



CHAPTER 2: THE BIOLOGY OF MIND AND CONSCIOUSNESS

MYERS AND DEWALL



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- BIOLOGY AND BEHAVIOR
- NEURAL COMMUNICATION
- THE NERVOUS SYSTEM
- THE ENDOCRINE SYSTEM
- THE BRAIN
- STATES OF CONSCIOUSNESS

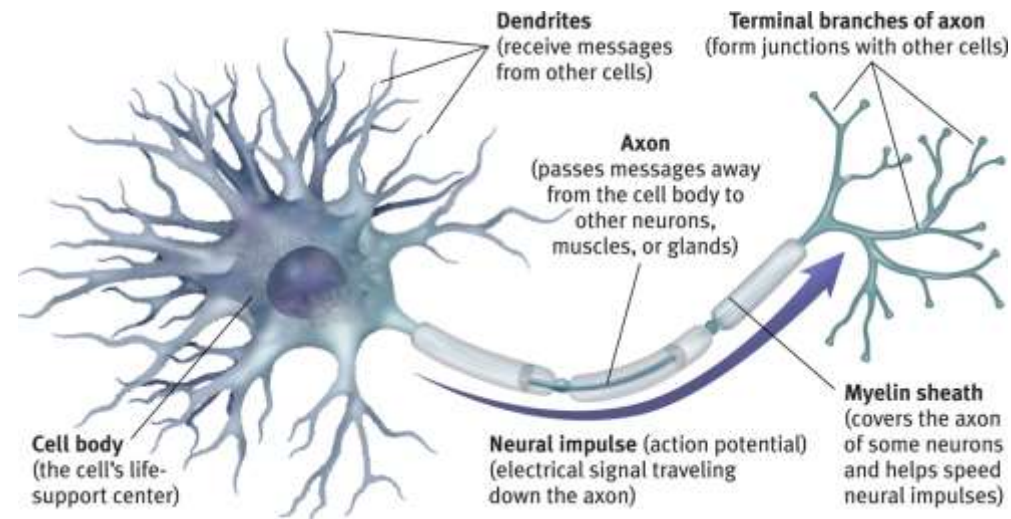
- Everything Psychological is also Biological – thought, moods, urges, behaviors all have their roots in biology
- **Biopsychology** – the study of the connection between biology and thoughts and behaviors



The Biological Bases
of Behavior

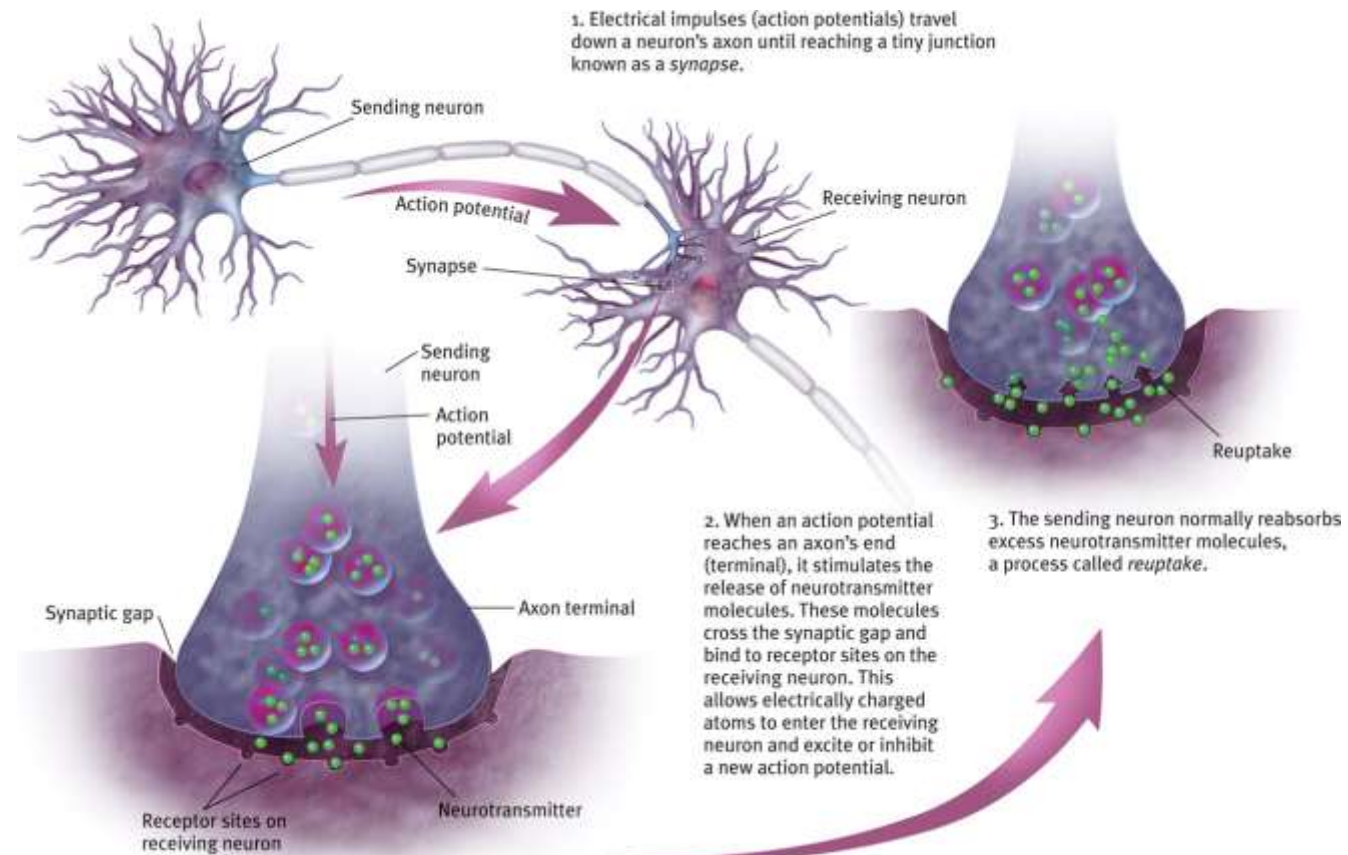
NEURAL COMMUNICATION NETWORK

- **Neuron** – the various nerve cells that make up our nervous system
 - Comprise of a **Cell Body**, **Dendrites** that receive messages and **Axons** that send messages
 - **Action Potential** – neural impulses that transfer electric signals along the **Axon** “firing”
 - **Synapses** – small gaps between the **Axon** and **Dendrites** of communicating **Neurons**
- **Neural Communication** – neurons activate when they receive more excitatory signals compared to inhibitory “threshold”



NEURAL COMMUNICATION NETWORK

- **Neurotransmitters** – chemicals emitted from Axons that communicate (bind) to Dendrite receptors



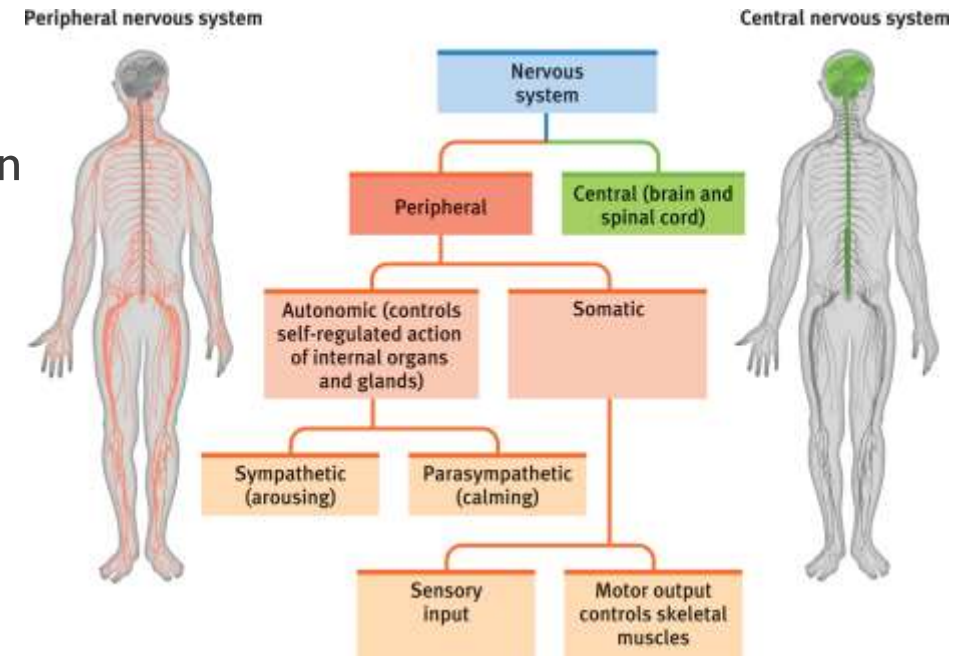
NEURAL COMMUNICATION NETWORK

TABLE 2.1 Some Neurotransmitters and Their Functions

Neurotransmitter	Function	Examples of Imbalances
<i>Serotonin</i>	Affects mood, hunger, sleep, and arousal.	Undersupply linked to depression. Some drugs that raise serotonin levels are used to treat depression.
<i>Dopamine</i>	Influences movement, learning, attention, and emotion.	Oversupply linked to schizophrenia. Undersupply linked to tremors and loss of motor control in Parkinson's disease.
<i>Acetylcholine (ACh)</i>	Enables muscle action, learning, and memory	With Alzheimer's disease, ACh-producing neurons break down.
<i>Norepinephrine</i>	Helps control alertness and arousal.	Undersupply can depress mood.
<i>GABA (gamma-aminobutyric acid)</i>	A major inhibitory neurotransmitter.	Undersupply linked to seizures, tremors, and insomnia.
<i>Glutamate</i>	A major excitatory neurotransmitter; involved in memory.	Oversupply can overstimulate brain, producing migraines or seizures (which is why some people avoid MSG, monosodium glutamate, in food).
<i>Endorphins</i>	Neurotransmitters that influence the perception of pain and pleasure.	Oversupply with opiate drugs can suppress the body's natural endorphin supply.

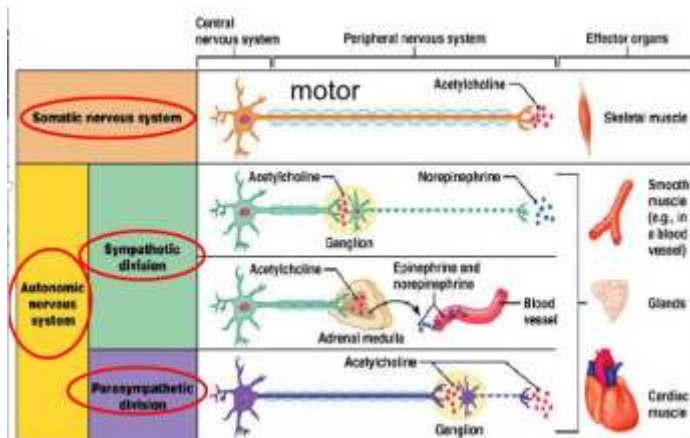
NERVOUS SYSTEM

- **Nervous System** – the body’s neurological communication network comprise of the central and peripheral systems
 - **Central Nervous System** – comprised of brain and spinal cord
 - **Peripheral Nervous System** – sensory and motor neurons connecting the CNS with rest of your body
- **Types of Neurons**
 - **Sensory** – send messages from sense receptors and tissues to brain
 - **Motor** – send messages from CNS to muscles and glands
 - **Interneurons** – CNS neurons that process and share information



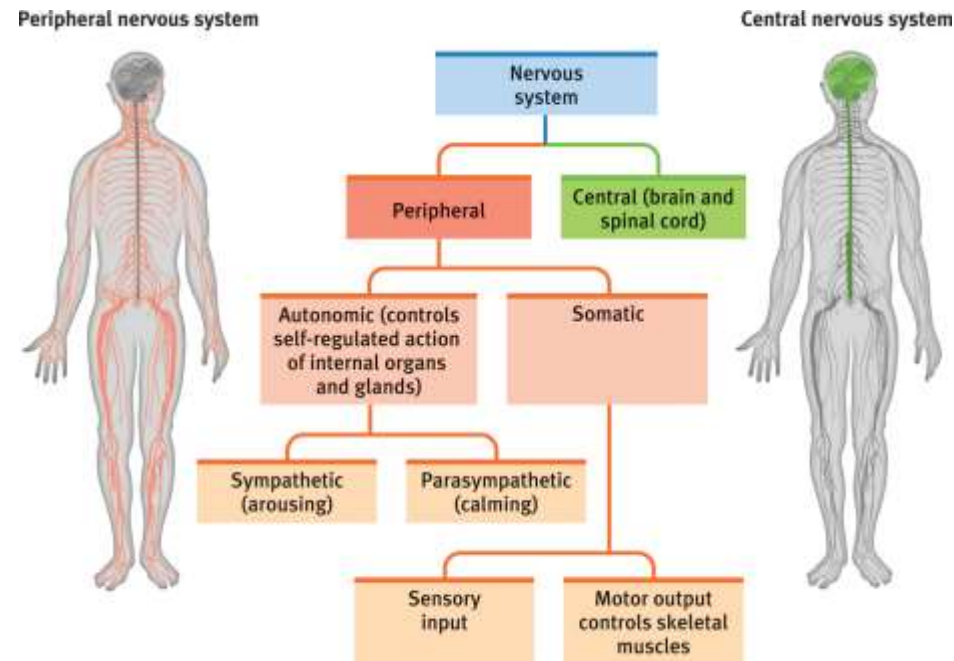
PERIPHERAL NERVOUS SYSTEM

- Peripheral Nervous System – made up of two components: Autonomic and Somatic Systems
 - Somatic Nervous System (Skeletal) – sends messages to control skeletal muscles
 - Autonomic Nervous System – controls glands and internal organs, comprised of sympathetic and parasympathetic pathways
 - Sympathetic Nervous System – responsible for arousal, energy, and stimulation
 - Parasympathetic Nervous System – responsible for reducing arousal following stimulation



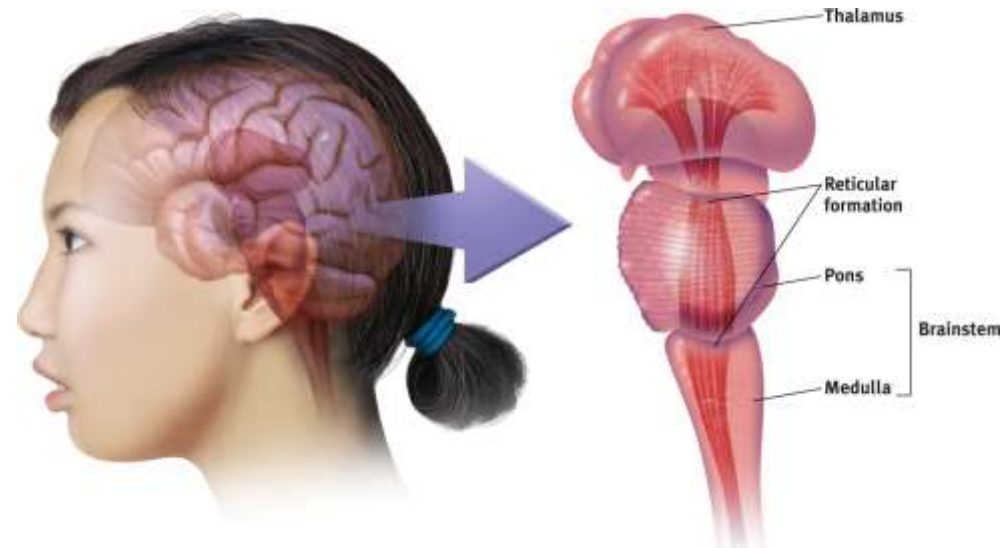
CENTRAL NERVOUS SYSTEM

- Brain - comprised of roughly **86 BILLION** neurons clustered into neural networks
 - Neural Networks- shorter quick connections that work together
- Spinal Cord – highway of nerves connecting the Brain and Peripheral Nervous Systems



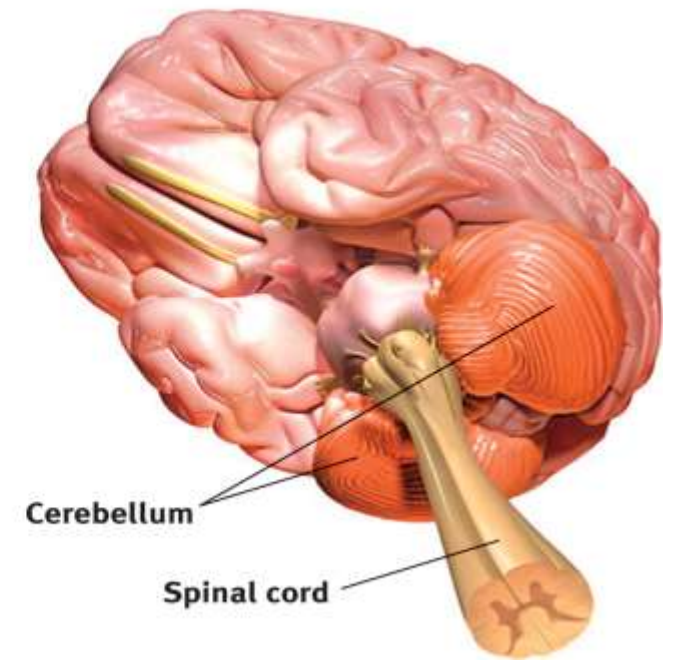
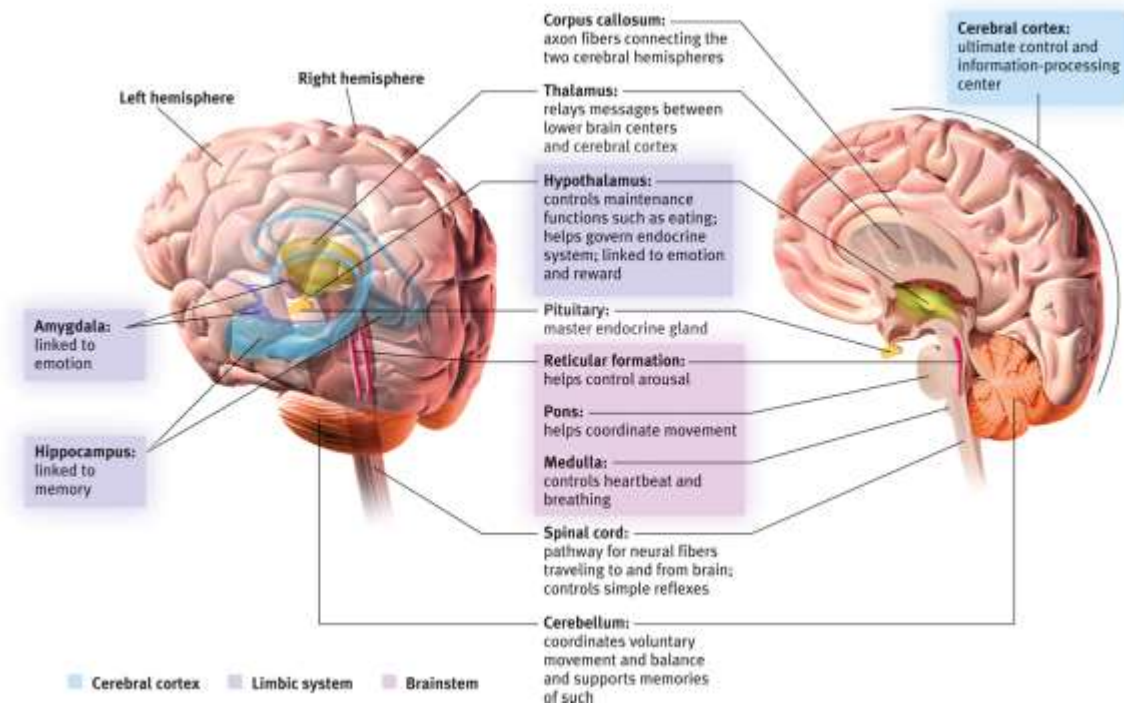
CNS: GEOGRAPHY OF THE BRAIN

- Brainstem – area of the brain that forms from the spinal cord
 - Medulla – controls the heart and lungs
 - Pons – helps to coordinate movement
 - Reticular Formation – controls arousal and other sensory messages
 - Thalamus – sensory control center

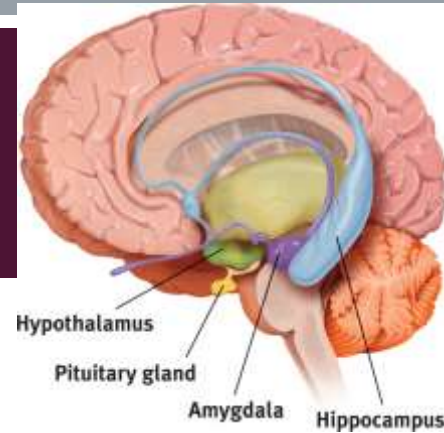


CNS: GEOGRAPHY OF THE BRAIN

- **Cerebellum** – influences perceptions of voluntary movement, and subconscious memories



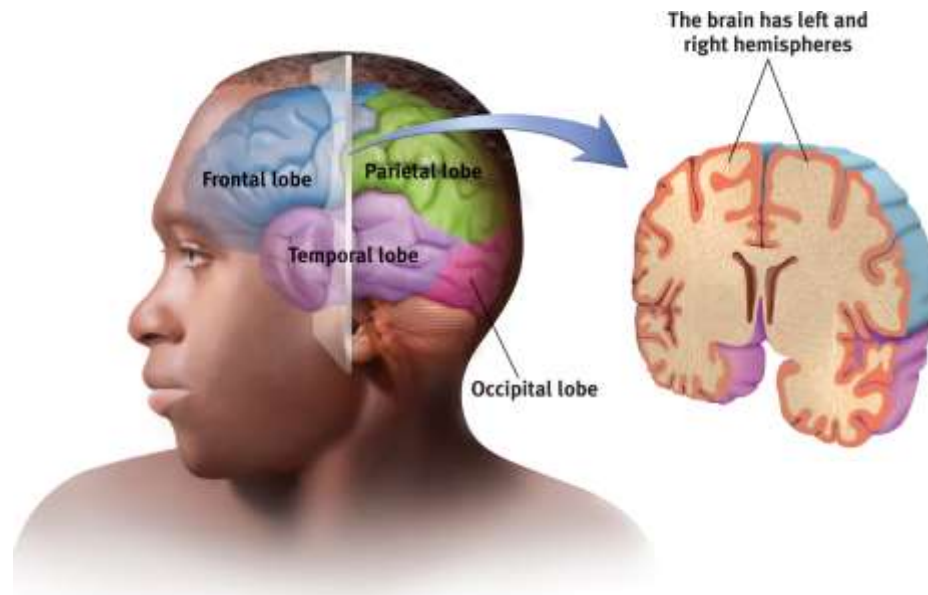
CNS: GEOGRAPHY OF THE BRAIN



- **Limbic System** – mid-part of the brain containing the hippocampus, amygdala, and hypothalamus
 - **Hippocampus** – responsible for learning and conscious memories
 - **Amygdala** – two clusters responsible for fear and aggressive reactions
 - **Hypothalamus** – responsible for regulating and maintaining bodily functions, regulated body temp. thirst/appetite, sexual behavior, sleep
 - Activates pituitary gland in response to signals from other parts of the body
 - Part of body's reward center, stimulation releases dopamine and cause pleasurable sensations

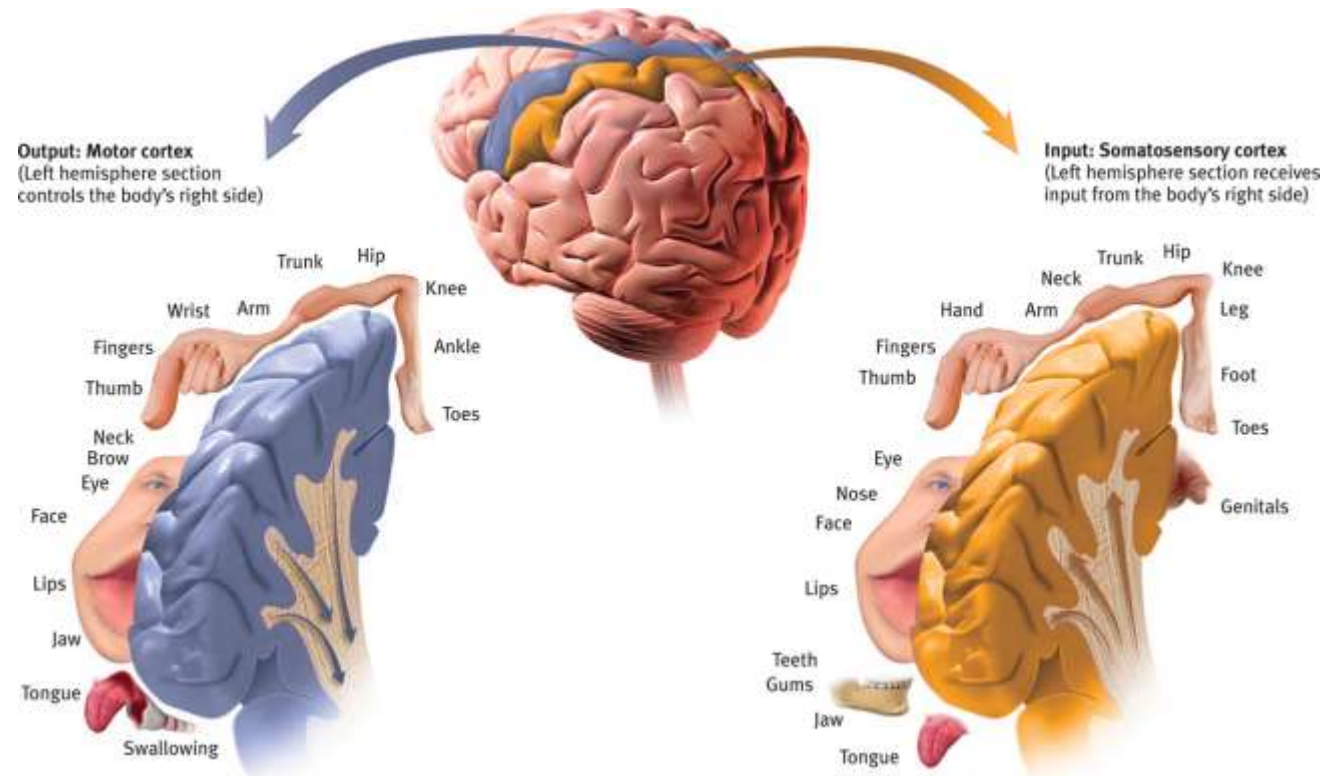
CNS: GEOGRAPHY OF THE BRAIN

- **Cerebrum** – largest and newest part of the brain that can be divided into two halves (hemispheres) and four lobes
- **Cerebral Cortex** – outer layer of neural fibers covering the Cerebrum



CNS: GEOGRAPHY OF THE BRAIN

- Functions of the Cerebral Cortex – using electrical stimulation researchers have “mapped” out portions of the cerebral cortex
 - Motor Cortex – rear of frontal lobe and control voluntary movement



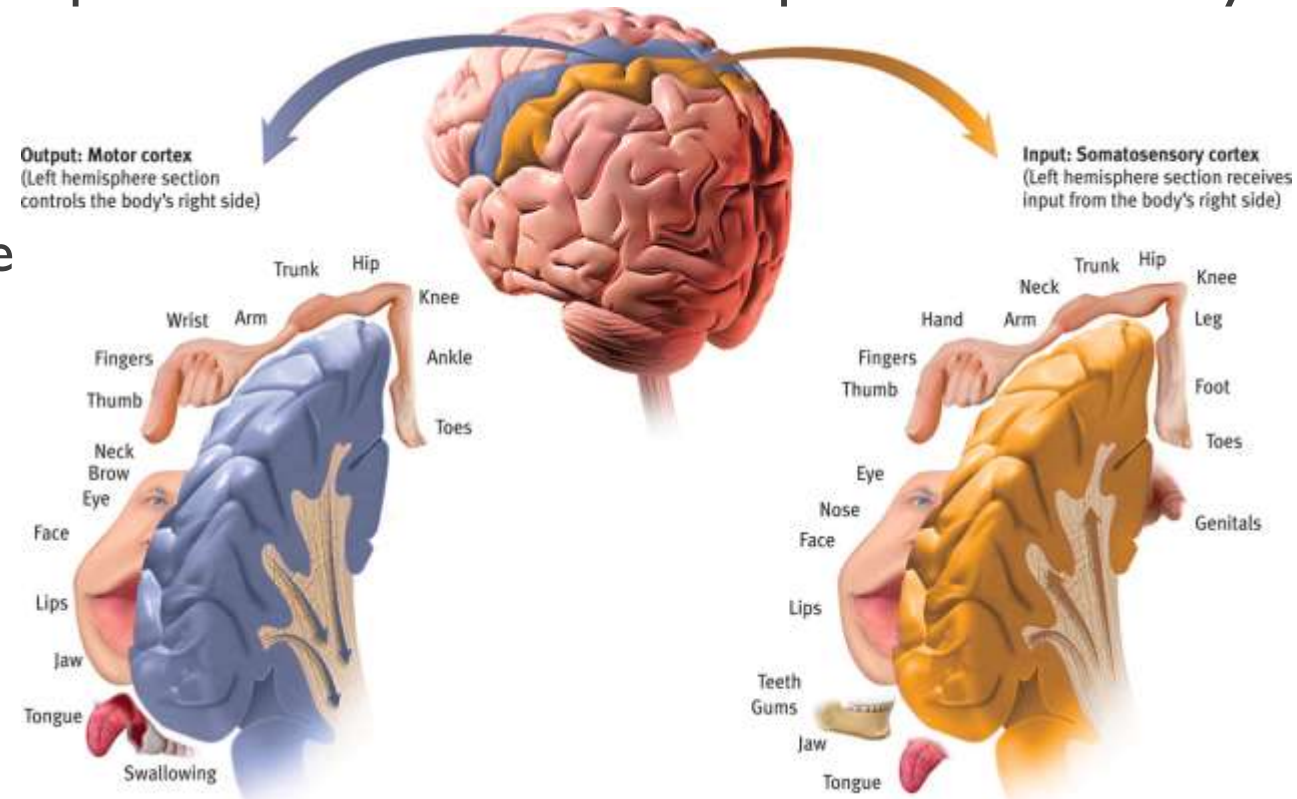
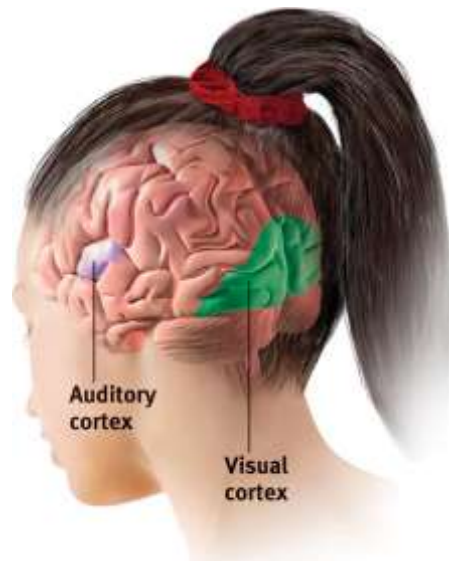
CNS: GEOGRAPHY OF THE BRAIN

■ Functions of the Cerebral Cortex (Sensory)

- **Somatosensory Cortex** – located in front of parietal lobes, receives and processes sensory input

- **Visual Cortex** – located in occipital lobe

- **Auditory Cortex** – located in temporal lobe



CNS: GEOGRAPHY OF THE BRAIN

- Functions of the Cerebral Cortex (Association Areas)
 - Association Areas – responsible for higher order thinking; interpretation, integration, judgments, planning, personality, math, spatial reasoning
 - Association areas work together to allow complex mental processes
 - Brain Plasticity – some parts of the brain can be modified/reorganized when damaged or loss
 - Neurogenesis – brain producing new neurons

■ Motor areas ■ Sensory areas ■ Association areas



Rat



Cat



Chimpanzee



Human



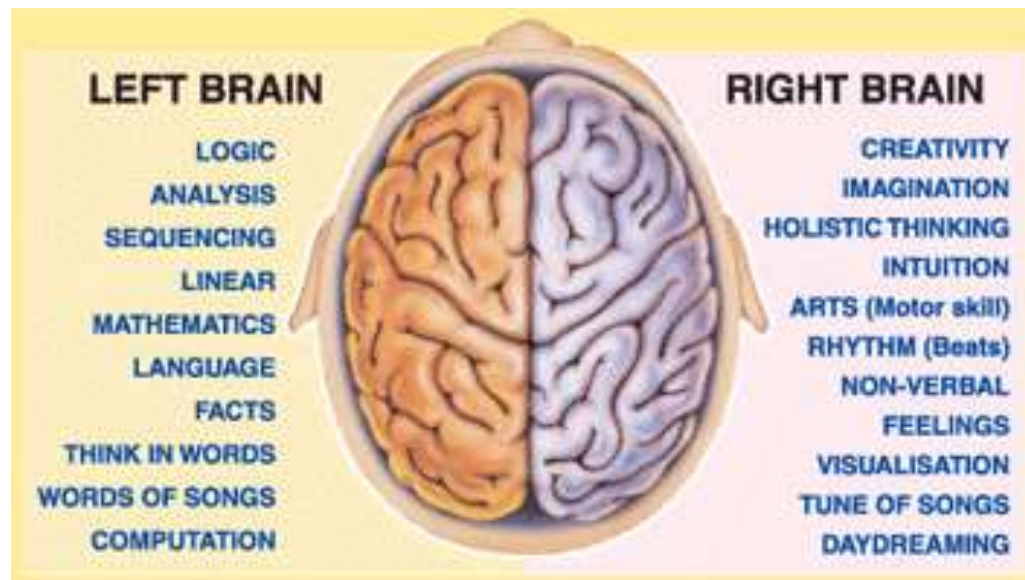
(a)



(b)

THE DIVIDED BRAIN

- Lateralization – the left and right hemispheres have differing functions
- Corpus Callosum – neural fibers connecting and passing information to the two hemispheres
- Split-brained patients are unaware at times that they brains are experiencing different stimuli





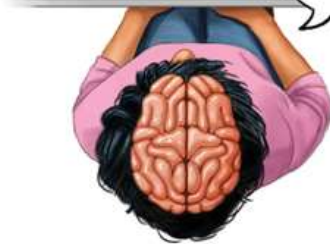
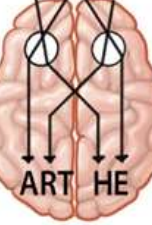
"Look at the dot."

(a)



Two words separated by a dot are momentarily projected.

(b)



"What word did you see?"

or

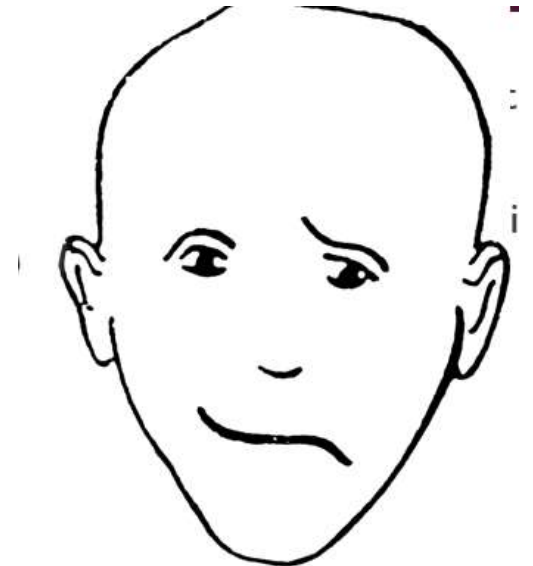
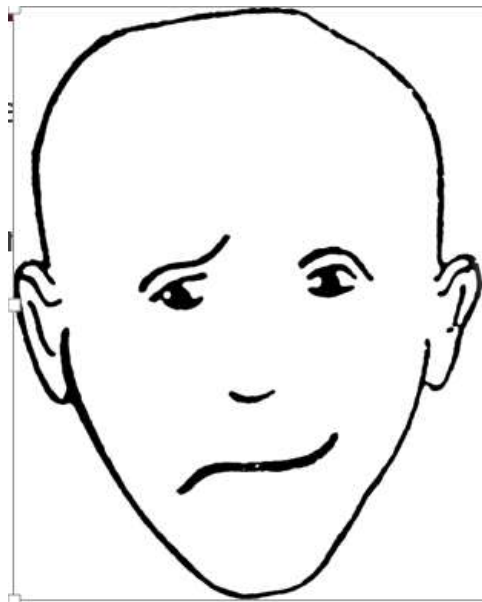


"Point with your left hand to the word you saw."

(c)

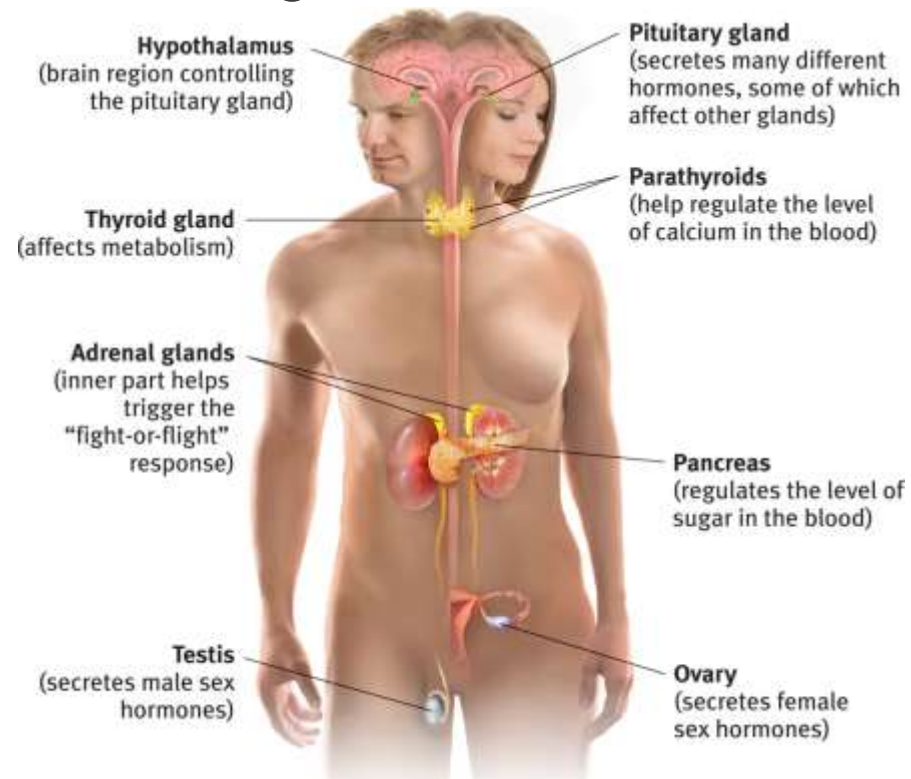
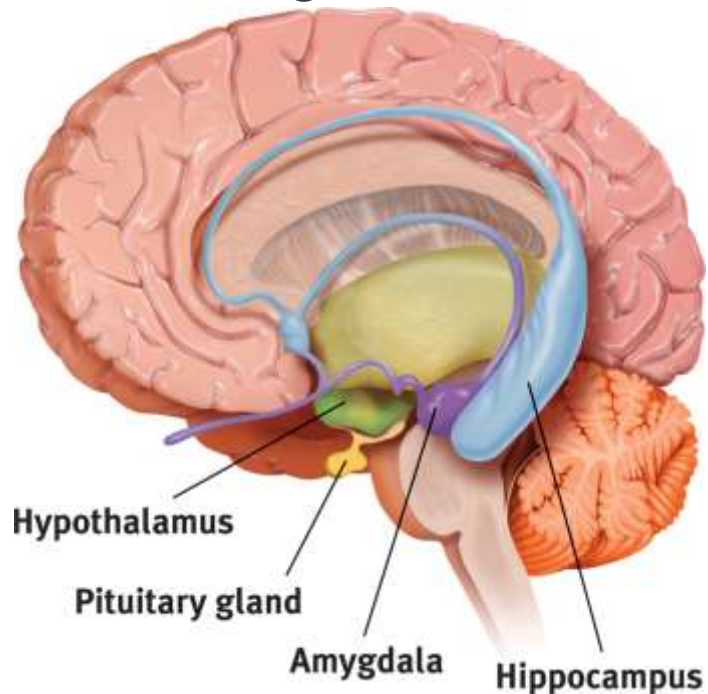
THE DIVIDED BRAIN

- **Left Hemisphere** – responsible for language perception, production, and mathematical calculations
- **Right Hemisphere** – responsible for emotional perception, expression, drawing, and higher order language and thinking



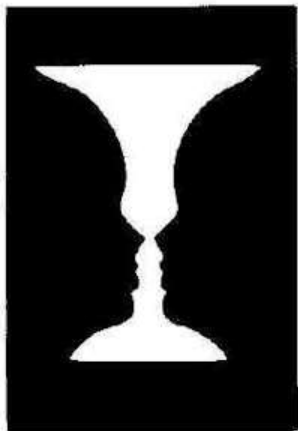
ENDOCRINE SYSTEM

- Endocrine System – secondary communication system comprised of glands
 - Pituitary Gland – master gland, near the hypothalamus, that controls the activation of other glands
 - Hormones – glandular secretions that send messages via the bloodstream



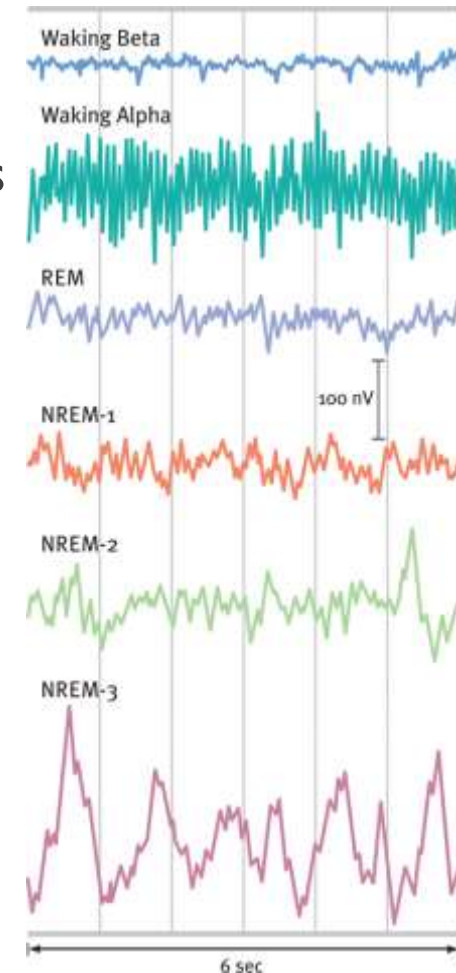
BRAIN AND STATES OF CONSCIOUSNESS

- **Consciousness** – awareness of ourselves and our surroundings
- **Selective Attention** – focusing your consciousness on specific stimuli
 - **Multi-tasking** – generally switching attention back and forth between stimuli
 - **Inattentional Blindness** – missing stimuli when attention is focus on other events
 - **Change Blindness** – missing environmental changes when attention is focused elsewhere

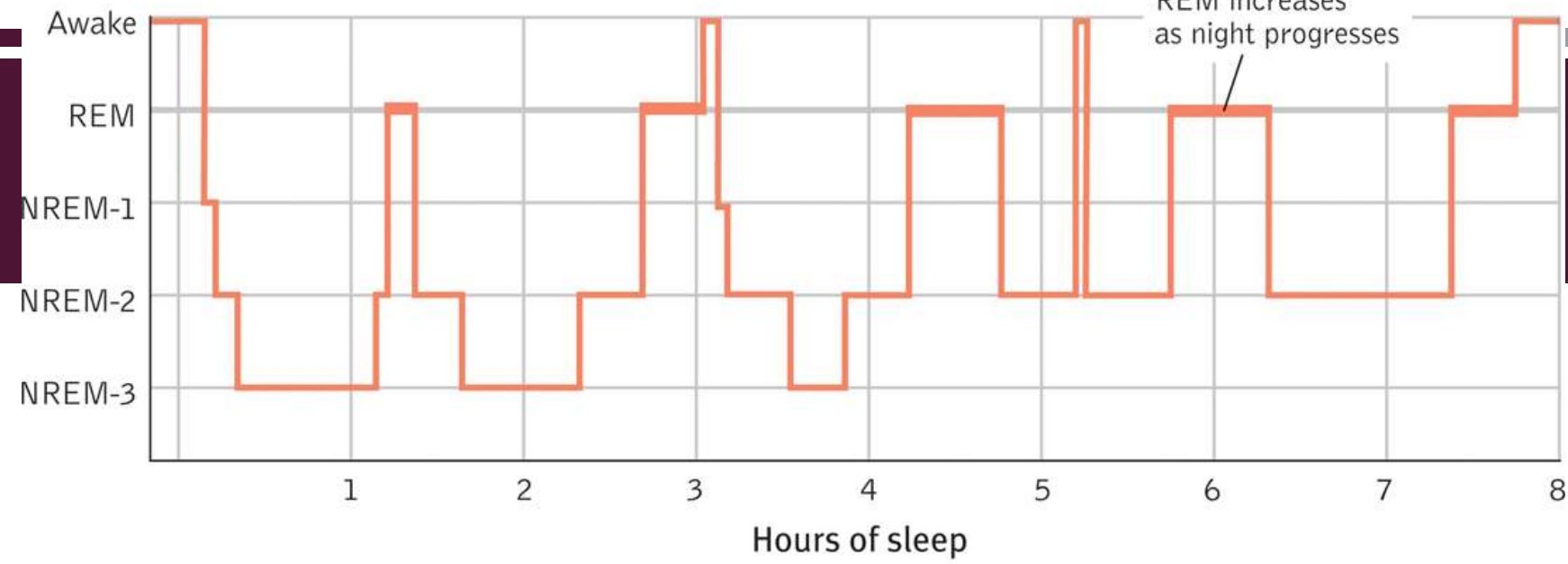


BRAIN AND STATES OF CONSCIOUSNESS – SLEEP AND DREAMS

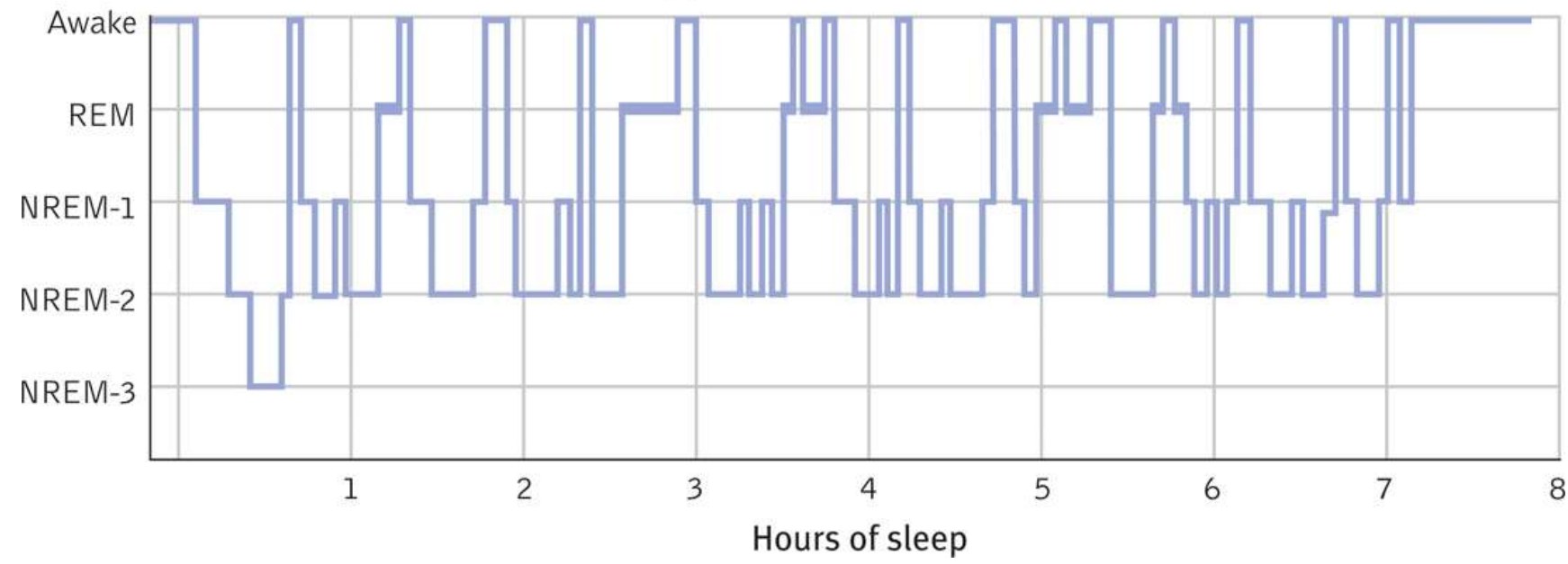
- Circadian Rhythm – biological clock that regulates our body rhythms
- Sleep Stages – 90 minute cycle of brain activity comprised of four stages
 - NREM-1 – drowsy sleep characterized by bursts of images, falling, floating, spasms
 - NREM-2 – more relaxed state, still can be easily wakened
 - NREM-3 – deep or slow-wave sleep
 - REM – brain activity mirrors waking activity, but your muscles are relaxed
 - 20-25% of sleep is spent in REM



(a) Young Adults



(b) Older Adults



BRAIN AND STATES OF CONSCIOUSNESS – SLEEP AND DREAMS

- Dreams – mental hallucinations that occur during sleep
 - May be brain making sense of neural activity
 - Sigmund Freud suggest dreams have a manifest (obvious) meaning and a latent (hidden) meaning
 - Dreams help us to process and store information, strengthen and increase neurons



BRAIN AND STATES OF CONSCIOUSNESS – WHY DO WE SLEEP?

- How many hours of sleep do we need?
 - Cultural Influences – we sleep less now than previous generations
 - Sleep is protective, restorative, aids memory & creativity, and promotes muscle growth



BRAIN AND STATES OF CONSCIOUSNESS – WHY DO WE SLEEP?

- **Sleep Debt** – accumulation of loss sleep leading to fatigue loss of energy, attention, reaction time, weight gain
- **Sleep Disorders**
 - **Insomnia** – chronic inability to fall and/or stall asleep
 - **Narcolepsy** – sudden bouts of overwhelming sleepiness
 - **Sleep Apnea** – individual who stop breathing during sleep
 - **Sleepwalking and talking**

