Introduction

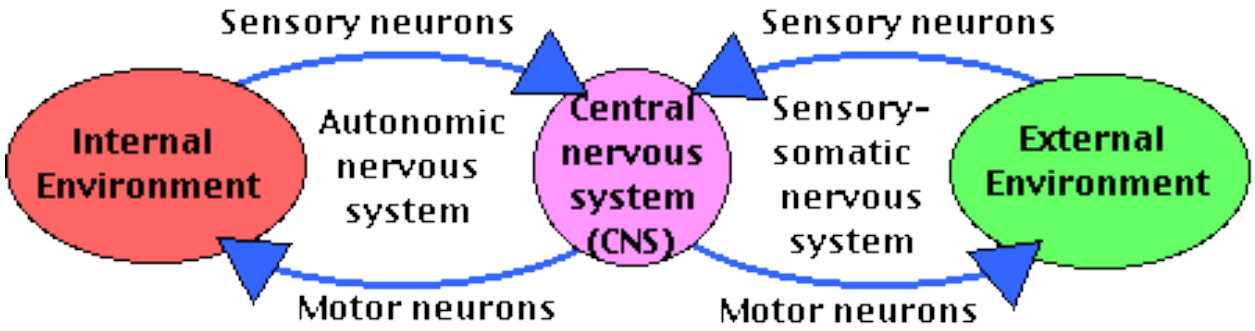
https://www.youtube.com/watch?v=cNZPRsrwumQ

https://www.youtube.com/watch?v=fSByydx1JdU

https://www.youtube.com/watch?v=t2VgzMyhkG8

http://www.brainfacts.org/book

1. Brain structure & function

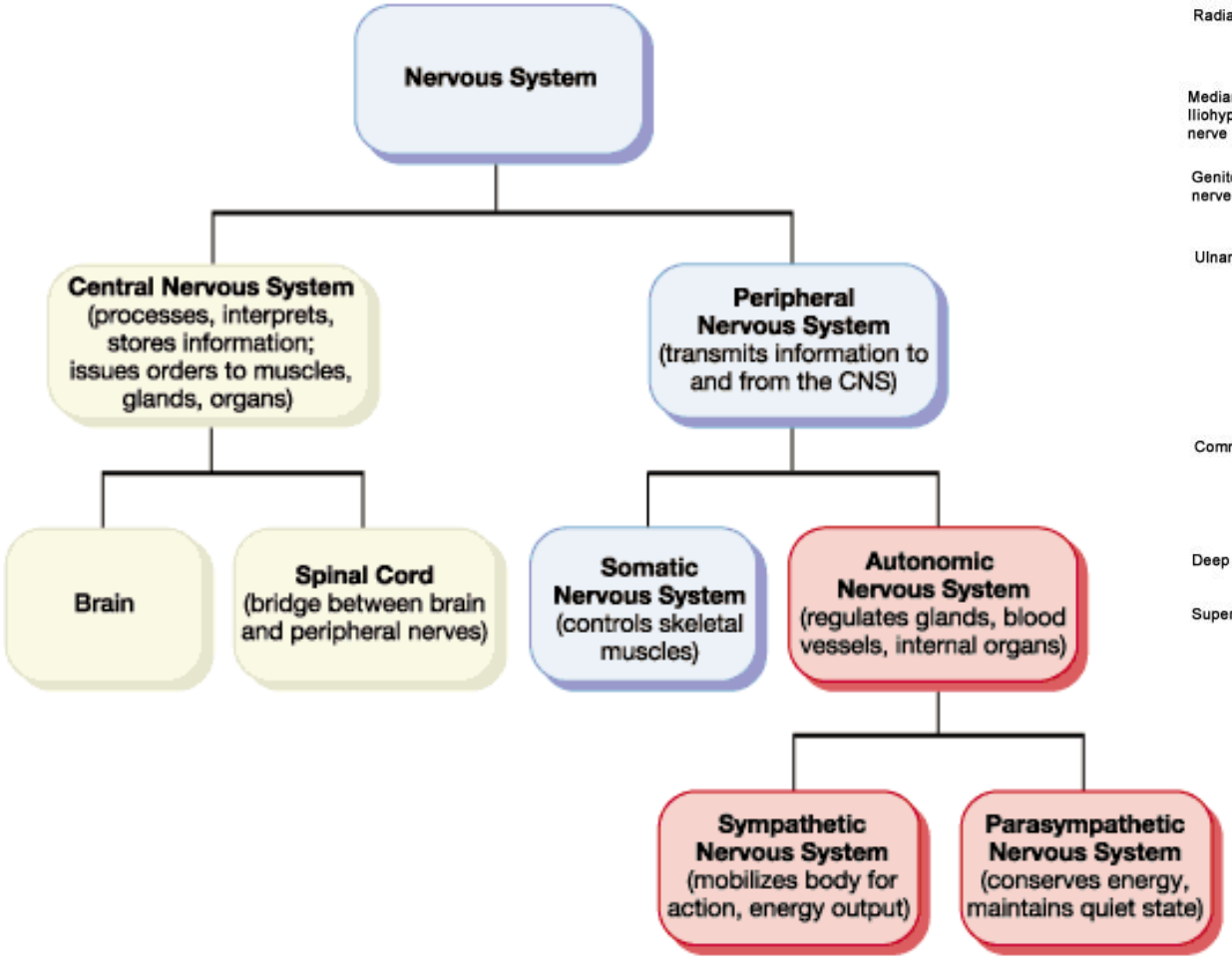


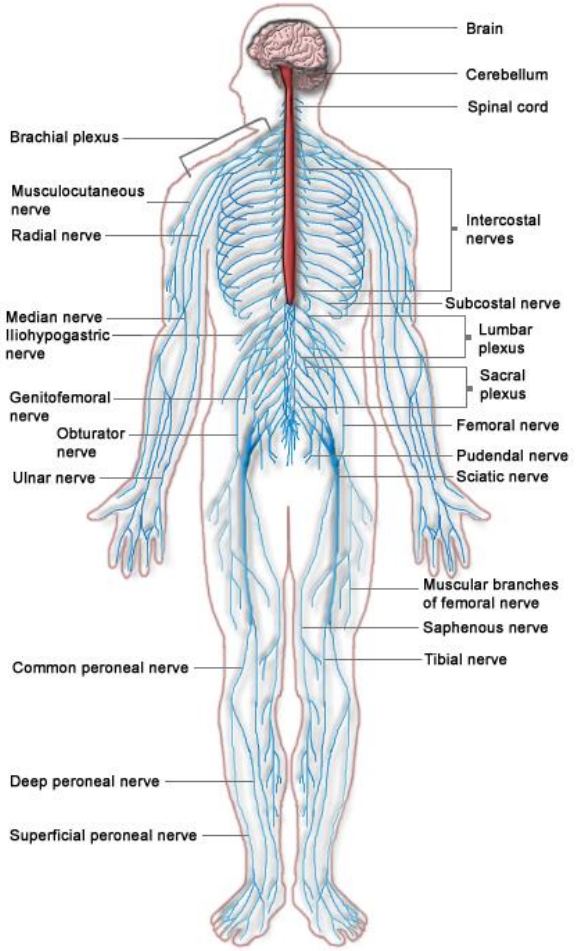
Brain structure videos

14 min: https://www.youtube.com/watch?v=kMKc8nfPATI

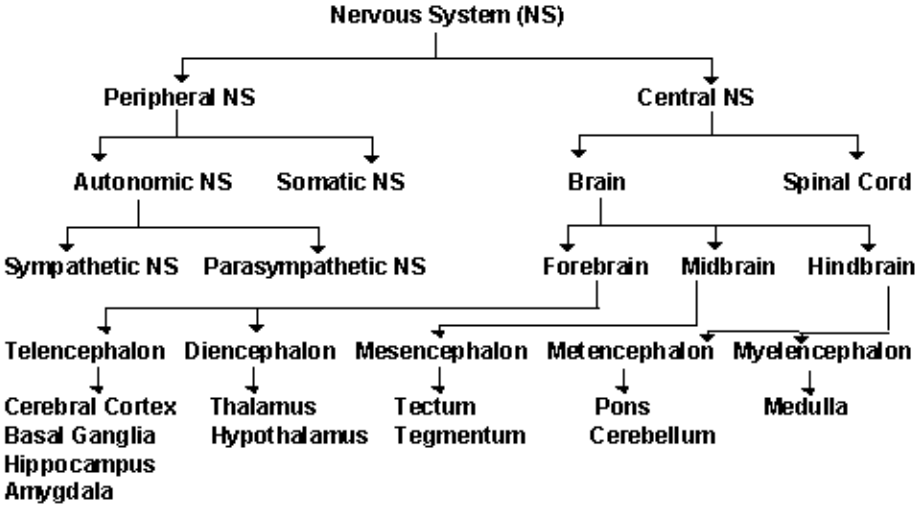
14 min: https://www.youtube.com/watch?v=_aCCsRCw78g

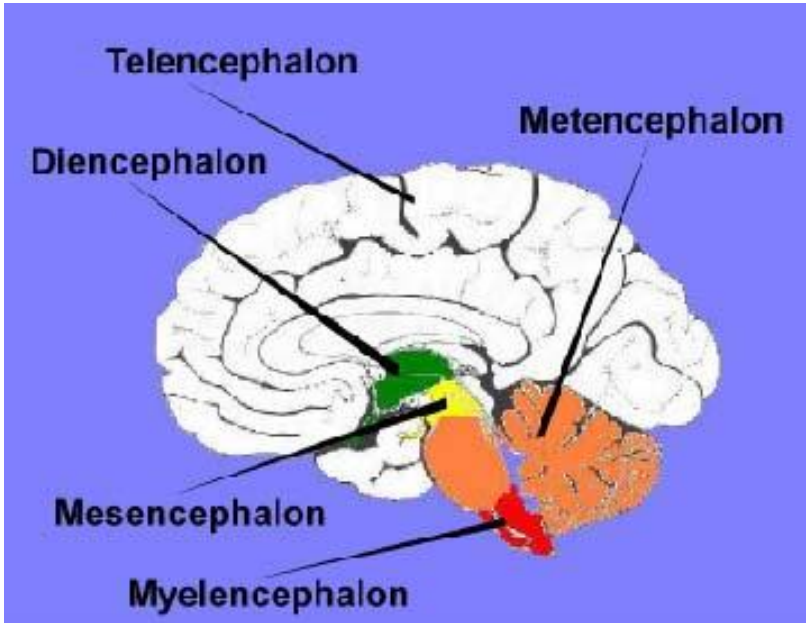
The nervous system

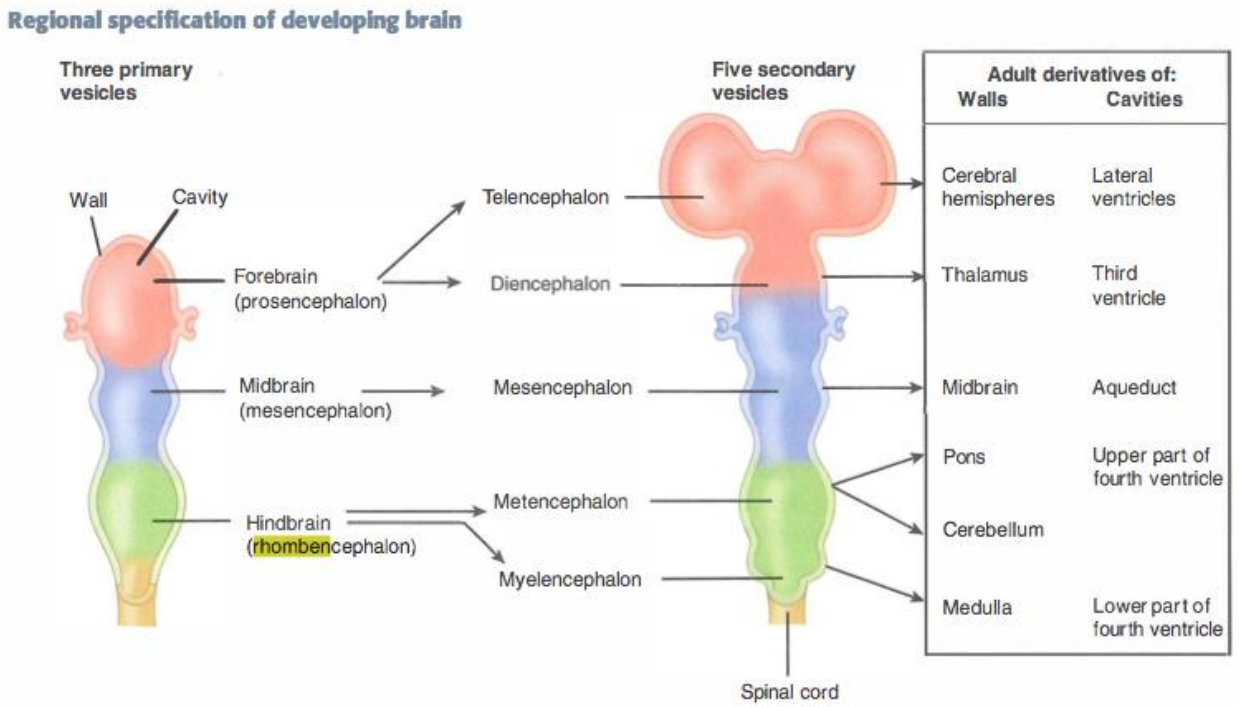




The central nervous system

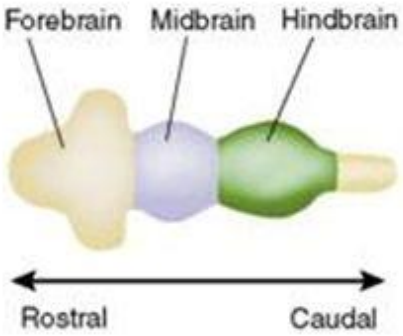




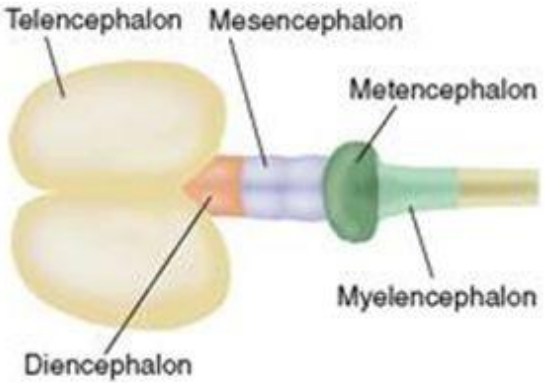


Diencephalon 1/1: https://www.youtube.com/watch?v=dUpmrVCWSwY
Diencephalon 2/2: https://www.youtube.com/watch?v=Ih19iPXqa9o
Basal ganglia 1/3: https://www.youtube.com/watch?v=6cvlFKZiT6s
Basal ganglia 2/3: https://www.youtube.com/watch?v=2I9-p_STeIY
Basal ganglia 3/3: https://www.youtube.com/watch?v=bHwb2U_kRTY

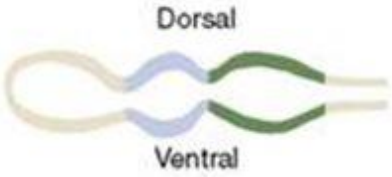
The developing brain



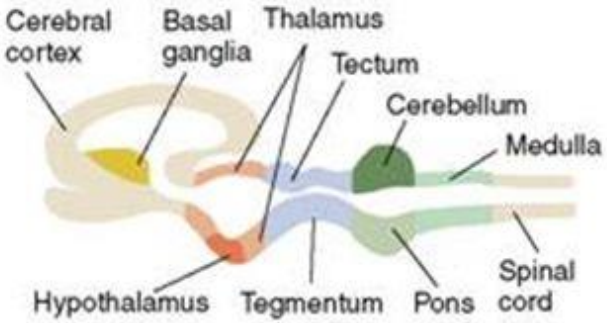
(a)



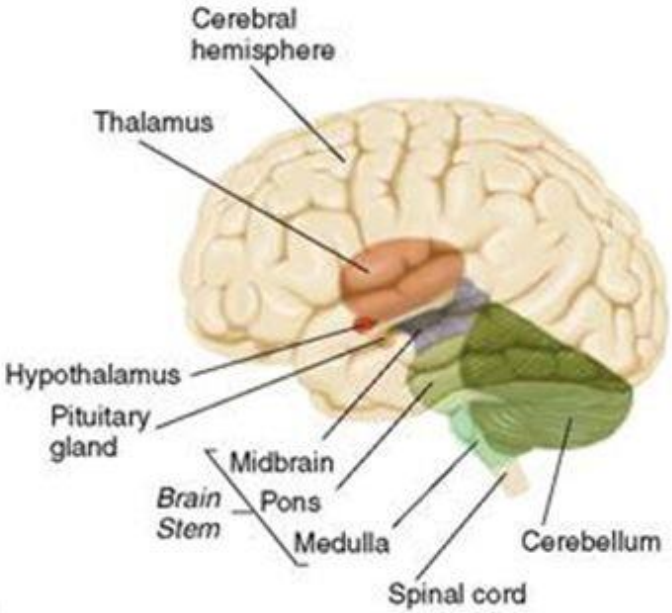
(b)



(c)

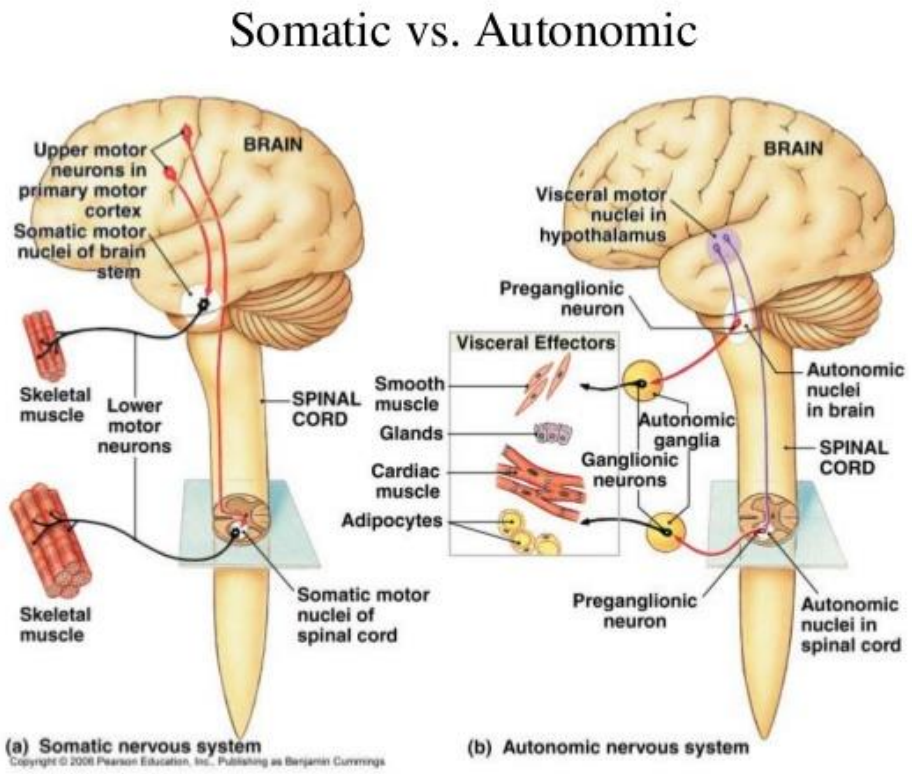


(d)



(e)

The peripheral nervous system



The Somatic Nervous System

Responsible for voluntary body movements and sensing external stimuli

motor neurons and sensory neurons

Consists of 12 pairs of cranial nerves and 31 pairs of spinal nerves

Anatomical Differences in Sympathetic and Parasympathetic Divisions

Come from different regions of the CNS

- **Sympathetic**—from the **thoracolumbar** region (흉요추부)
- **Parasympathetic**—from the **craniosacral** region (두개천골부)

Differing locations of ganglia

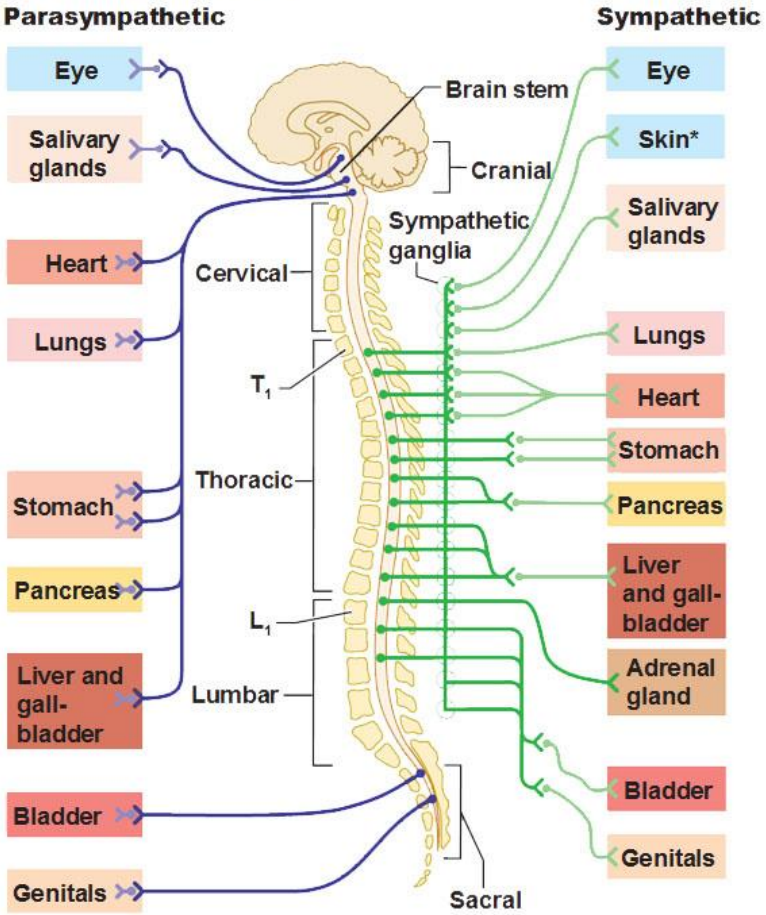
- Sympathetic – close to spinal cord in a chain
- Parasympathetic – close to target organs

Differing lengths of *postganglionic* fibers

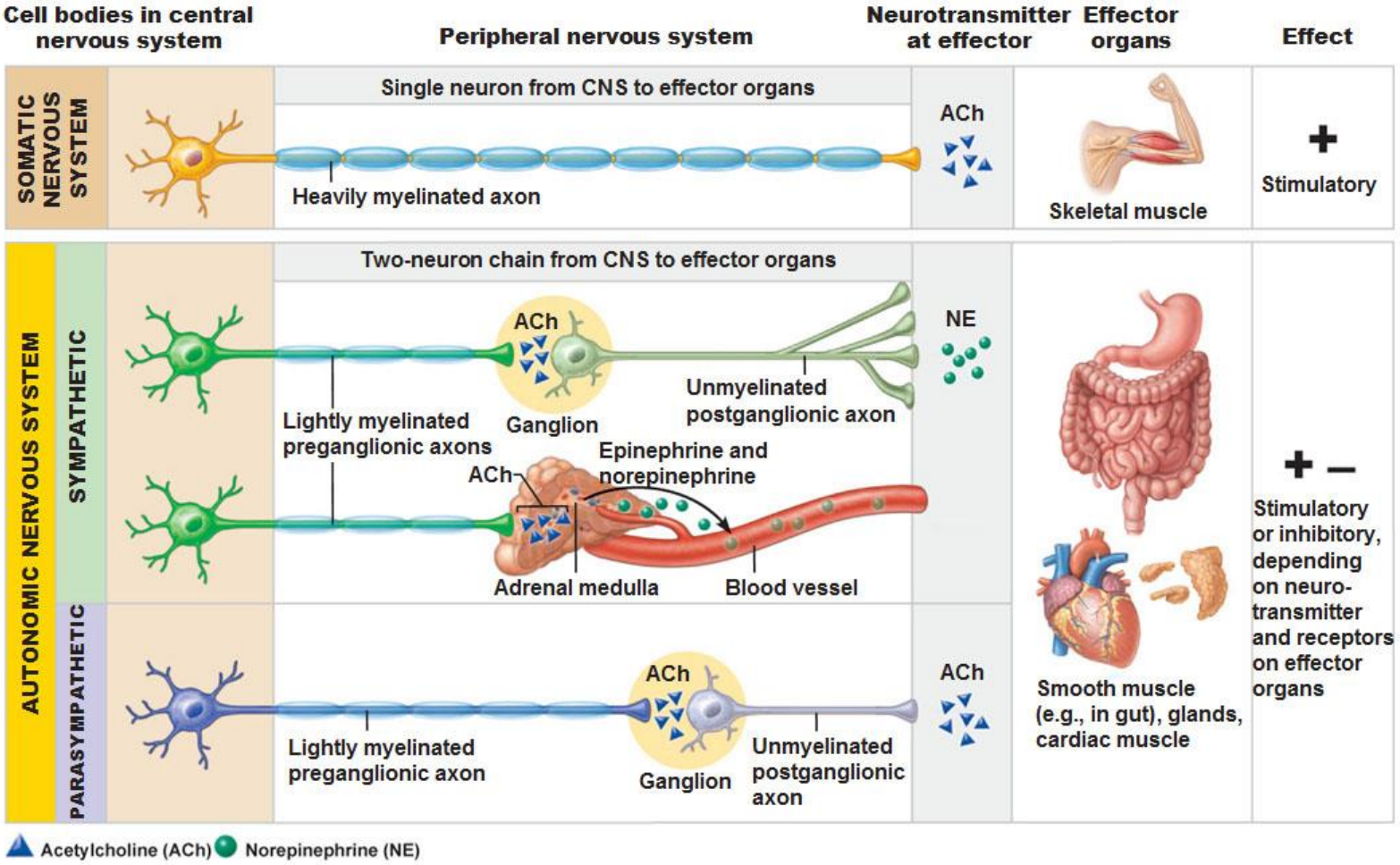
- Sympathetic – Long
- Parasympathetic – Short

Postganglionic branching

- Sympathetic – lots, so that multiple organs can be mobilized at once
- Parasympathetic – very little branching

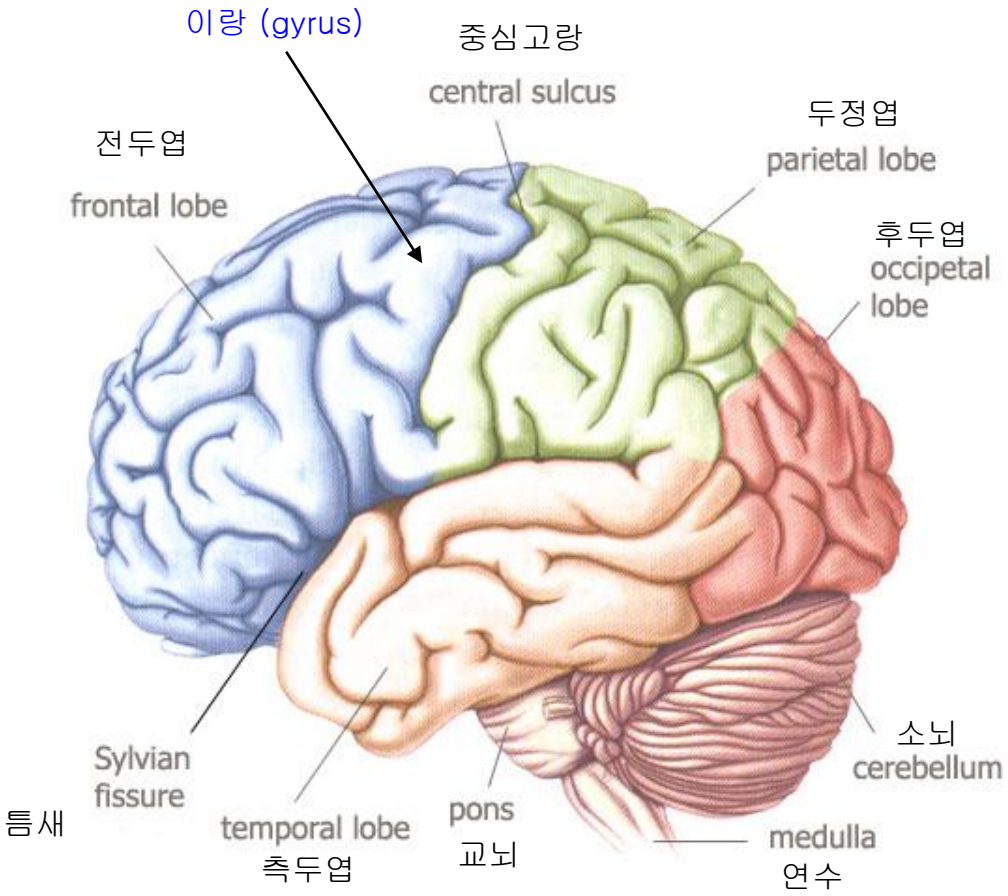


Comparison of Autonomic and Somatic Motor Systems

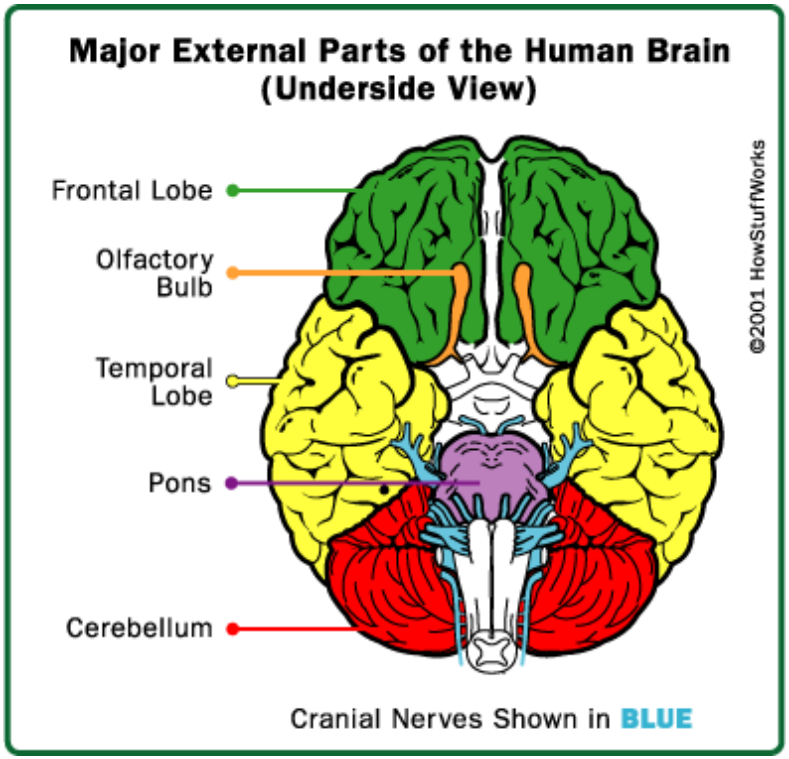


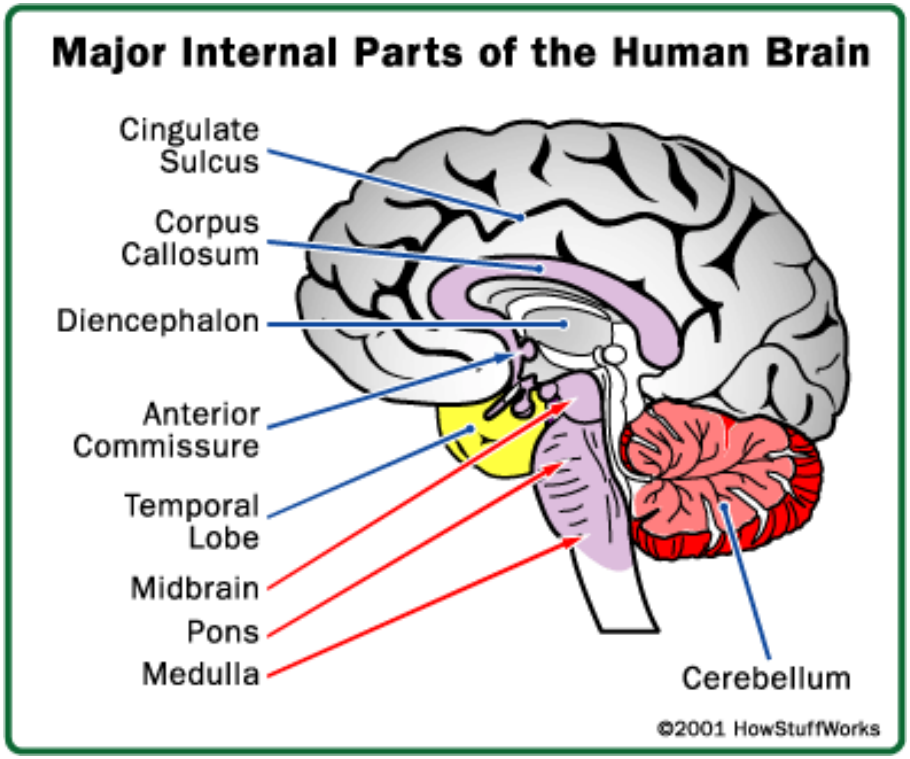
Brain Structure and Function

틈새 (fissure): 깊이 패인 홈
고랑 (sulcus): 얕게 패인 홈

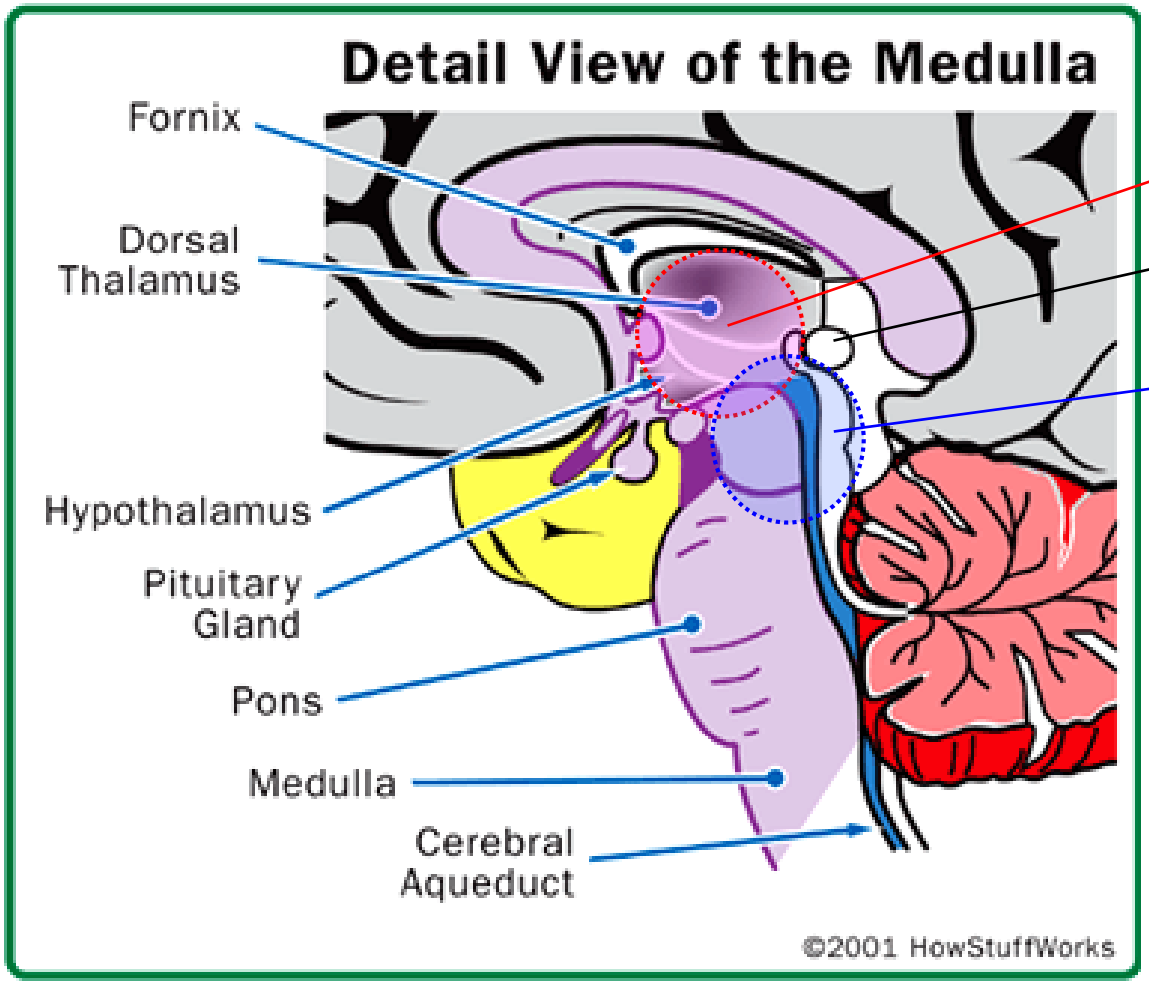


http://www.childtrauma.org/ctamaterials/brain_I.asp





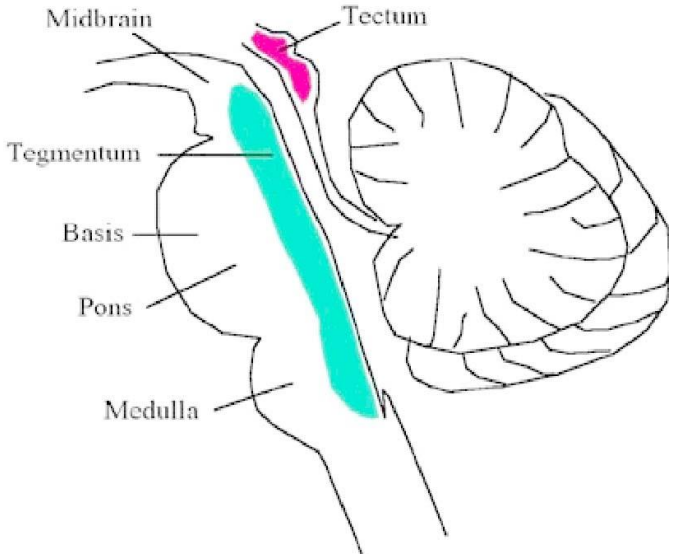
http://health.howstuffworks.com/brain.htm/printable

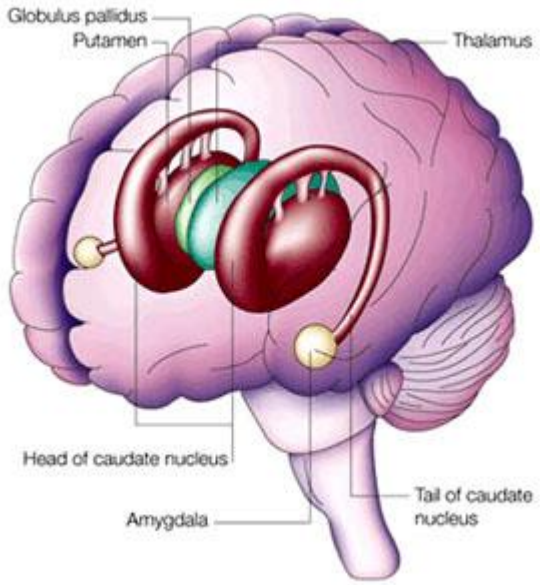


diencephalon

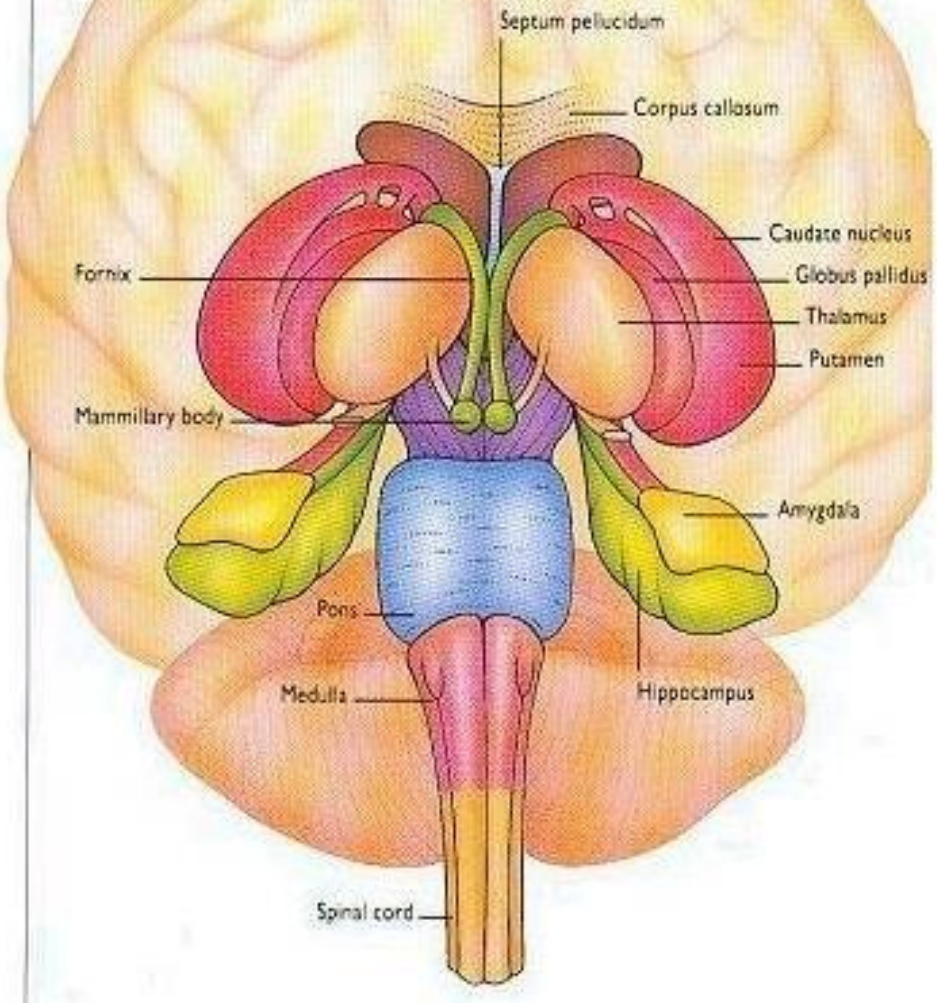
pineal gland

midbrain



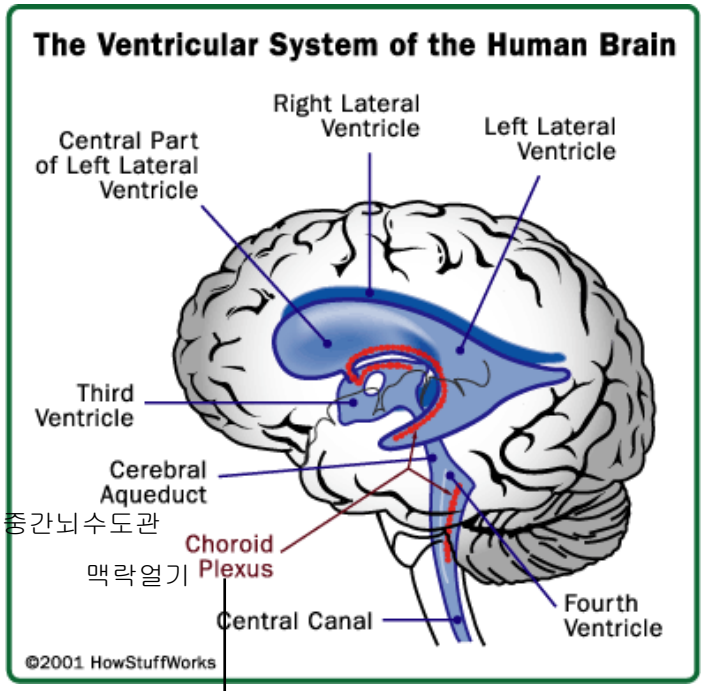


The caudate nucleus along with the putamen and the globus pallidus, which together make up the lentiform nucleus, have a role in the control of movement.

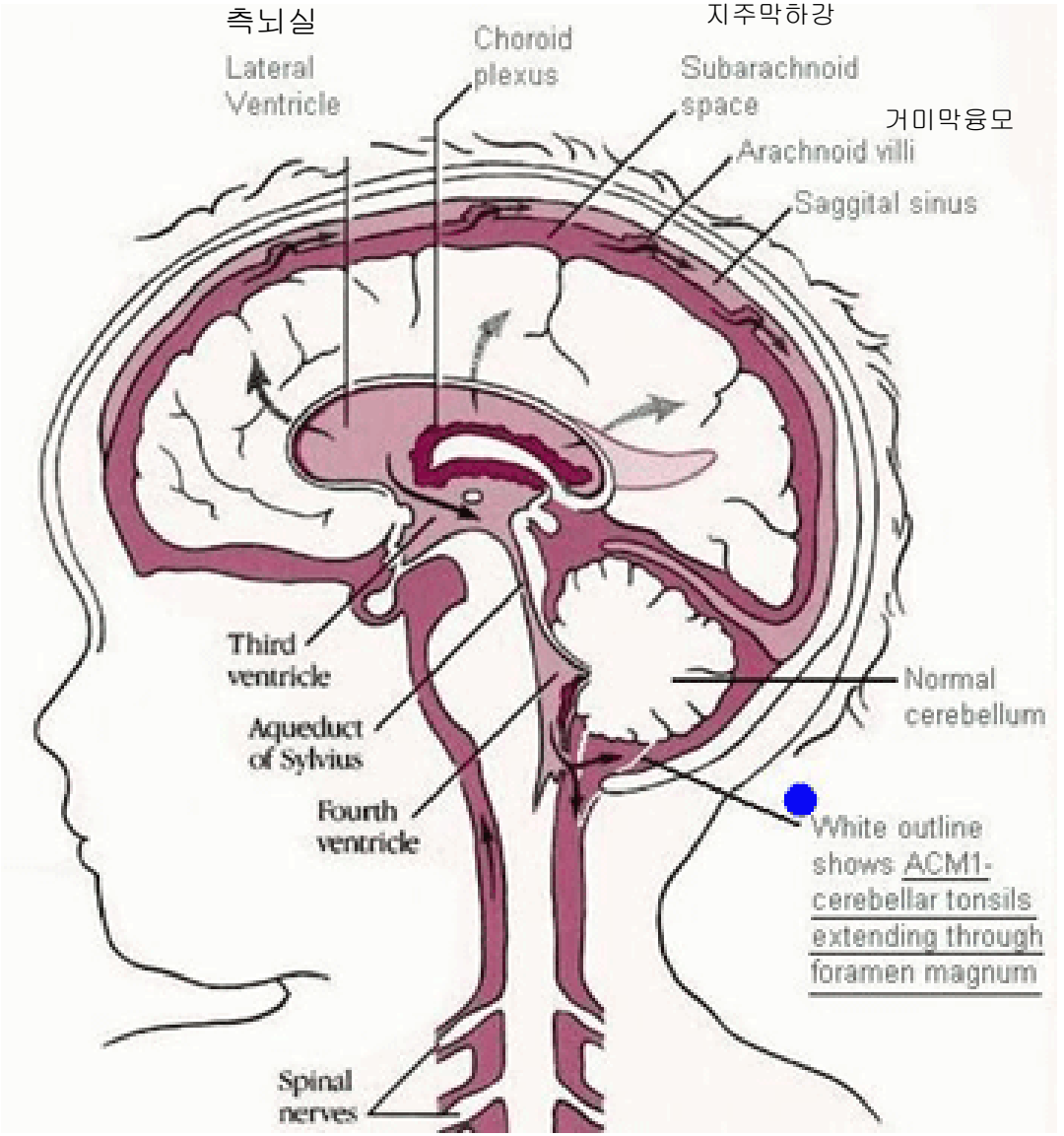


Cerebrospinal fluid

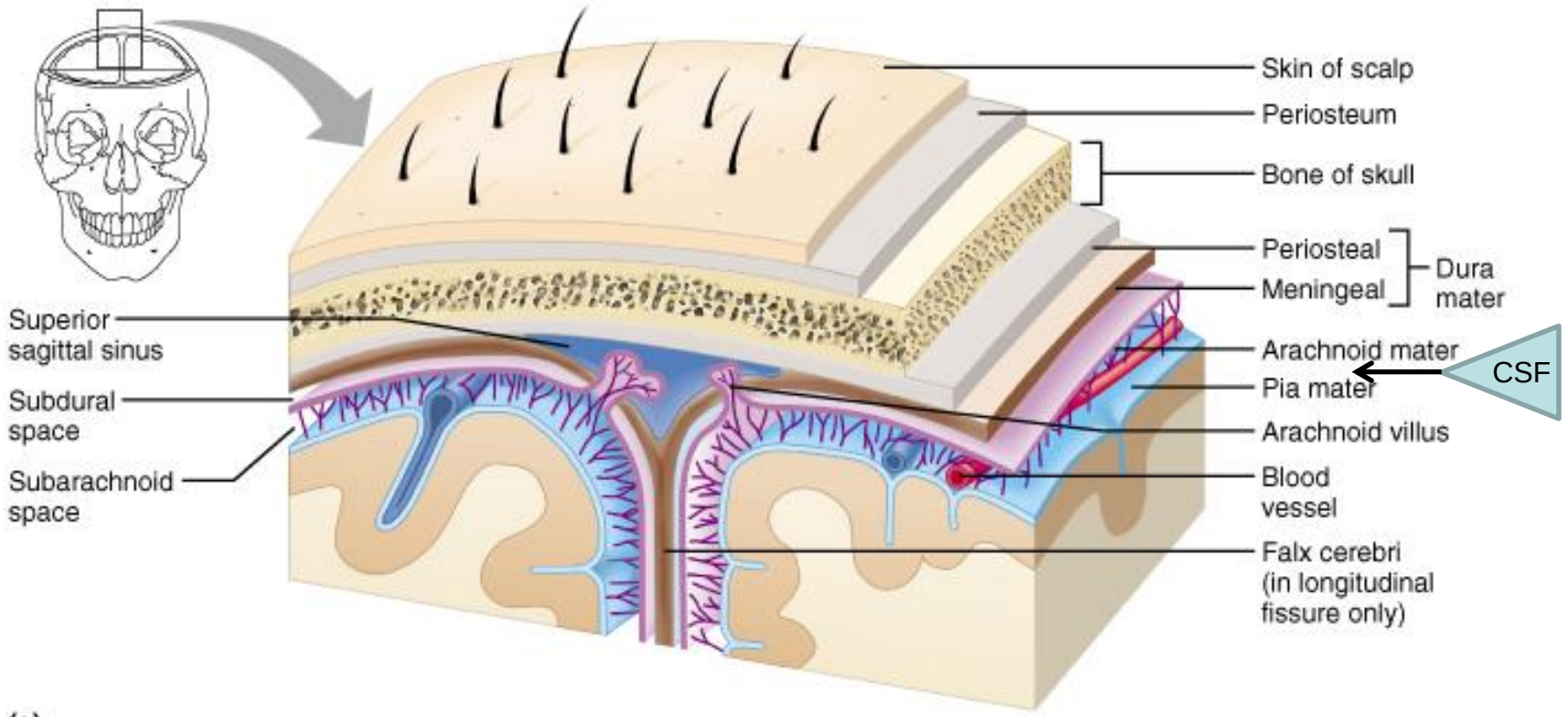
http://en.wikipedia.org/wiki/Cerebrospinal_fluid



Site of CSF production



http://www.nfra.net/chiarmal_15_cmi.htm



(a)

Brain for the soul, thoughts, and feelings

The Greeks: brain for the soul
consciousness, mind, individuality, personality
Alcmeon of Croton: The center of thinking
(Egyptian anatomists)
Galen: CSF as the substance of soul

Uniform barin (homogenous function): no specialized parts

Marcello Malpighi: inverted tree

Jean-Pierre-Marie Flourens: step by removal of brain parts

*The concept of mass action: take over of damaged parts

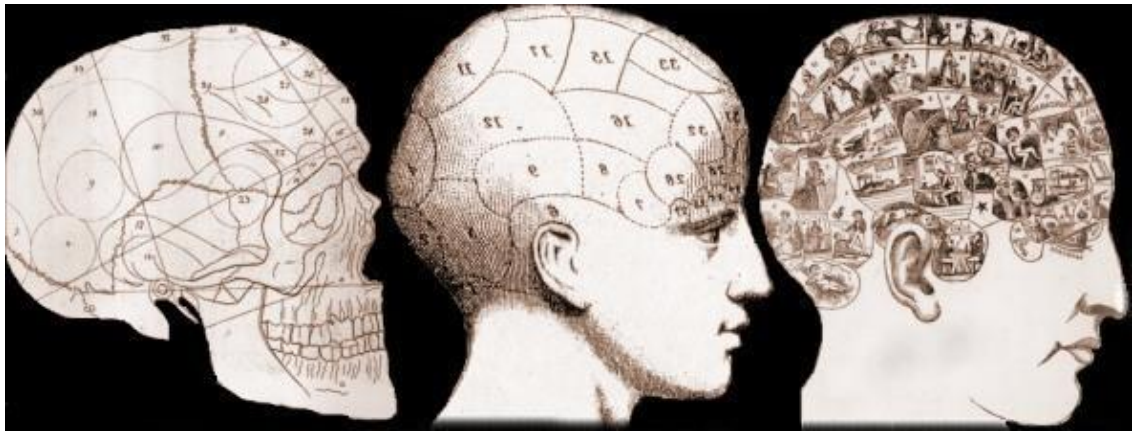
Compartmented brain:

Franz Gall: study of the dead skull and the characters

27 different character traits

a map of the surface of the head

Phrenology (the study of the mind): somewhat scientific?



the history of phrenology on the web
http://pages.britishlibrary.net/phrenology/

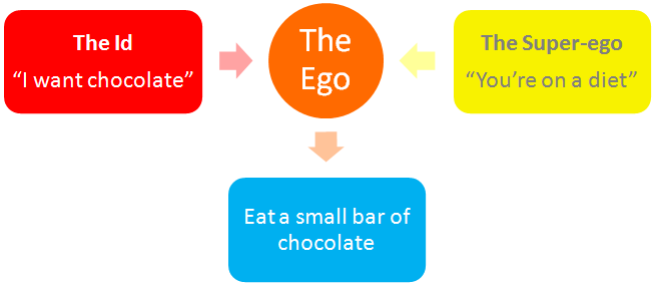
Alternative scenario (organized)

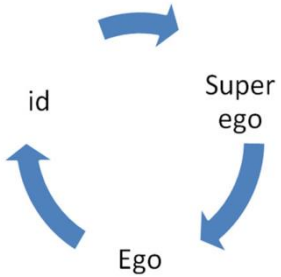
John Hughlings-Jackson

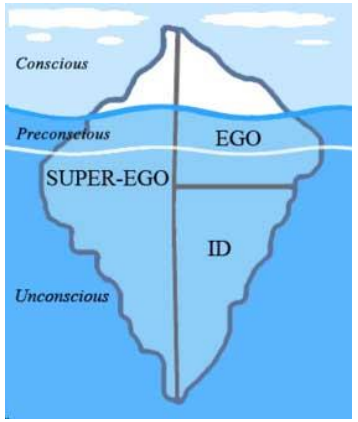
Brain as organized into a hierarchy
(Sigmund Freud: id, ego, superego)
Understandable in psychiatric or moral terms
But no physical counterpart to direct all operations

Paul Maclean: triune brain concept

primitive reptilian: brain stem for instinctive behavior
old mammalian: limbic system for emotional behavior
new mammalian: cortex for rational thought
coordination between them

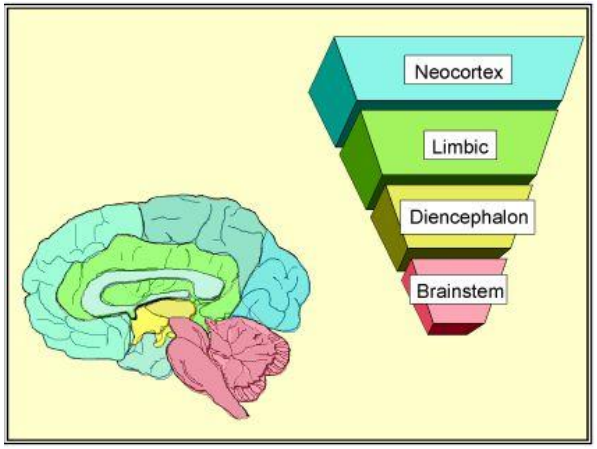






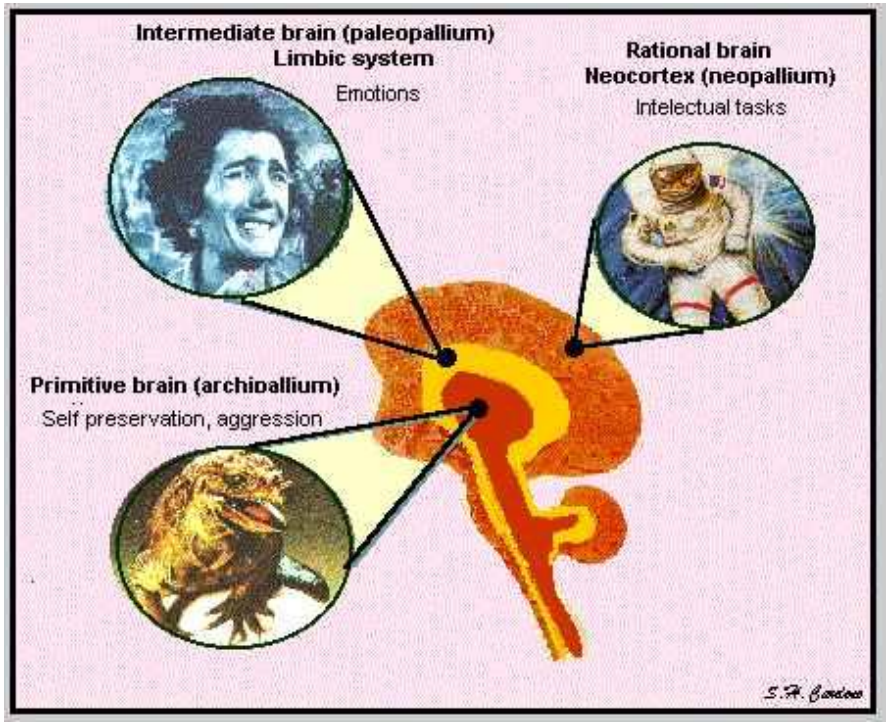
http://www.kheper.net/topics/intelligence/MacLean.htm
http://psychweb.syr.edu/psy393/lectures/l3ppt/sld001.htm
http://www.arachnoid.com/lutusp/science/sld001.html

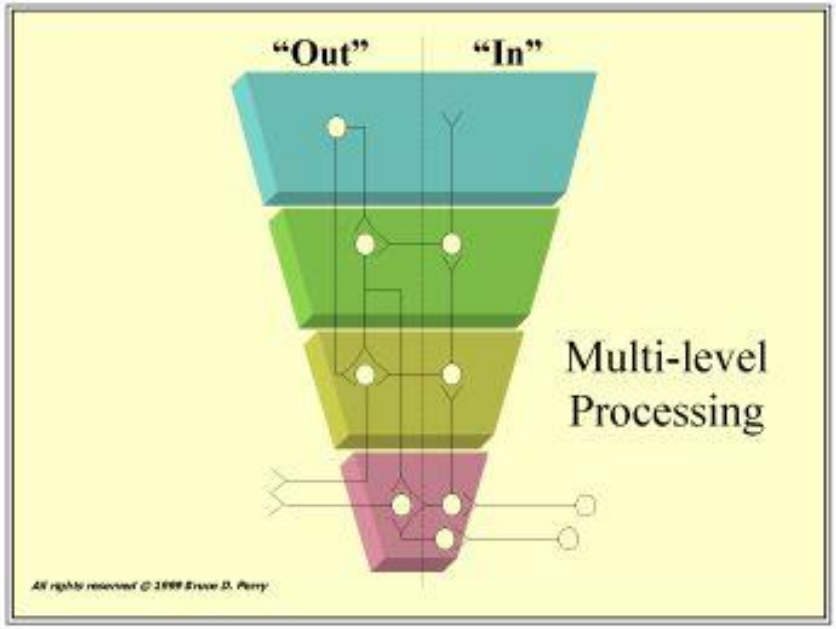
3-Brains-in-One



The Human Brain: The brain can be divided into four interconnected areas: brainstem, diencephalons, limbic and neocortex. The complexity of structure, cellular organization and function increases from the lower, most simple area, the brainstem to the most complex, the neocortex.

	Where?	*Name*	*Typical Animals*
Brain One	Center of the Brain	"R complex"	snakes, lizards
Brain Two	Wrapped around Brain One	"limbic system" or "old mammalian brain"	dogs, cats
Brain Three	Outside Surface (Wrapped around Brain Two!)	"neocortex"	primates, especially human primates





Sequential Processing All incoming sensory information first enters the CNS at the level of the spinal cord or brainstem. This means that the first place where patterns of activation are matched against previously stored templates is in these primitive areas. Indeed, the spinal cord and brainstem may process and act on incoming information before the integrated and interpreted signals even get up to the cortex (e.g., reflex withdrawal of a finger from fire).

Functional Division	Constituent Parts	Developmental Division	Primary Division	
Neocortex (신피질)	**Cerebral cortex (대뇌피질)** Frontal Lobes (전두엽) Temporal Lobes (측두엽) Parietal Lobes (두정엽) Occipital Lobes (후두엽) Corpus Callosum (뇌량)	Telencephalon (종뇌)	Cerebral Hemispheres	Forebrain
Limbic system(변연계) Cingulate Cortex Amygdala Hippocampus Septum	Amygdala (편도체)			
	Hippocampus (해마)			
	Basal ganglia (기저핵) Caudate Nucleus (미상핵) Putamen Globus Pallidus			
Diencephalon (간뇌)	Thalamus (시상)	Diencephalon (간뇌)	Diencephalon	
	Hypothalamus (시상하부)			
Brainstem (뇌간)	**Midbrain** Superior Colliculus Inferior Colliculus	Mesencephalon (중뇌)	Brainstem	Midbrain
	Cerebellum (소뇌)	Metencephalon (후뇌)		Hindbrain
	Pons (교뇌)			
	Medulla Oblongata (연수)	Myelencephalon (수뇌)		
Spinal Cord (척수)	Spinal Cord		Spinal Cord	

Structure and function

THE CEREBRUM:

Frontal Lobe

- •Behavior
- •Abstract thought processes
- •Problem solving
- •Attention
- •Creative thought
- •Some emotion
- •Intellect
- •Reflection
- •Judgment
- •Initiative
- •Inhibition
- •Coordination of movements
- •Generalized and mass movements
- •Some eye movements
- •Sense of smell
- •Muscle movements
- •Skilled movements
- •Some motor skills
- •Physical reaction
- •Libido (sexual urges)

Occipital Lobe

- •Vision
- •Reading

Parietal Lobe

- •Sense of touch (tactile sensation)
- •Appreciation of form through touch (stereognosis)
- •Response to internal stimuli (proprioception)
- •Sensory combination and comprehension
- •Some language and reading functions
- •Some visual functions

Temporal Lobe

- •Auditory memories
- •Some hearing
- •Visual memories
- •Some vision pathways
- •Other memory
- •Music
- •Fear
- •Some language
- •Some speech
- •Some behavior and emotions
- •Sense of identity

Right Hemisphere (the representational hemisphere)

- •The right hemisphere controls the left side of the body
- •Temporal and spatial relationships
- •Analyzing nonverbal information
- •Communicating emotion

Left Hemisphere (the categorical hemisphere)

- •The left hemisphere controls the right side of the body
- •Produce and understand language

Corpus Callosum

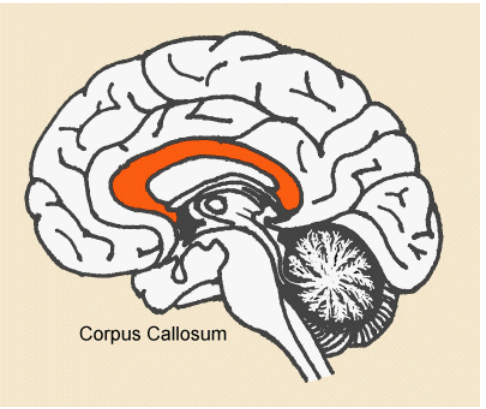
- •Communication between the left and right side of the brain

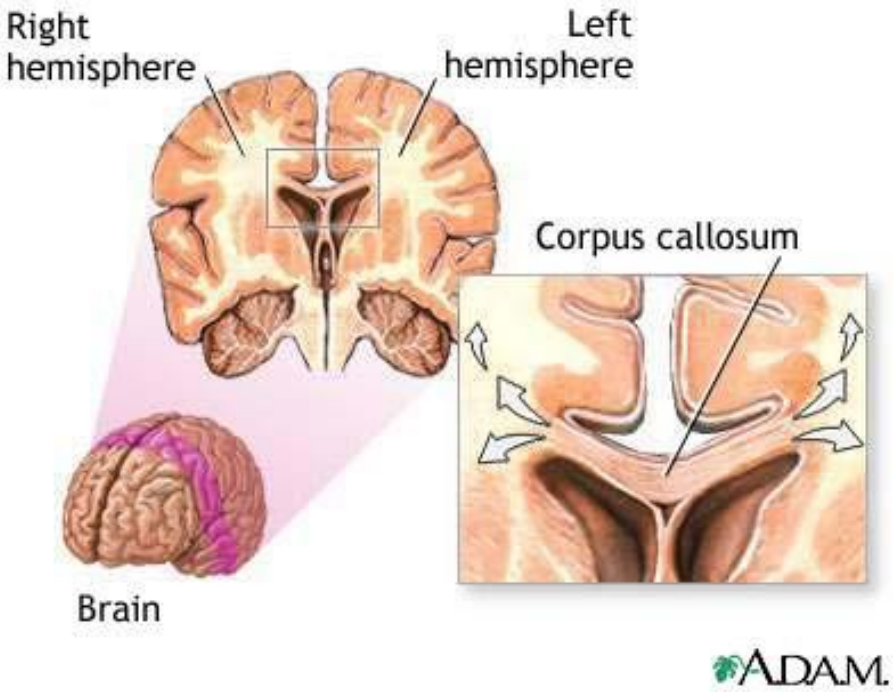
THE CEREBELLUM

- •Balance
- •Posture
- •Cardiac, respiratory, and vasomotor centers

THE BRAIN STEM

- •Motor and sensory pathway to body and face
- •Vital centers: cardiac, respiratory, vasomotor

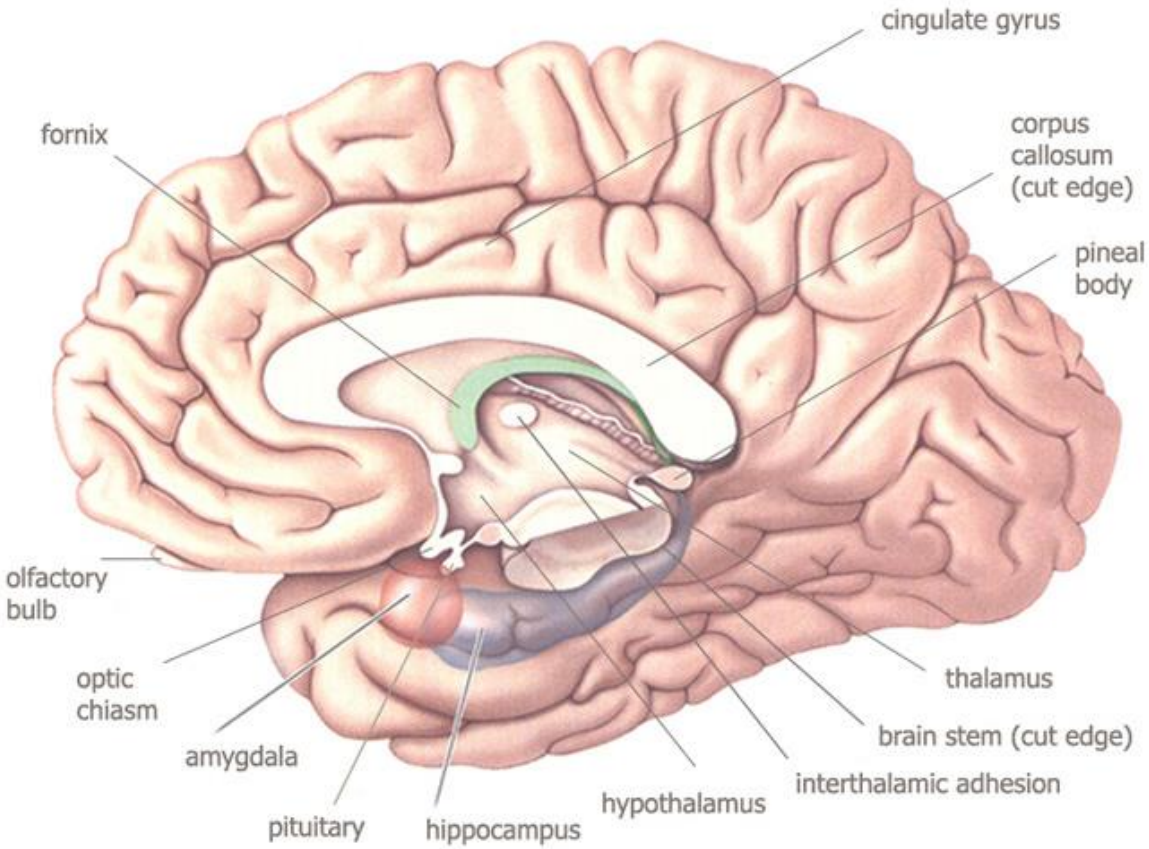




Hypothalamus
- •Moods and motivation
- •Sexual maturation
- •Temperature regulation
- •Hormonal body processes

Optic Chiasm
- •Vision and the optic nerve

Pituitary Gland
- •Hormonal body processes
- •Physical maturation
- •Growth (height and form)
- •Sexual maturation
- •Sexual functioning



Spinal Cord
- •Conduit and source of sensation and movement

Pineal Body
- •Unknown

Ventricles and Cerebral Aqueduct
- •Contains the cerebrospinal fluid that bathes the brain and spinal cord

Comparative anatomy of brain

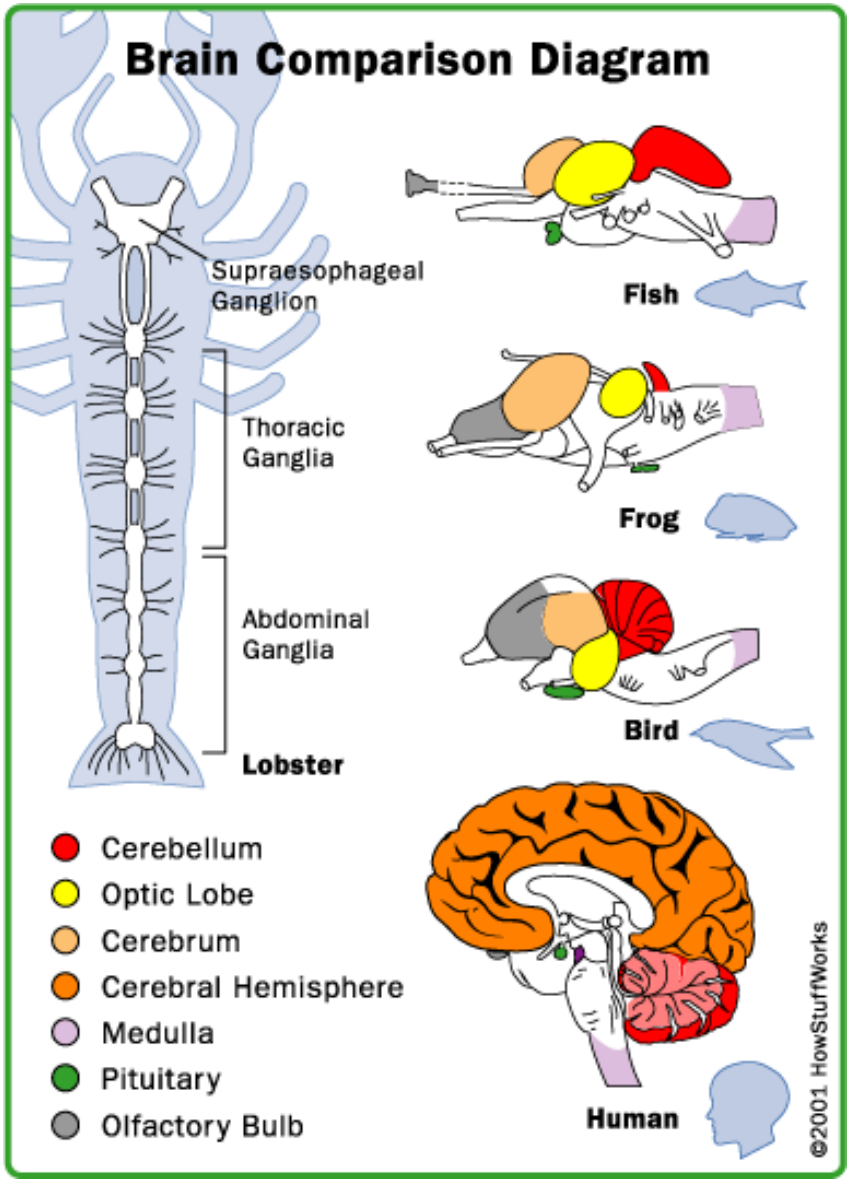
Brain size

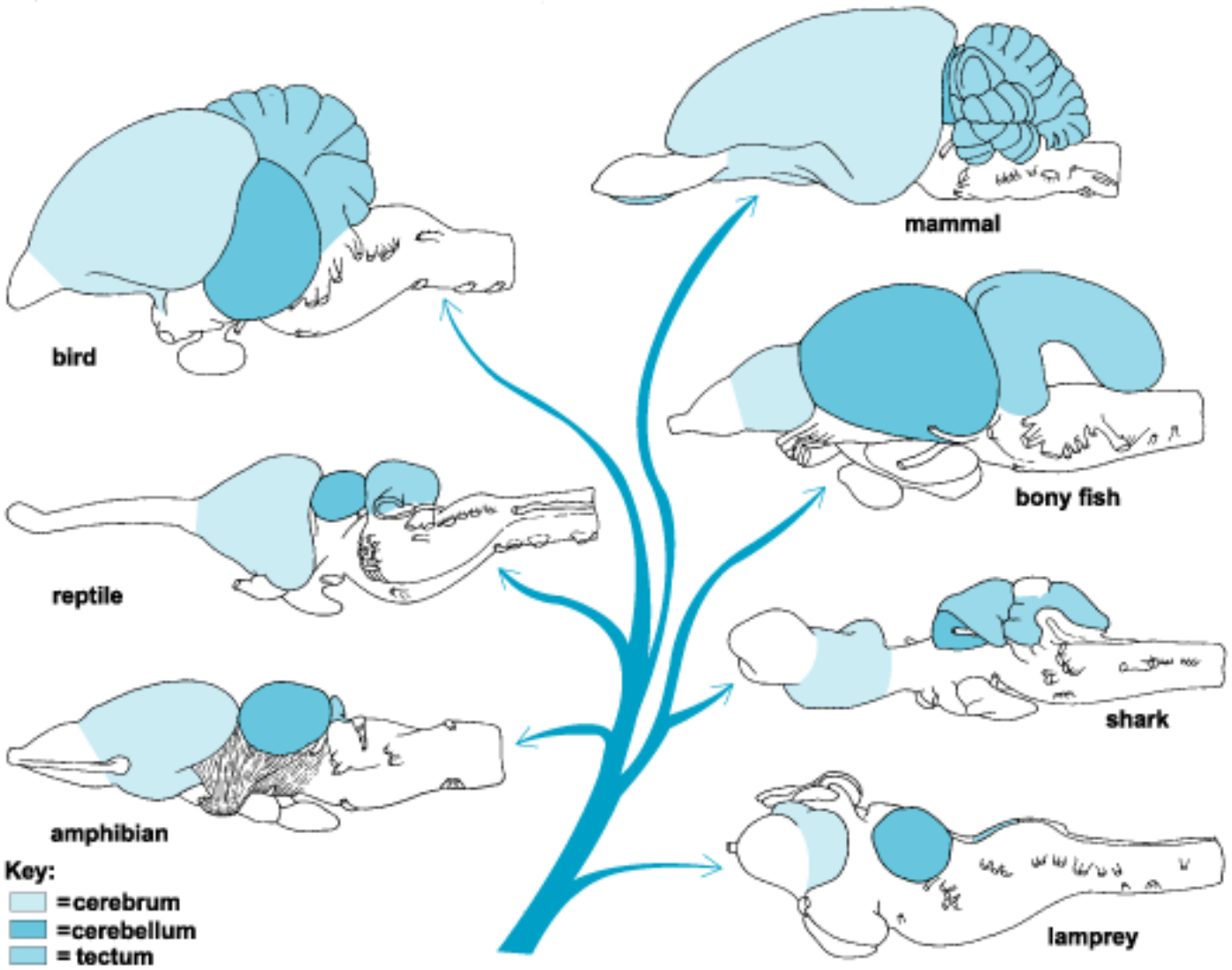
Brain size/body weight

Different brain regions

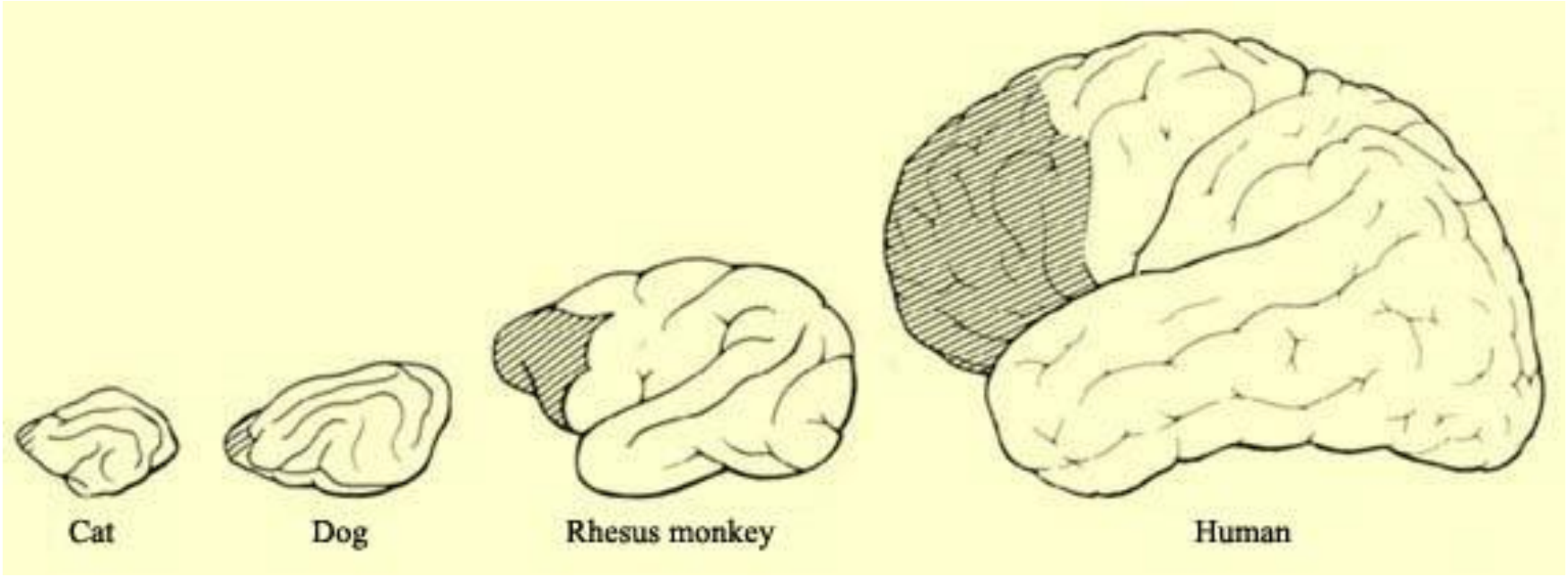
cerebellum: more prominent in reptile & fish

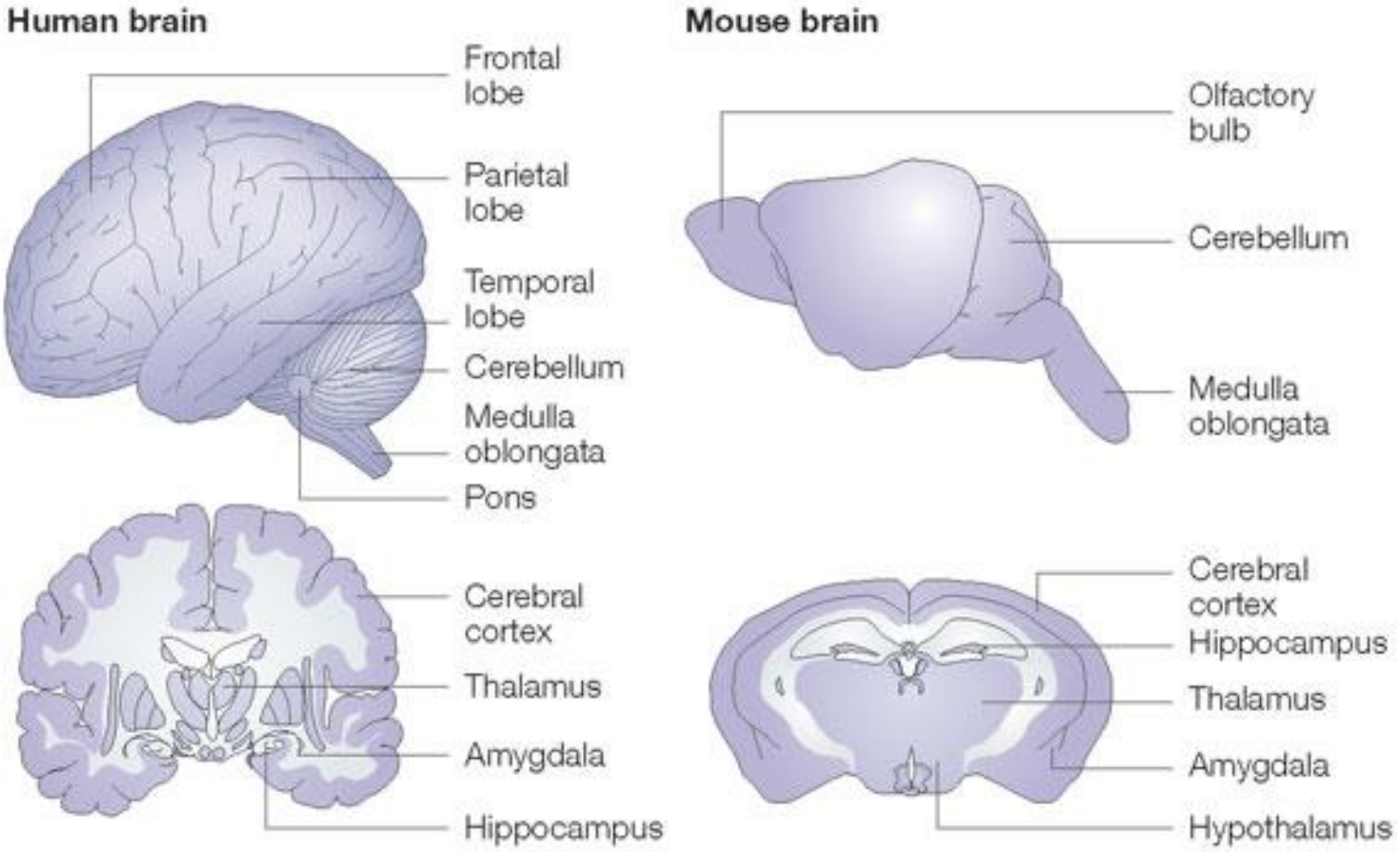
cortex: surface area




mammal
bird
bony fish
reptile
shark
amphibian
lamprey
Key:
=cerebrum
=cerebellum
= tectum

Prefrontal cortex





Nature Reviews | Drug Discovery

What is the function of the frontal brain area?

Leucotomy: Egas Moniz

- cutting frontal lobe to treat emotional illnesses
- 1936-1978: 35000 people in the States
- severe side effects:
  - impaired social behavior
  - poor problem solving, coordination, working memory

Complicated function

Functional mapping of cerebral cortex

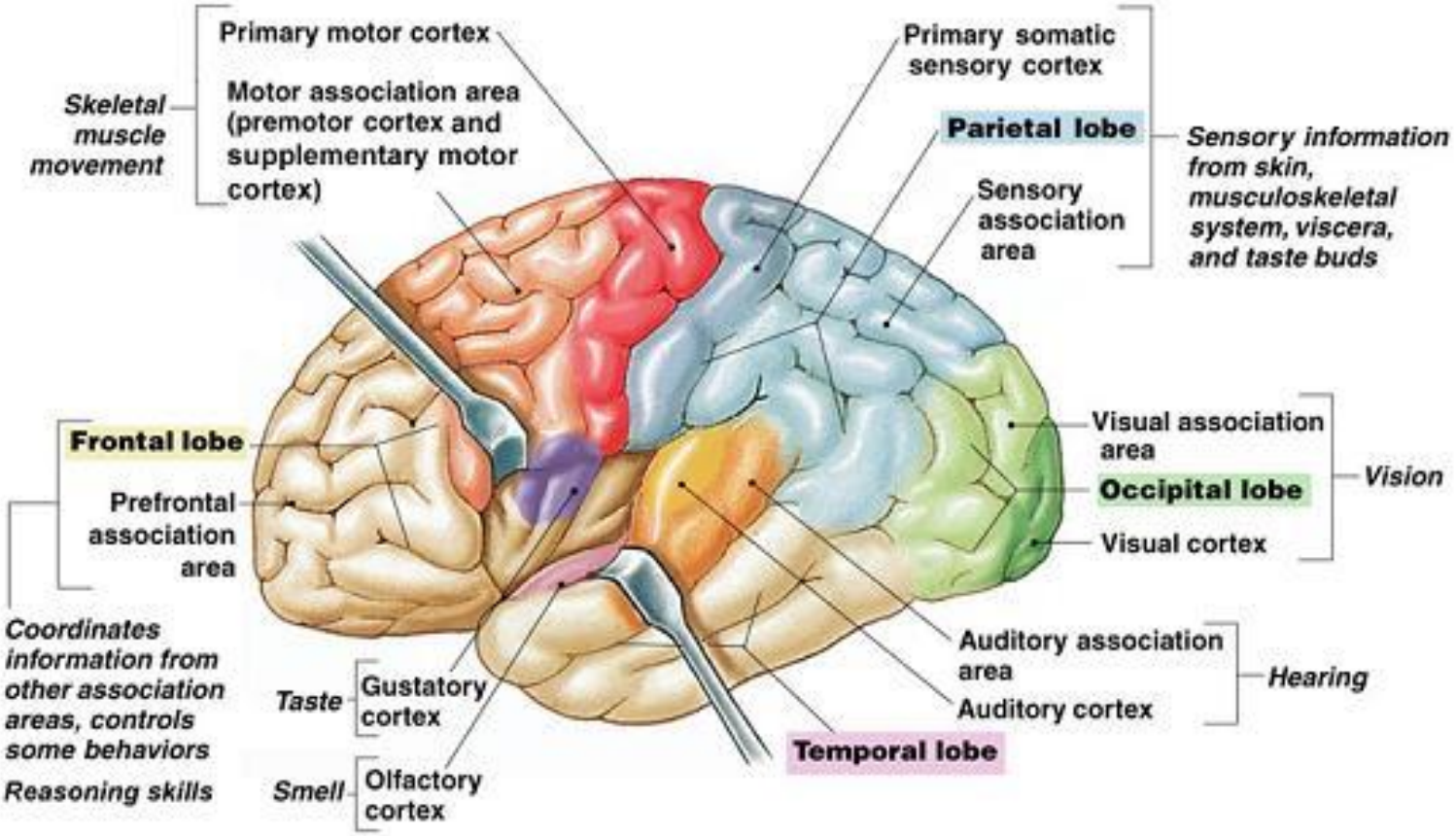
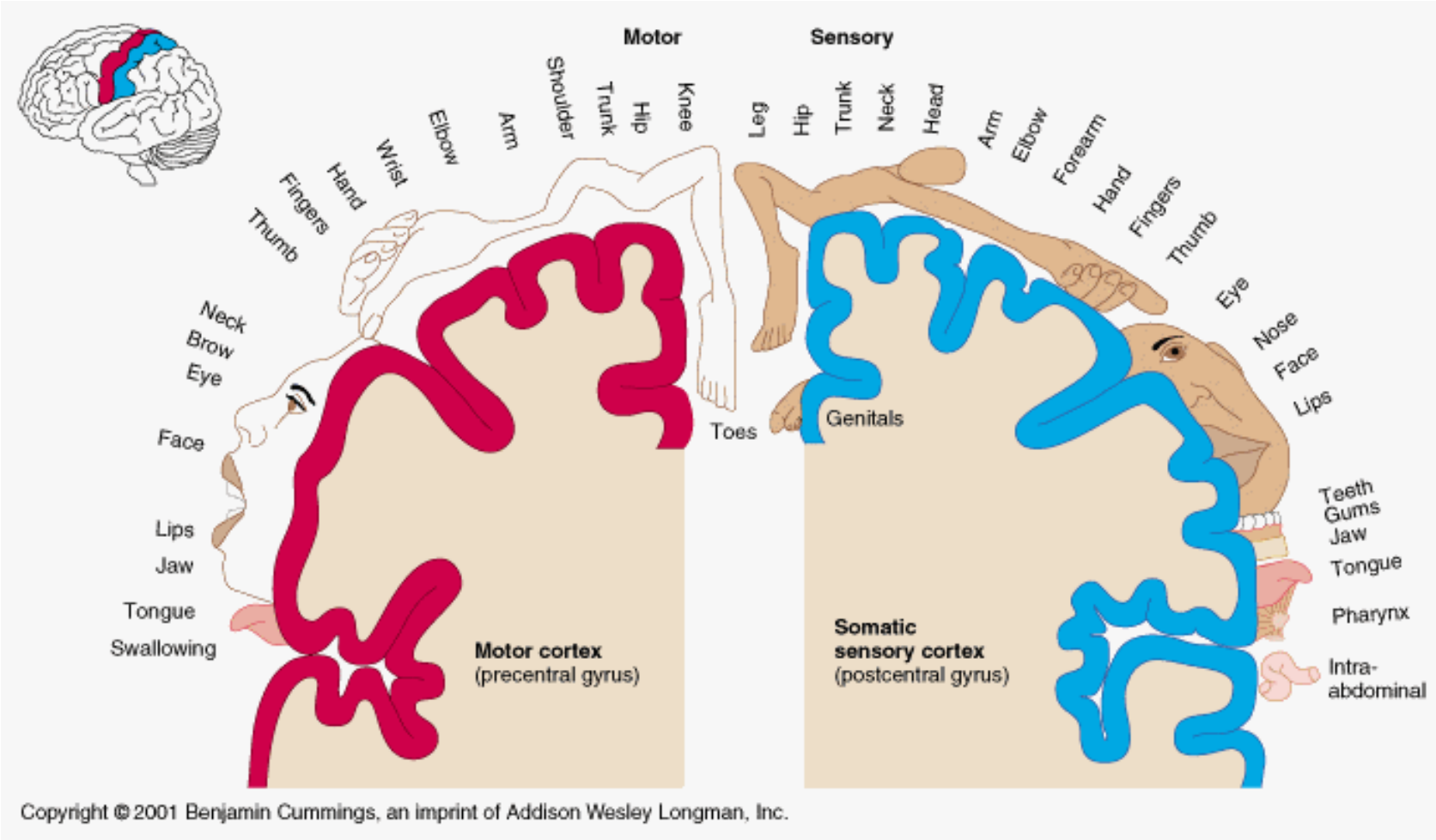
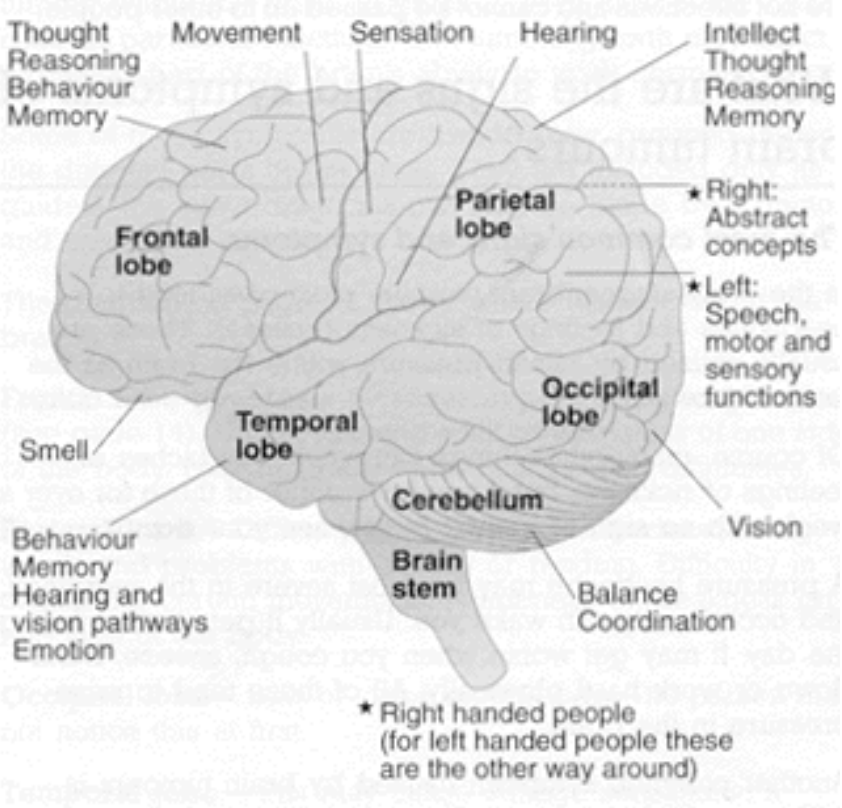


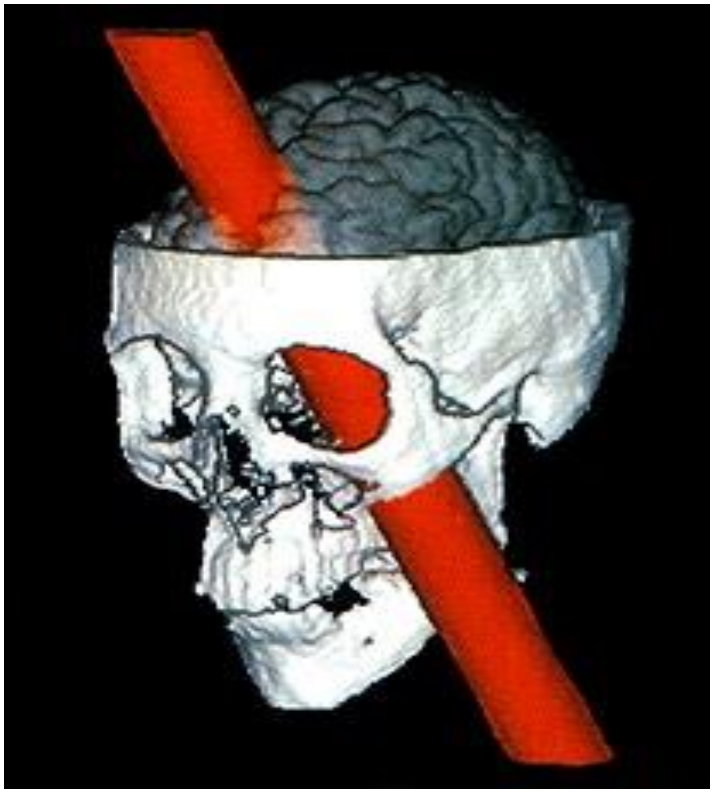
Fig. 9-15



Association areas

Most intriguing and hardest to understand
Prefrontal cortex: most spectacular growth in human
Phineas Gage story: damaged prefrontal cortex, changed characters





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