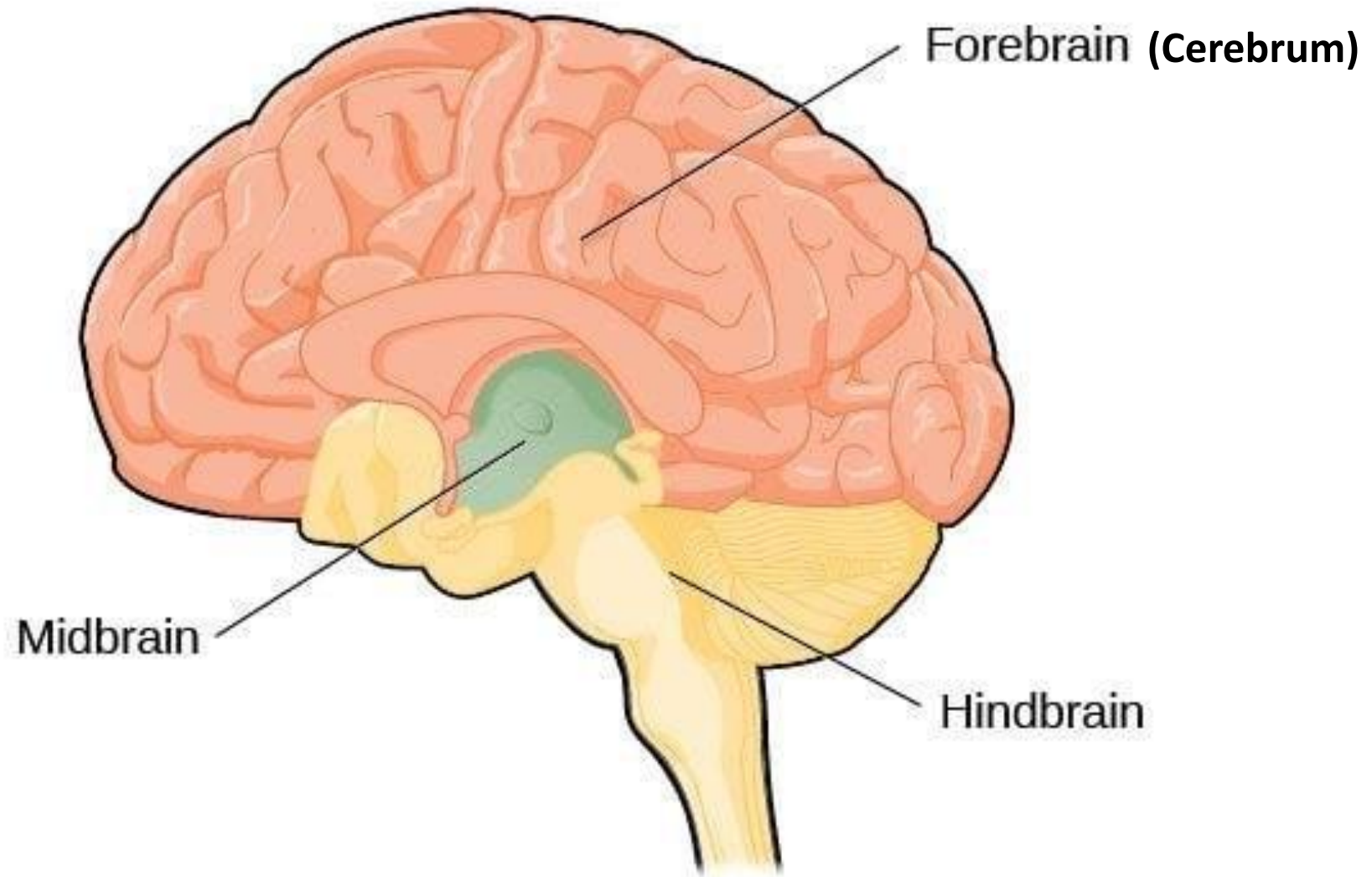
somatic: allows you to interact with the external world

autonomic: regulates the internal environment of your body

fight or
flight

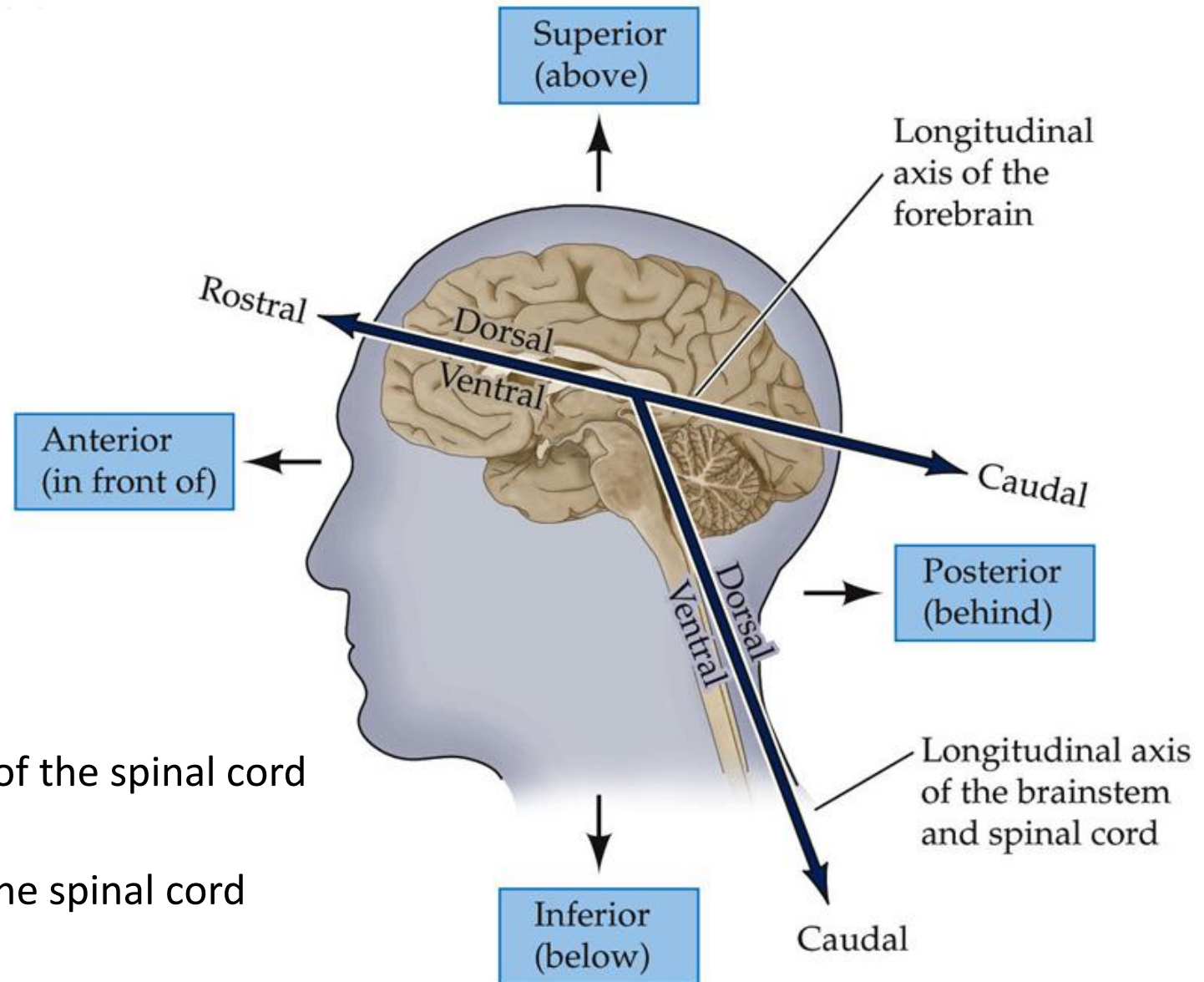
rest and
restore

Major divisions of the brain



Directional terms for the brain and spinal cord

- **anterior**: toward the face
- **posterior**: toward the back of the head
- **superior**: above
- **inferior**: below
- **lateral**: toward the side
- **medial**: toward the middle
- **dorsal**: towards the top of the head or back of the spinal cord
- **ventral**: towards the spinal cord or front of the spinal cord



The Forebrain – Cerebral Cortex

Frontal Lobe

Primary motor cortex (PMA): execution of movement

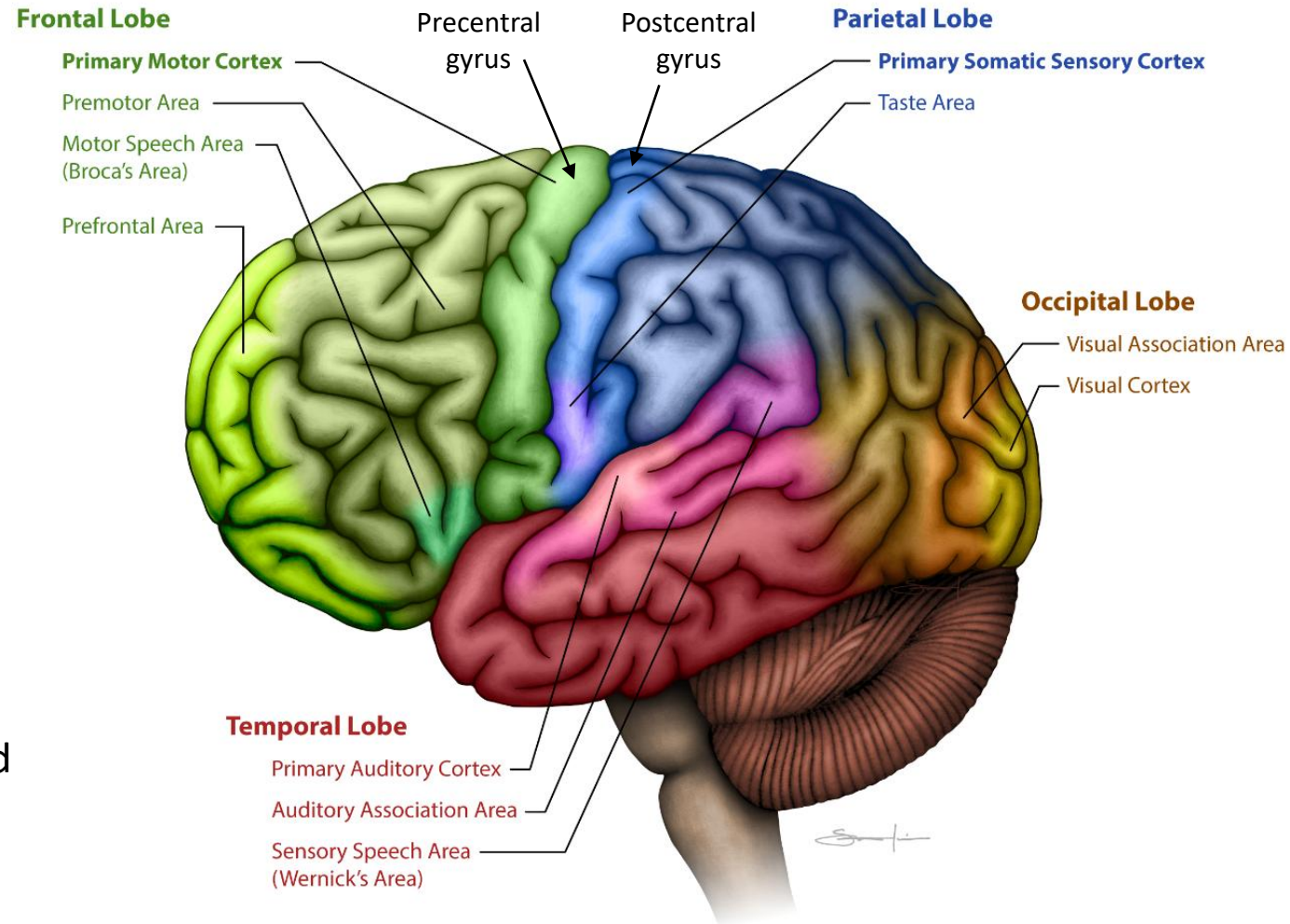
Supplementary motor area: planning & control of movement, learning motor sequences
works with PMA, prefrontal cortex, inferior parietal cortex, basal ganglia, cerebellum -> motor imagery

Broca's area: produces speech and written language

Prefrontal cortex: emotion, memory, attention, self-awareness, higher-order cognitive functions

abnormalities or damage here produces site-specific and diverse effects

Specialization not Specificity Connections vs Structure



The Forebrain – Cerebral Cortex

Parietal Lobe

Integration of sensory information
pressure, temp., pain, proprioception, gustation
damage produces *many* “a ____” syndromes

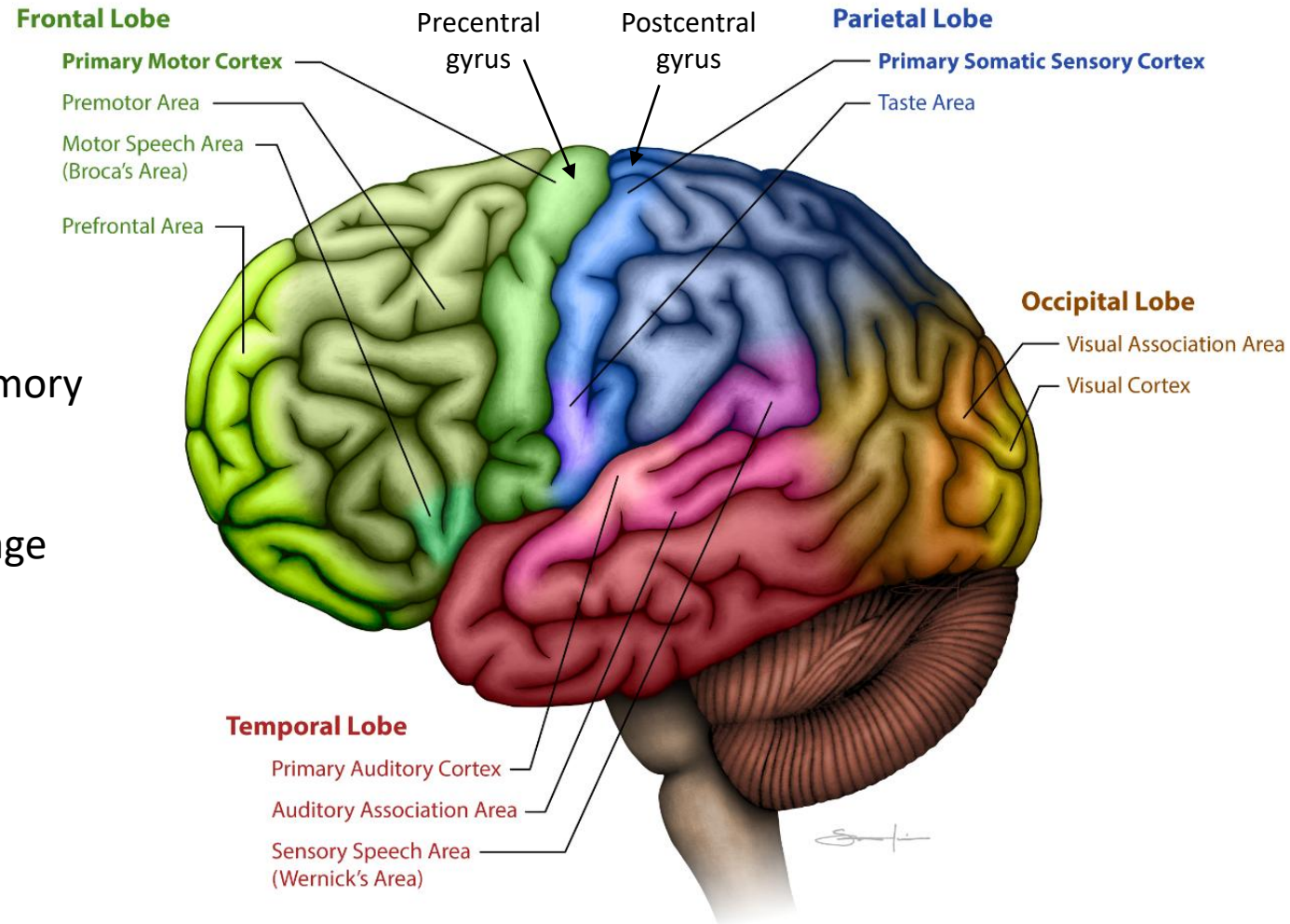
Temporal Lobe

Auditory sensation & perception
Encoding, storing, retrieving long-term declarative memory
Lesions -> retrograde & anterograde memory loss for semantic & episodic memory
Wernicke's area – understanding and producing language

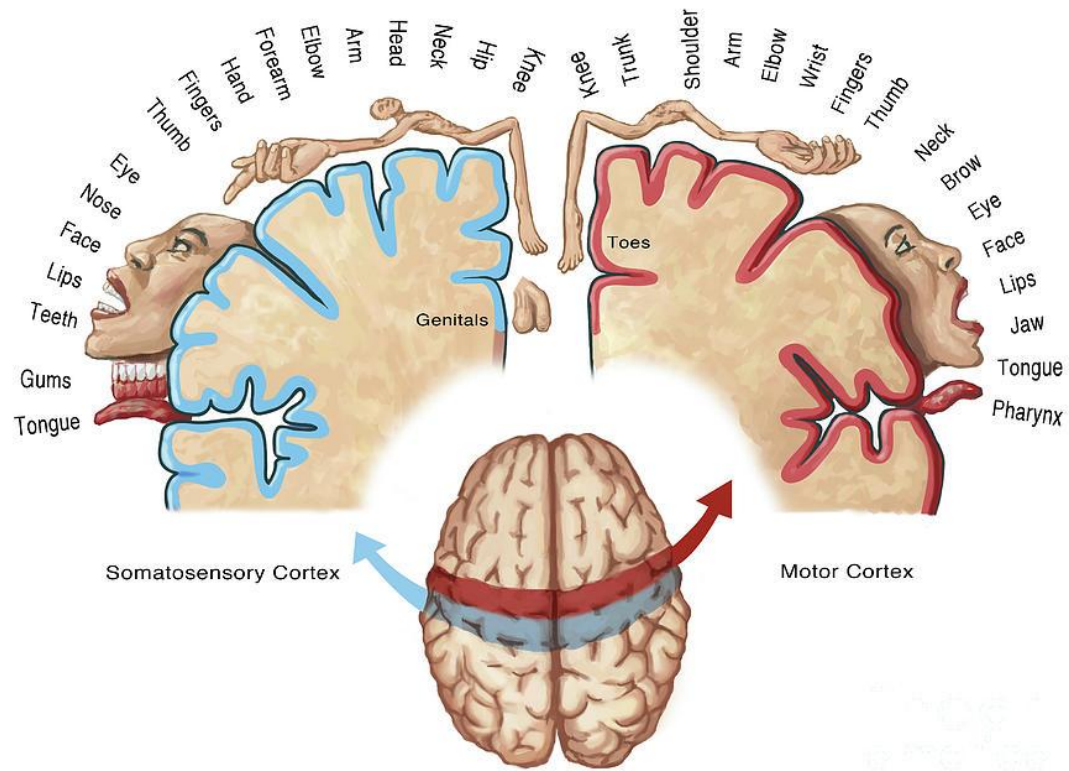
Occipital Lobe

Visual perception, recognition, and memory

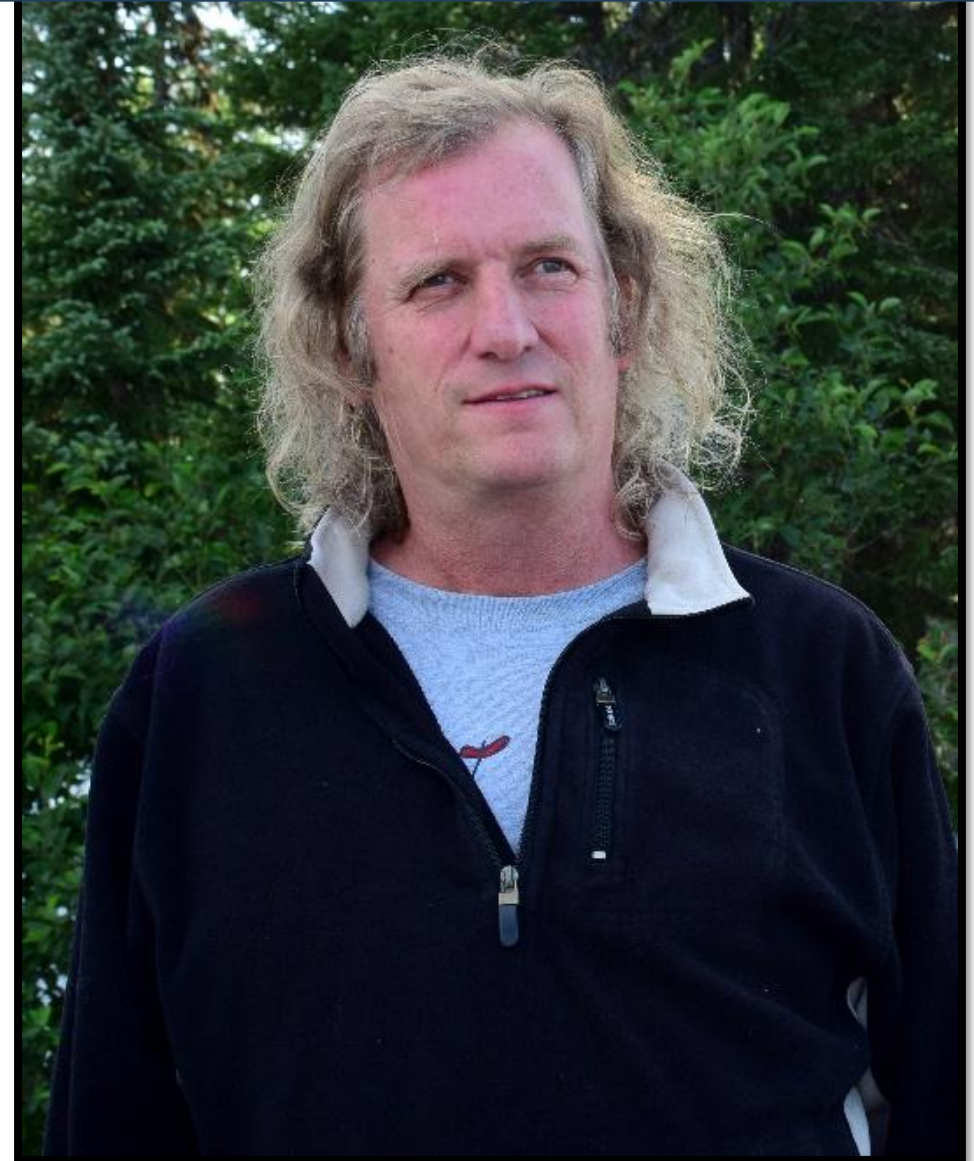
Specialization not Specificity



Parietal Lobe Tumor & My Hubby



Homunculus



Forebrain - subcortical - Diencephalon

Thalamus

relay for all sensory information
(except smell) to the cortex

motor activity, language, memory



Coronal slice

Hypothalamus

Language translator for central NS & endocrine system

Hormone regulation and homeostasis

Key role in stress via pituitary gland and the autonomic N.S.

The four Fs

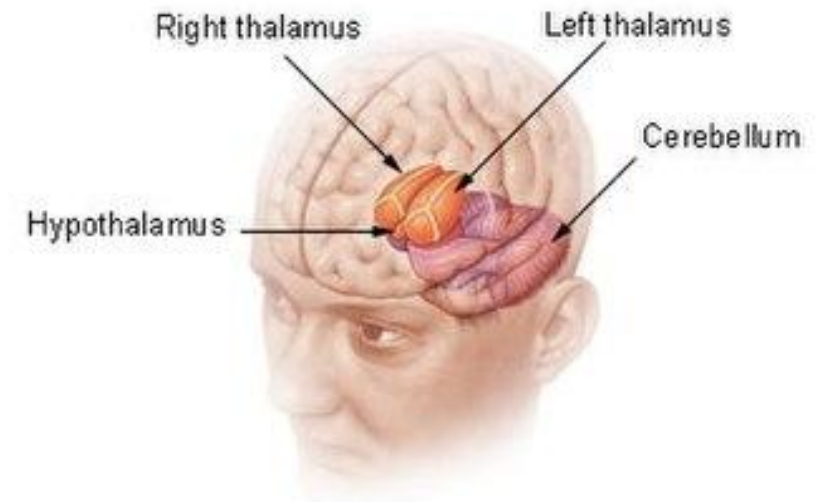
Sleep, body temp, movement, emotions

Suprachiasmatic nucleus circadian rhythms (sleep-wake cycle)

Mamillary bodies: learning and memory



Diencephalon



Forebrain – subcortical - Basal ganglia

Coordinates voluntary movement, planning, motivation, facial expressions, sensorimotor learning

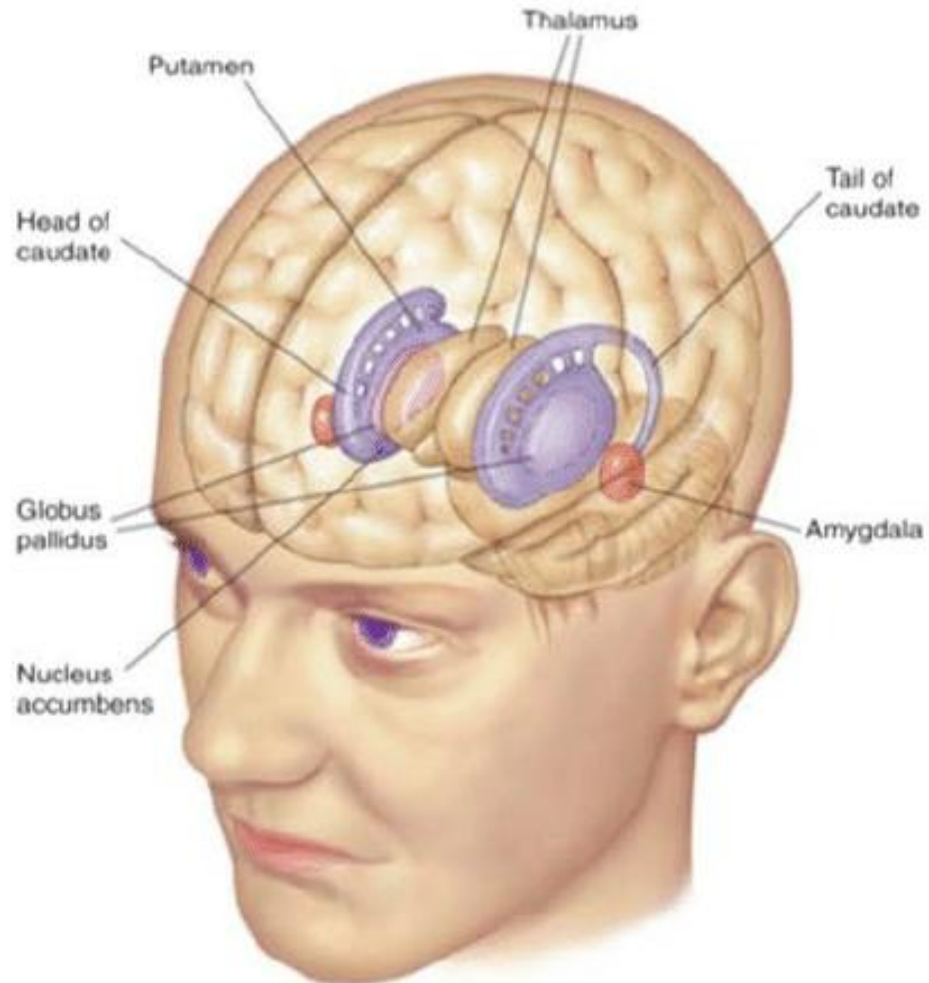
globus pallidus

substantia nigra

located in the midbrain

striatum

caudate nucleus
putamen

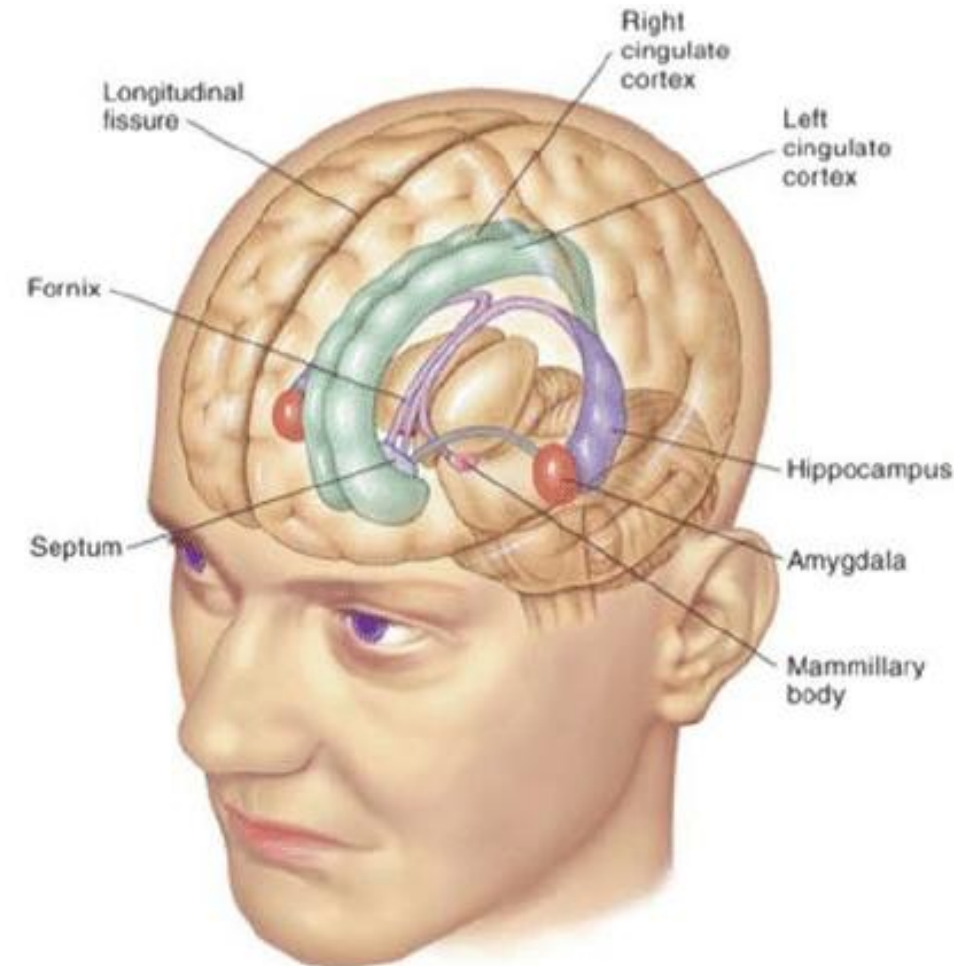


Forebrain - subcortical - Limbic system

Amygdala: integrates and directs emotional and motivational activities
attaches emotions to memories
classical conditioning

Hippocampus: learning and memory
converts short-term memory to long-term
puts the break on the stress (HPA) response

Cingulate cortex: surrounds the corpus callosum
attention, emotion, perception of pain
emotional response to pain (anterior CC)



The midbrain

superior colliculus

Routes visual info

inferior colliculus

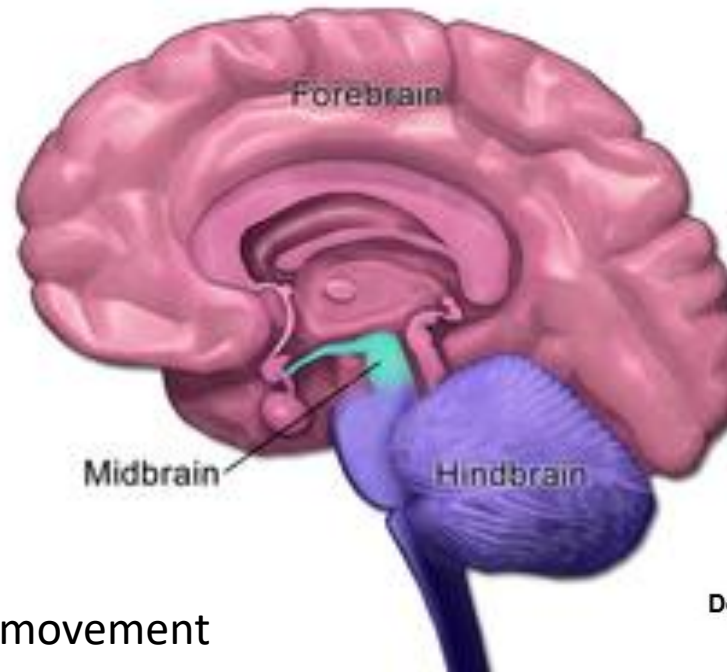
Routes auditory info

substantia nigra

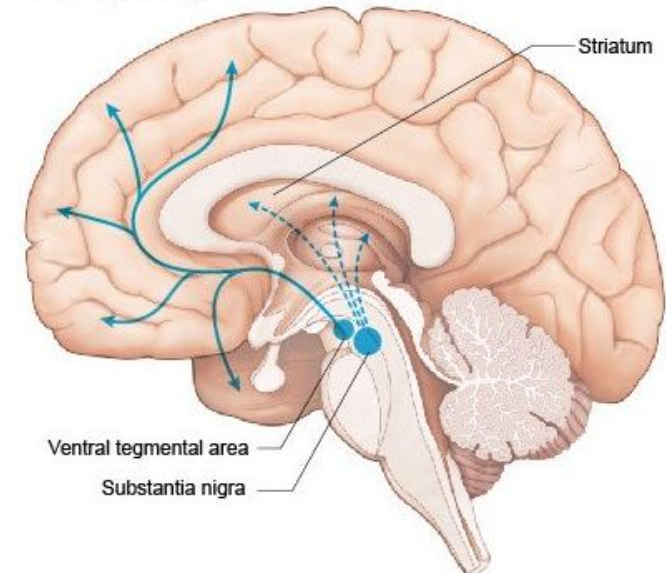
Sends tracts to striatum for smooth muscle movement
Important in motivation and reward

reticular formation

runs from brainstem through to the hypothalamus
coughing, vomiting, breathing, posture, locomotion, REM sleep



Dopaminergic pathways

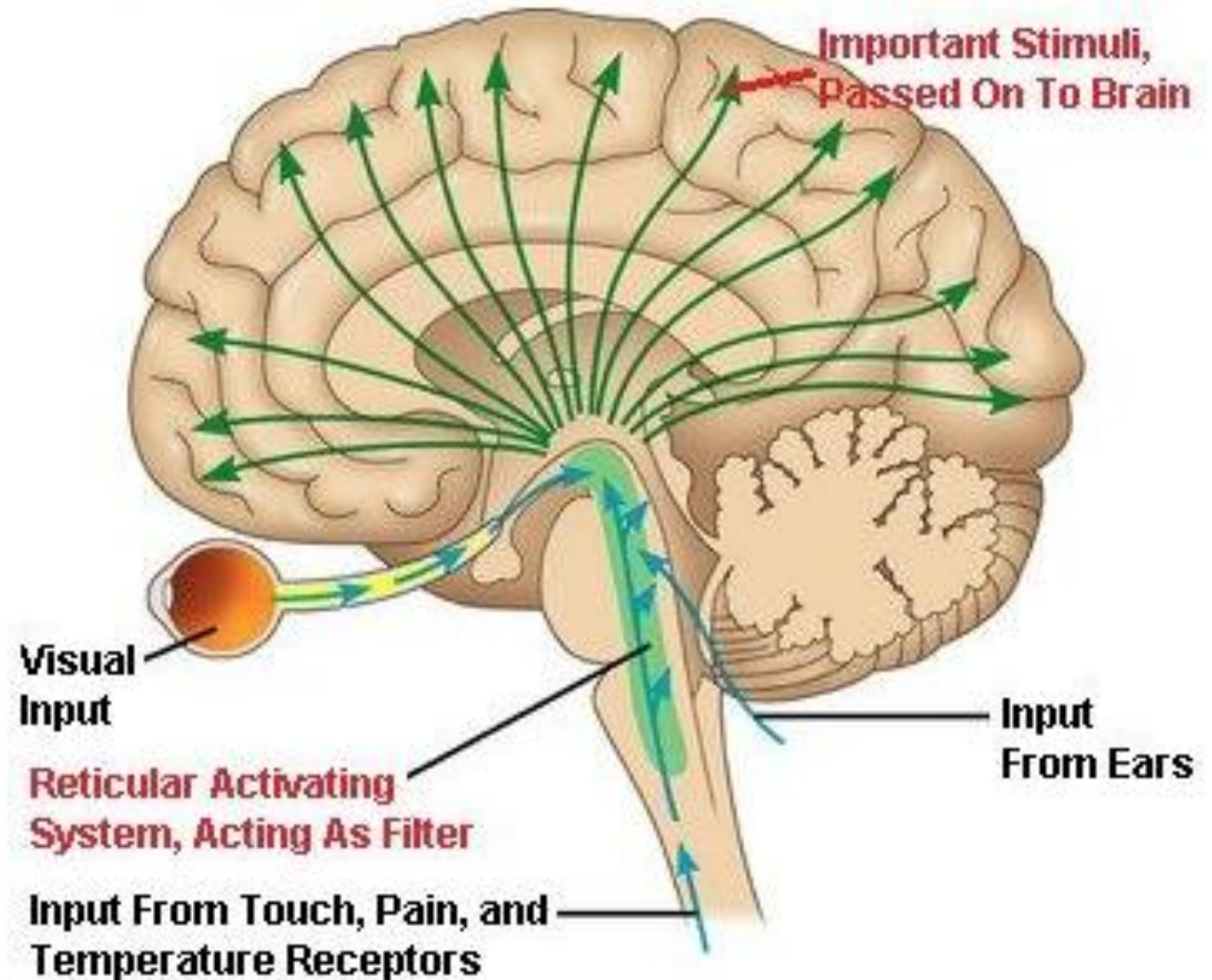


The reticular activating system

RAS is a part of the Reticular Formation

Arousal, sleep, and attention

Acts as a sensory filter & amplifier especially during sleep



The hindbrain

medulla oblongata

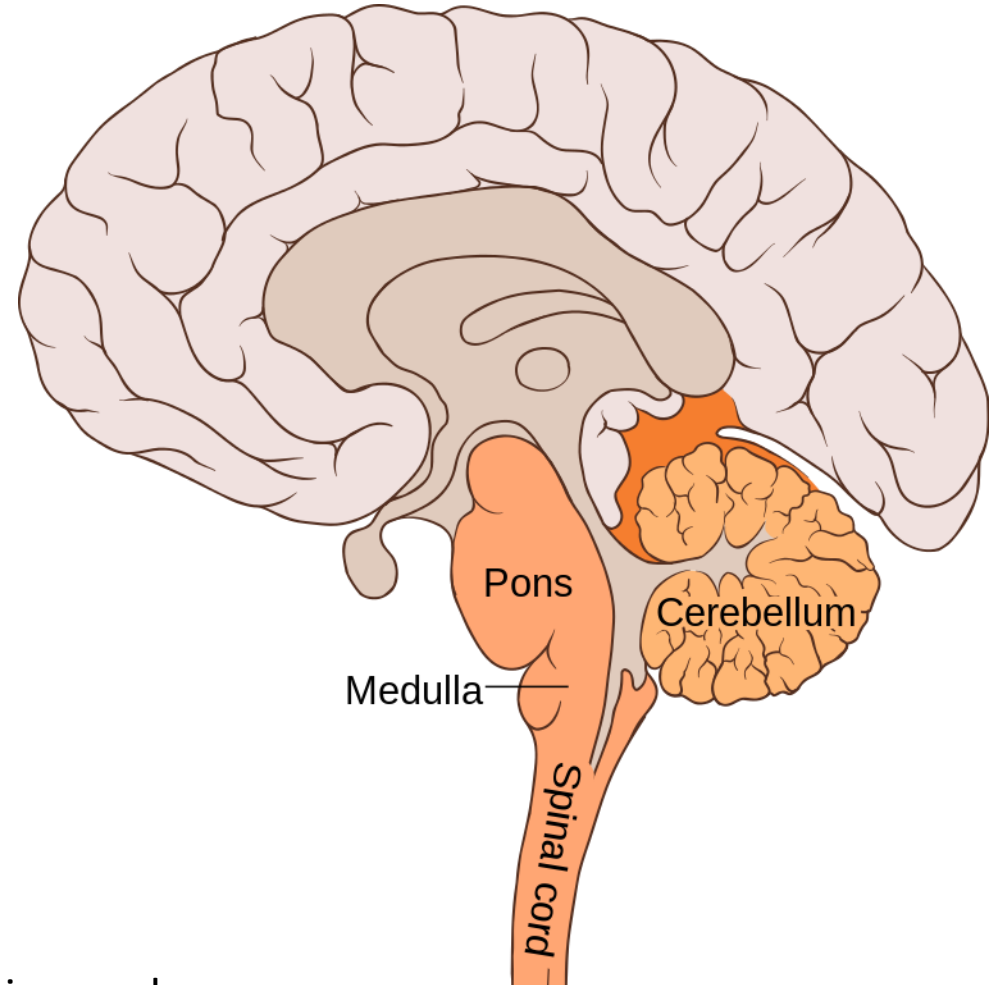
Influences information flow from spinal b/w cord and brain
Breathing, heart rate, blood pressure, vomiting, swallowing, coughing, sneezing

pons

Connects the L & R halves of the cerebellum
Transmits info between forebrain & cerebellum
Sleep, arousal, breathing, integrates L & R body movement

cerebellum

Means “little brain”
Coordinated and refined motor control, balance, sensorimotor learning, and memory



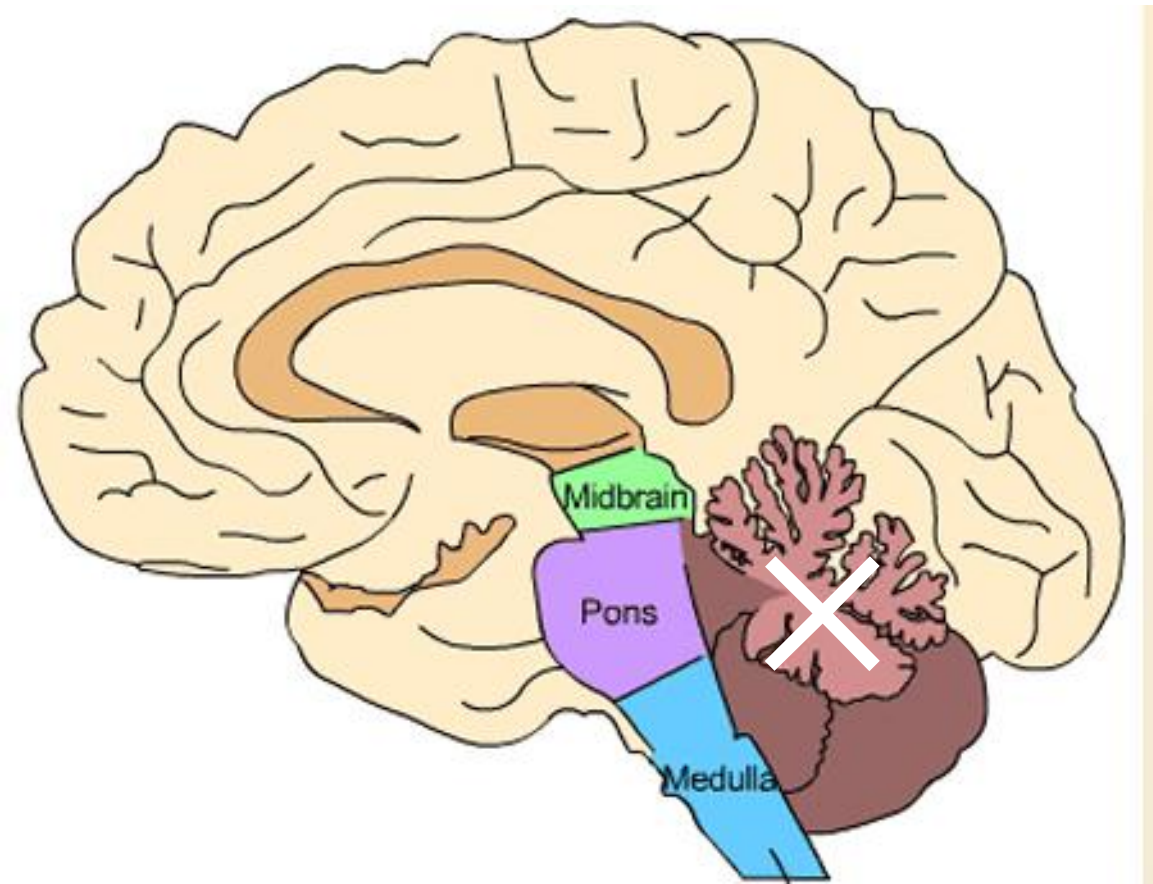
The Brain Stem

Midbrain

Pons

Medulla Oblongata

Extends from the spinal cord
all the way up to the
thalamus



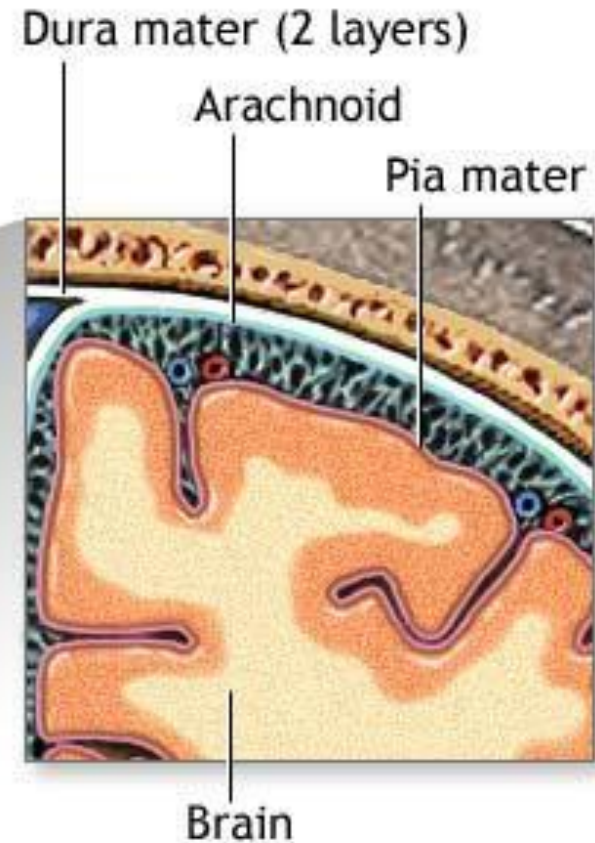
Protecting the brain and spinal cord

1. Skull and vertebrae



2. Meninges

The meninges are the membranes covering the brain and spinal cord



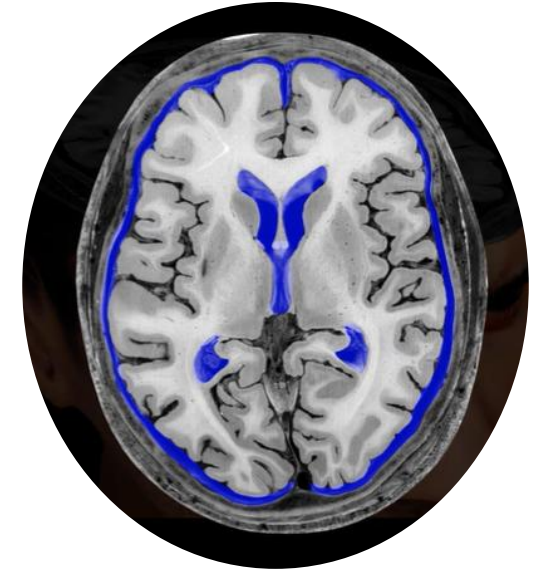
3. Blood Brain Barrier & Blood Spinal Cord Barrier



Protecting the brain (only)

Cerebral spinal fluid (CSF)

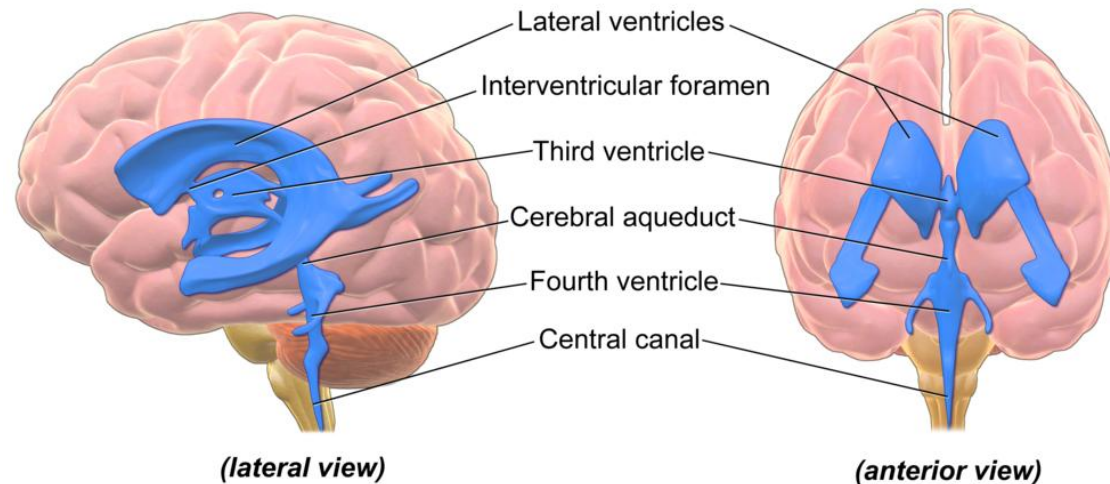
- Clear liquid made by the choroid plexus
- Removes waste & neurotoxins
- Found in the spinal cord, around the brain, and in ventricles



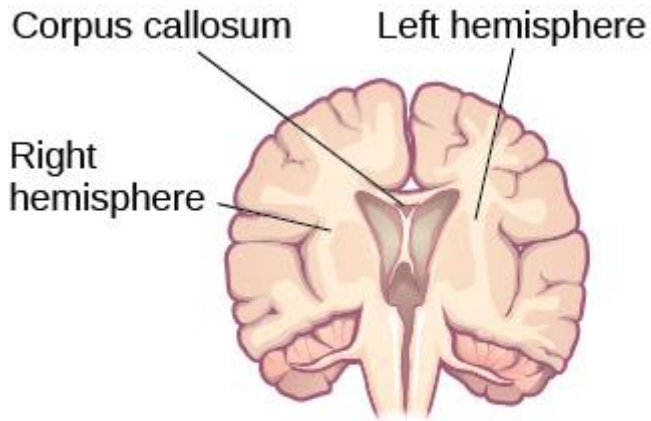
Ventricles

Spaces within the brain

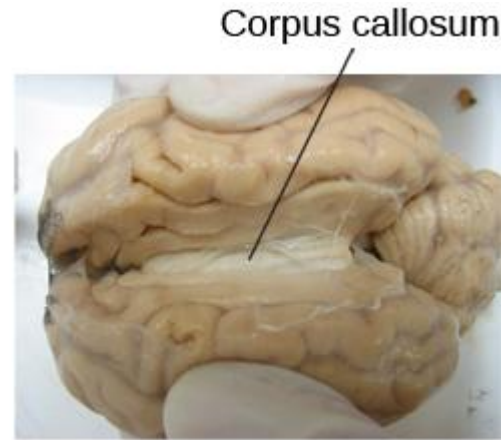
Two lateral ventricles
Third ventricle
Fourth ventricle



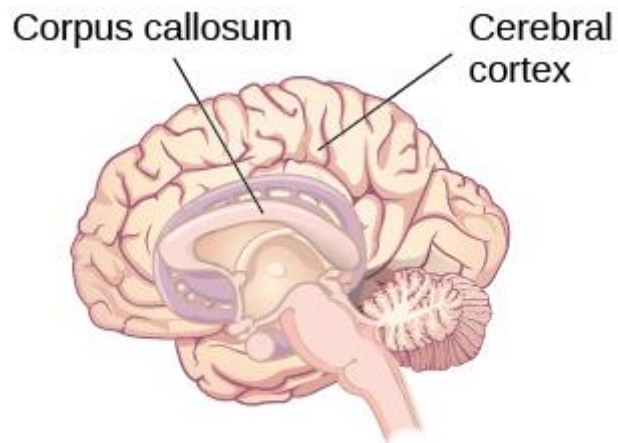
A tale of two hemispheres



(a) Front View



(c) Dissected Brain



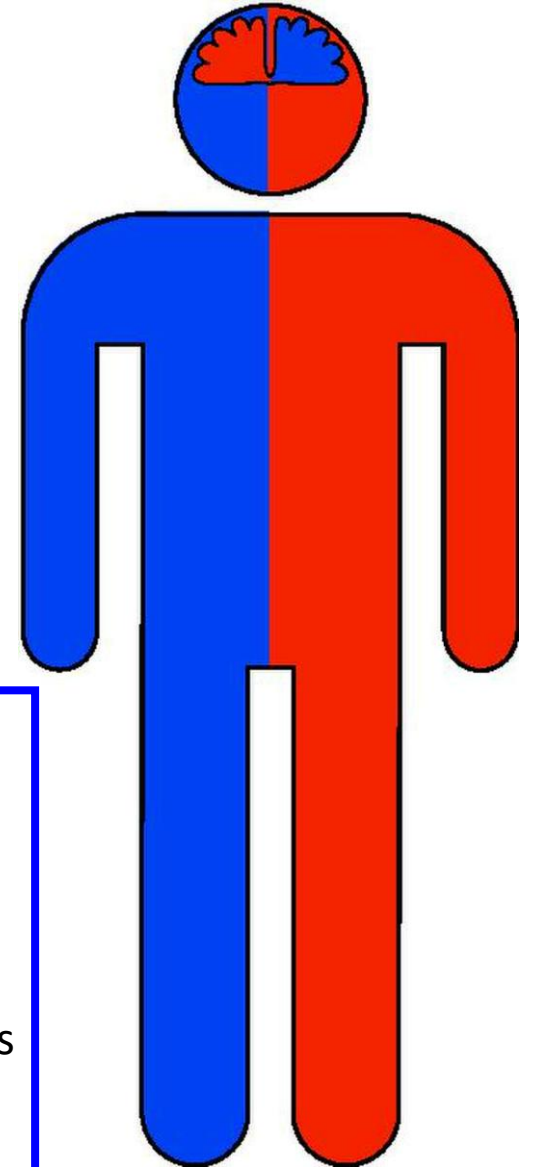
(b) Side View

**Contralateral
vs
Ipsilateral**

Most sensory and motor functions show contralateral representation – except –

Olfaction is ipsilateral

Vision: the right visual field of each eye goes to the left hemisphere, the left visual field of each eye goes to the right hemisphere



Brain Lateralization – a.k.a. hemispheric specialization

Function	Dominant (Left) Hemisphere	Non-dominant (Right) Hemisphere
Vision	letters, words	complex geometric patterns, facial rec.
Audition	language-related sounds	music & other non-language sounds
Memory	verbal memory	nonverbal memory
Language	speech, reading, writing, arithmetic	emotional content of language
Spatial Processing	---	geometry, sense of direction
Emotion	positive emotion	negative emotions
Reasoning	analytical, logical	holistic, intuitive

95-99% of R handed people and 50-60% of L handed people are left hemisphere dominant for written & spoken language, logical and analytical thinking. They are right hemisphere dominant for spatial relationships, creativity, & facial recognition

