

Brain and Behaviour

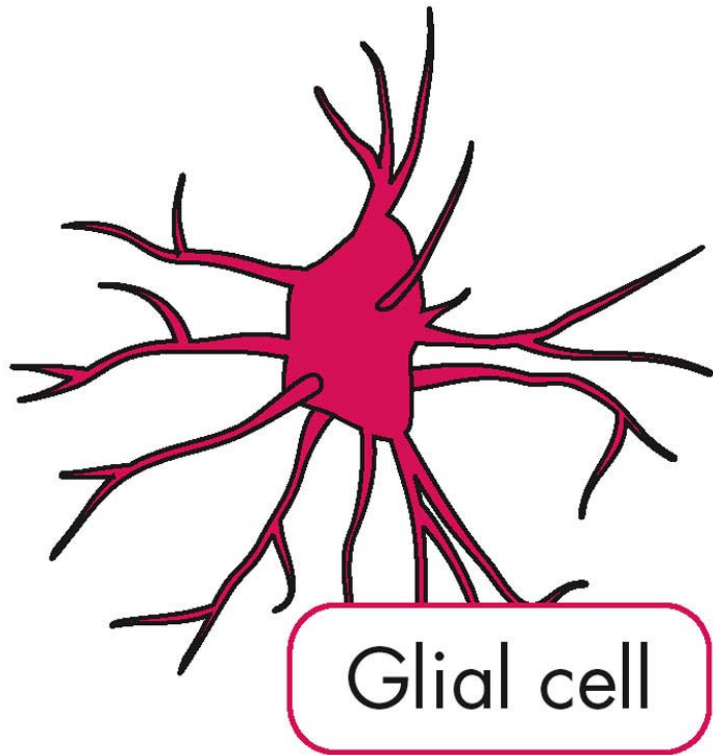
General Psychology

What will be covered

- The Nervous System
- The Brain
- The Endocrine System

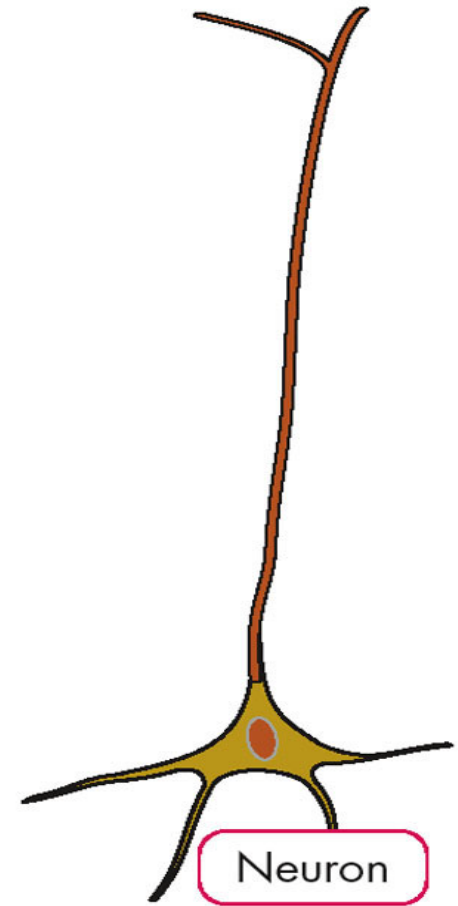
Structure of the brain

Glial Cells



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Neurons



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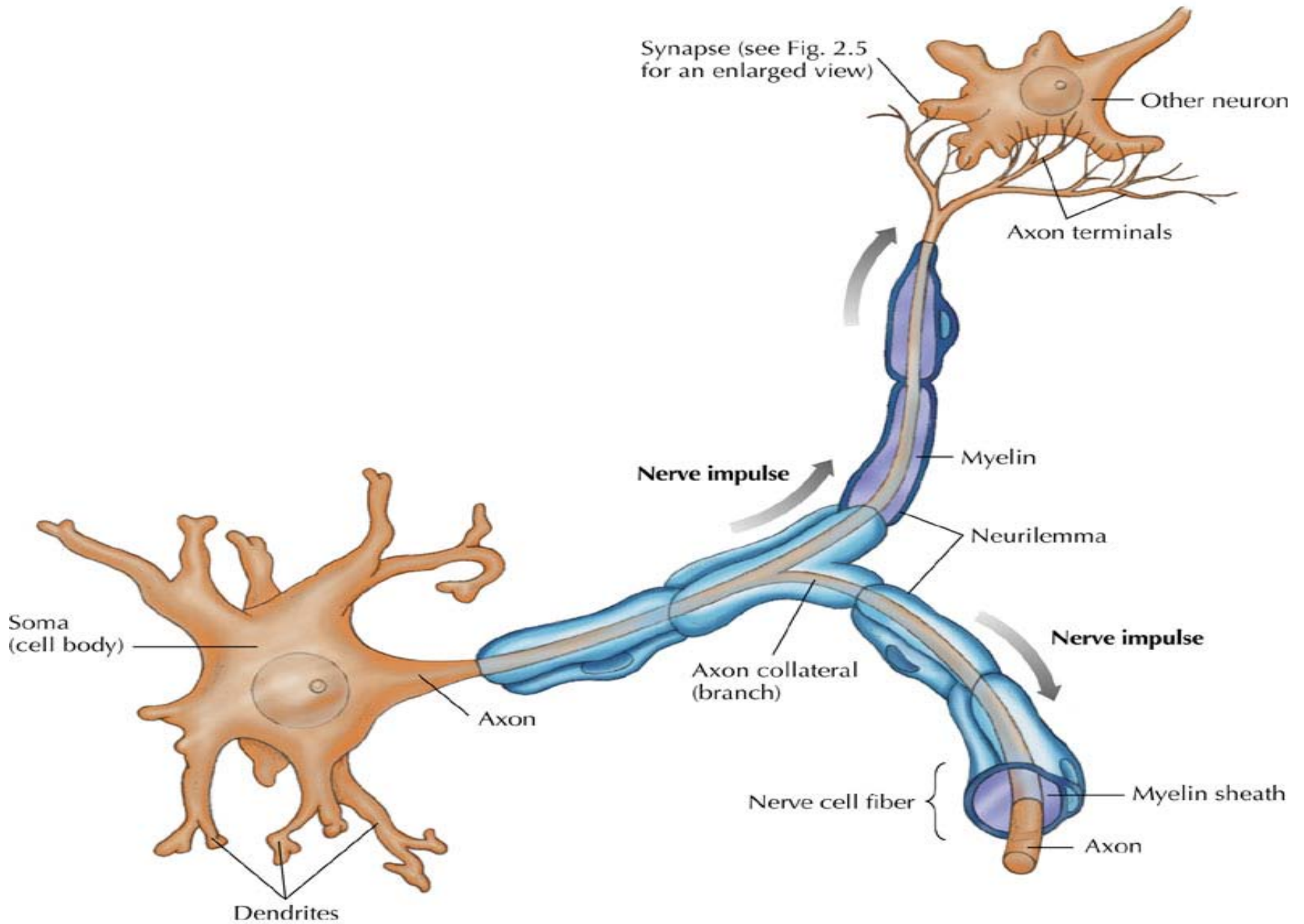
Structure of the brain

Glial Cells

- 3 Functions of glial cells
 1. guide the growth of developing neurons
 2. wrap around neurons and form an insulation to prevent interference from other electrical signals
 3. release chemicals that influence a neuron's growth and function

Neurons

- a brain cell with 2 specialised extensions
 - one extension is for receiving electrical signals
 - the other extension is for transmitting electrical signals



Parts of Neuron

- **Soma or Cell Body**

- large egg-shaped structure that provides fuel, manufactures chemicals, and maintains the entire neuron in working order

- **Dendrite**

- branchlike extensions that arise from the cell body
- receive signals from other neurons, muscles, or sense organs
- pass these signals onto the cell body

- **Axon**

- a single threadlike structure that extends from and carries signals away from the cell body to neighboring neurons, organs, or muscles

Parts of Neuron

- **Myelin Sheath**

- Separate tube-like segments composed of fatty material that wraps around and insulates an axon
- Prevents interference from electrical signals generated in surrounded neurons

- **End bulbs or Terminal bulbs**

- Tiny bubbles that are located at the extreme ends of the axon's branches.
- Stores chemicals called neurotransmitters which are used to communicate neighboring cells

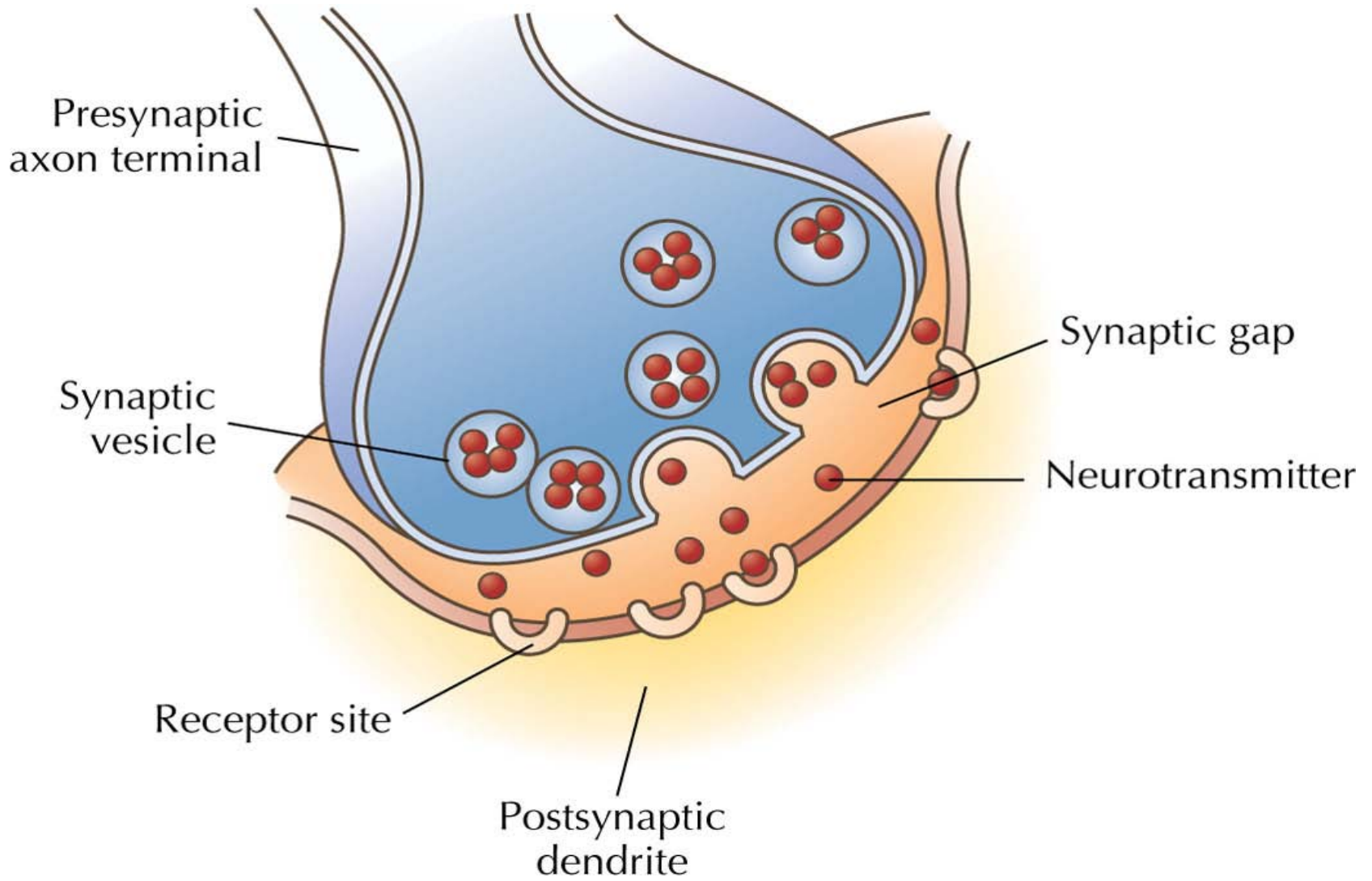
- **The synapse**

- the space where the axon meets the dendrites (or cell body) of another cell.

How Neurons Communicate

Describe how messages are transmitted by neurons.

- A nerve's dendrites are stimulated enough to send an electro-chemical message through its axon. Neurotransmitters are released from the end of the axon, and received by the dendrites of another neuron at the space called the synapse. The receiving cell then sends the message on or doesn't.

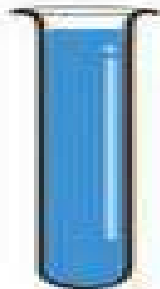


Neurotransmitters

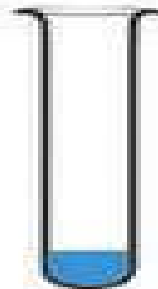
Neurotransmitter	Functions	Comments
Acetylcholine (ACh)	Causes muscle contractions and is involved in formation of memories	Found at synapses between motor neurons and muscles; deficiencies linked with paralysis and Alzheimer's disease
Dopamine	Plays a role in movement, learning, attention, memory, and emotional response	Tremors of Parkinson's disease linked with low levels of dopamine; people with schizophrenia may <i>overutilize</i> dopamine
Norepinephrine	Accelerates the heart rate, affects eating, and is linked with activity levels, learning, and remembering	Imbalances linked with mood disorders such as depression and bipolar disorder
Serotonin	Is involved in behavior patterns and psychological problems, including obesity, depression, insomnia, alcoholism, and aggression	Drugs that block the reuptake of serotonin helpful in the treatment of depression
Gamma-aminobutyric acid (GABA)	An inhibitory neurotransmitter that may lessen anxiety	Tranquilizers and alcohol may counter anxiety by binding with GABA receptors or increasing the sensitivity of receptor sites to GABA
Endorphins	Inhibit pain by locking pain-causing chemicals out of their receptor sites	Endorphins may be connected with some people's indifference to pain, the painkilling effects of acupuncture, and the "runner's high" experienced by many long-distance runners

Neurotransmitters

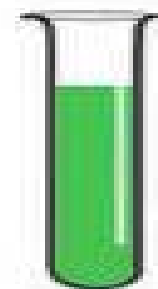
Schizophrenia



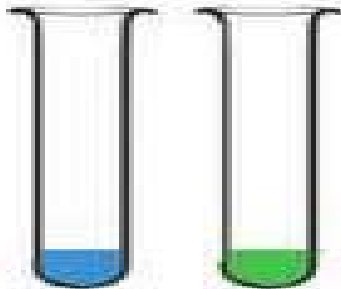
Anxiety



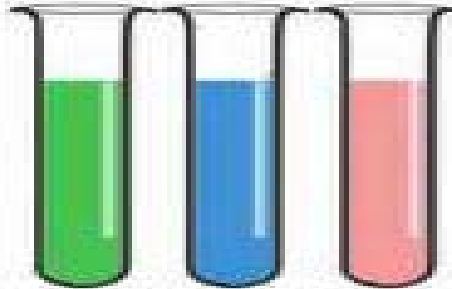
Happiness



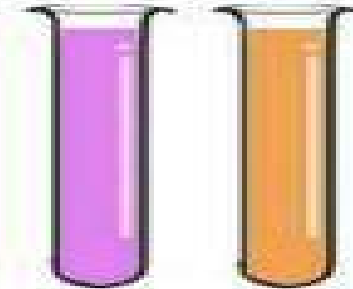
Depression



Love



Fight or Flight



They rule our lives

 - Dopamine

 - Serotonin

 - Oxytocin

 - Norepinephrine

 - Epinephrine

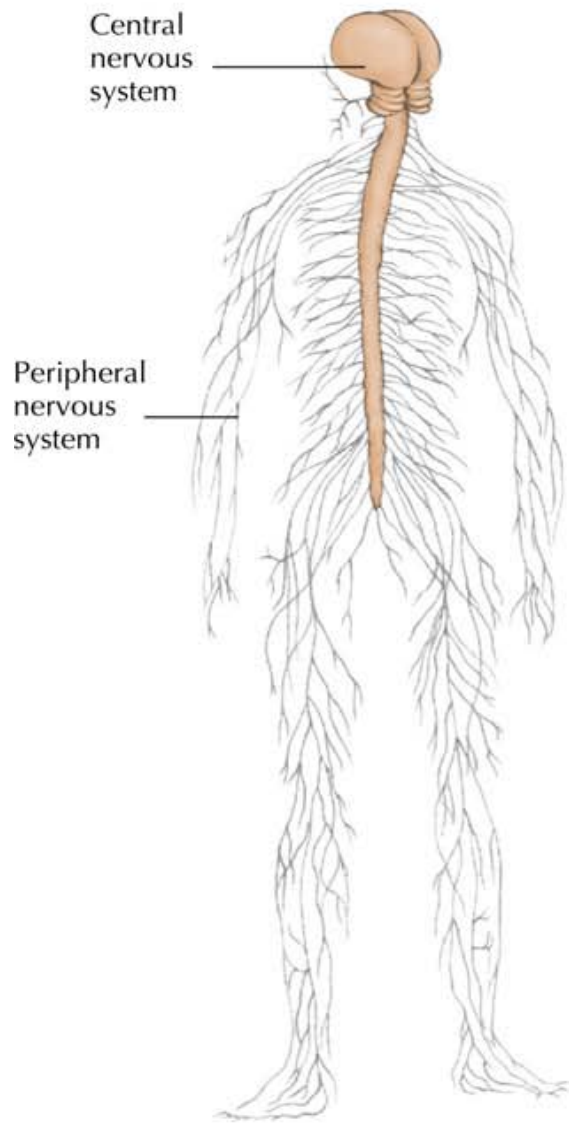
Neural Network

Central Nervous System (CNS)

- made up of neurons located in the brain & spinal cord

Peripheral Nervous System (PNS)

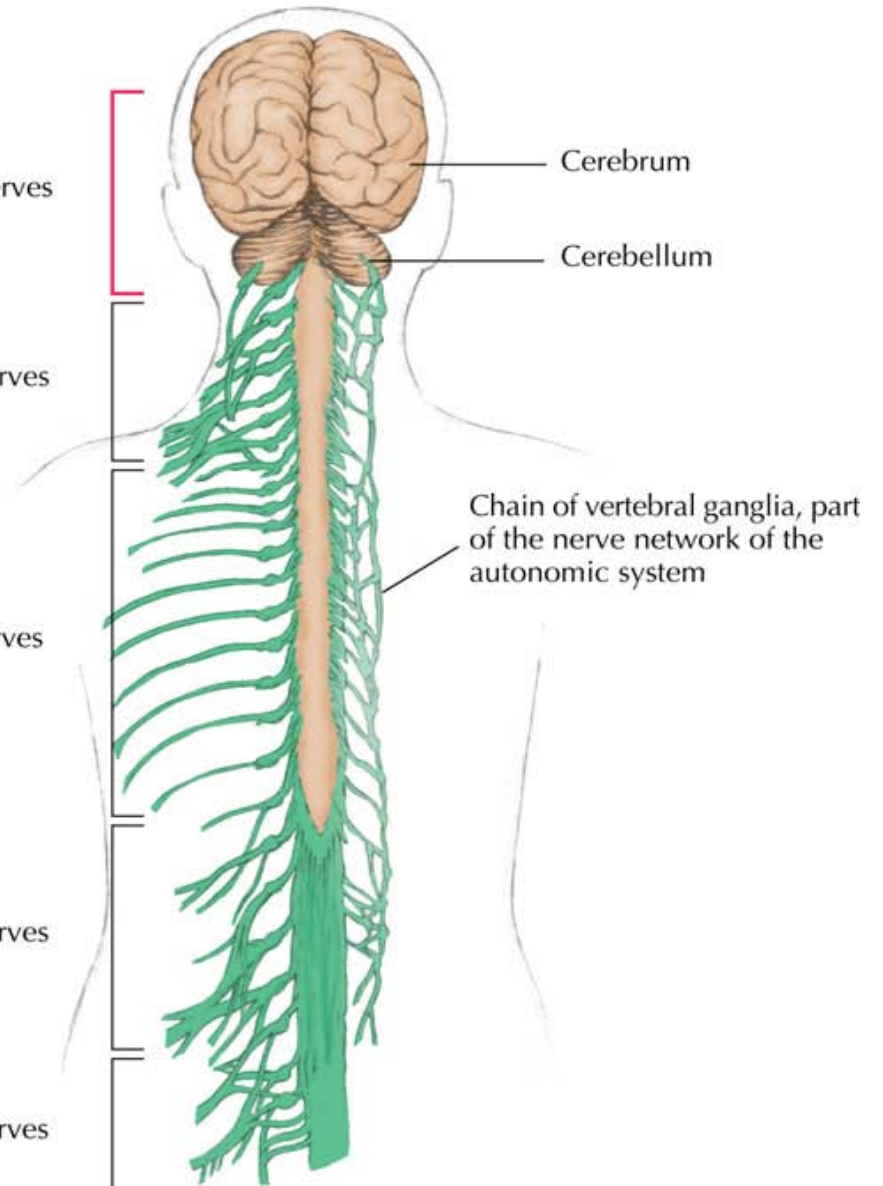
- made up of nerves that are located throughout the body, except in the brain & spinal cord
- Subdivisions of the PNS
 - somatic nervous system
 - autonomic nervous system - ANS
 - sympathetic division
 - parasympathetic division



(a)

Spinal nerves

- 12 cranial nerves
- 8 cervical nerves
- 12 thoracic nerves
- 5 lumbar nerves
- 5 sacral nerves



(b)

Nerves

- stringlike bundles of axons and dendrites that come from the spinal cord and are held together by connective tissue
- carry information from the senses, skin, muscles, and the body's organs to and from the spinal cord
- nerves in the peripheral nervous system have the ability to grow or reattach if severed or damaged

Nervous system

Central nervous system

Peripheral nervous system

Brain

Spinal cord

Somatic system

Autonomic system

Sympathetic system

Parasympathetic system

Peripheral Nervous System

Somatic System

- network of nerves that connect either to sensory receptors or to muscles that you can move voluntarily, such as muscles in your limbs, back, neck, and chest
- nerves contain two kinds of fibers
 - Afferent - sensory fibers; carry information to the brain
 - Efferent - motor fibers; carry information from brain or spinal cord to the muscles

Autonomic System

- regulates heart rate, breathing, blood pressure, digestion, hormone secretion, and other functions
- Subdivision of ANS
 - Sympathetic Division
 - Parasympathetic Division

Two Divisions of the Autonomic System

Parasympathetic

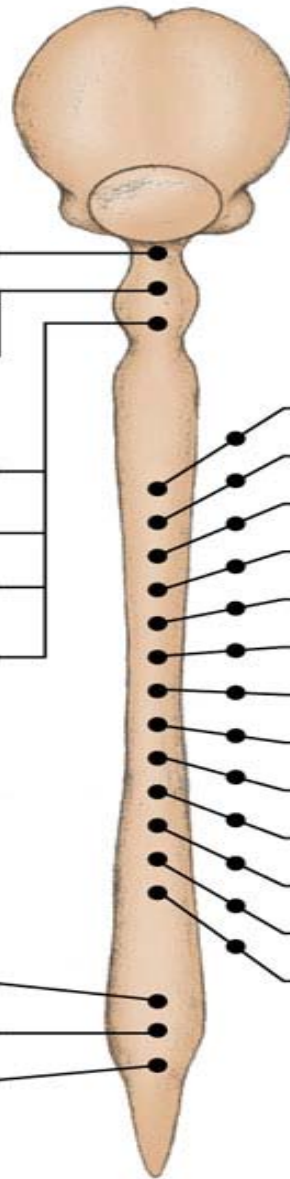
- Quiets body; most active after an emotional event
- returns the body to a calmer, relaxed state and is involved in digestion

Sympathetic

- triggered by threatening or challenging physical or psychological stimuli, increases physiological arousal and prepares the body for action
- Arouses body; emergency system

Parasympathetic

- Constricts pupil
- Stimulates tears
- Stimulates salivation
- Inhibits heart rate
- Constricts respiration
- Constricts blood vessels
- Stimulates digestion
- Contracts bladder
- Stimulates elimination
- Stimulates genitals

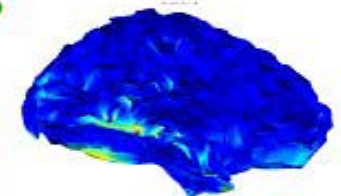
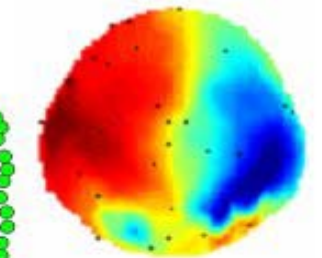
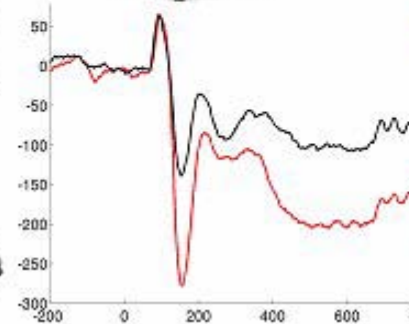
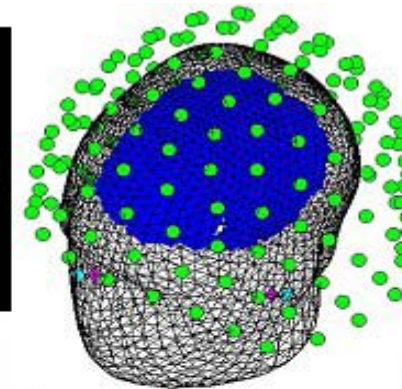
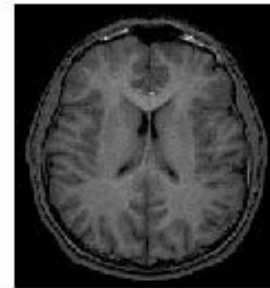
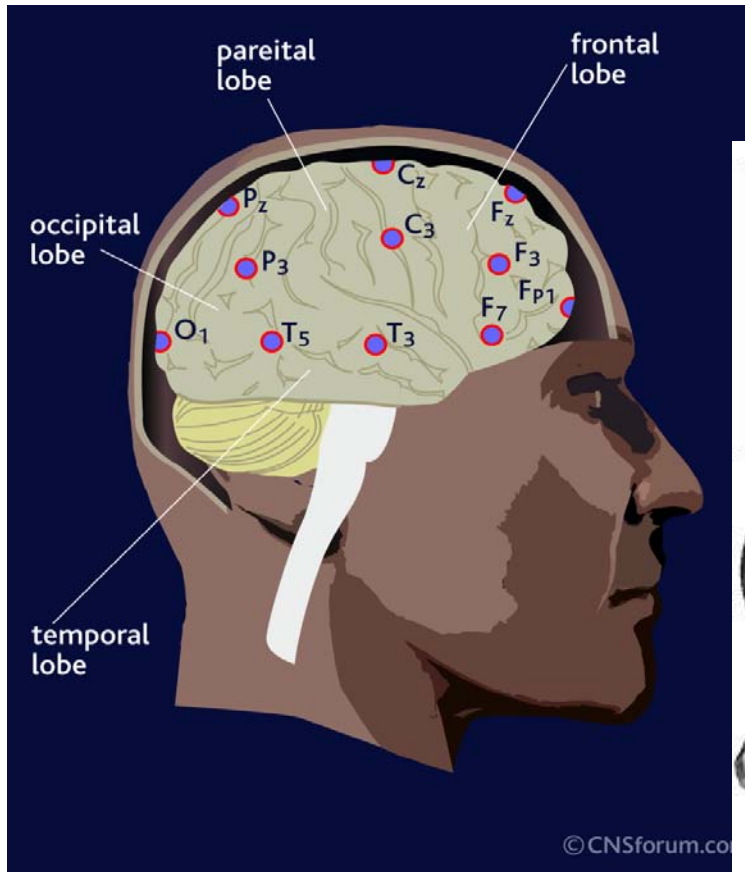
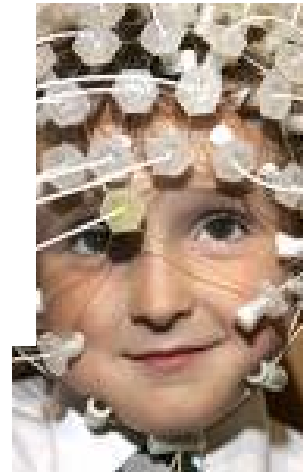
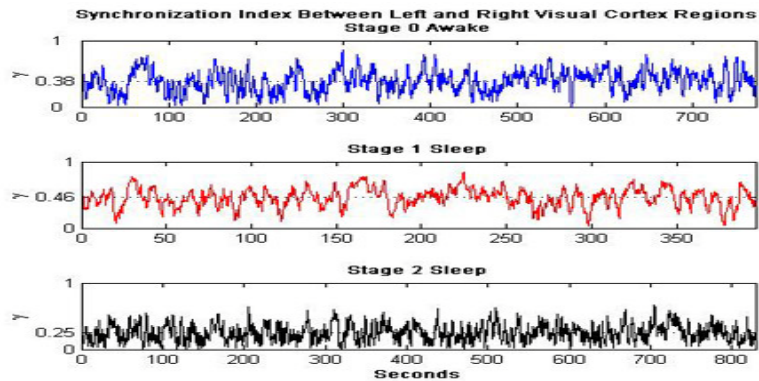


Sympathetic

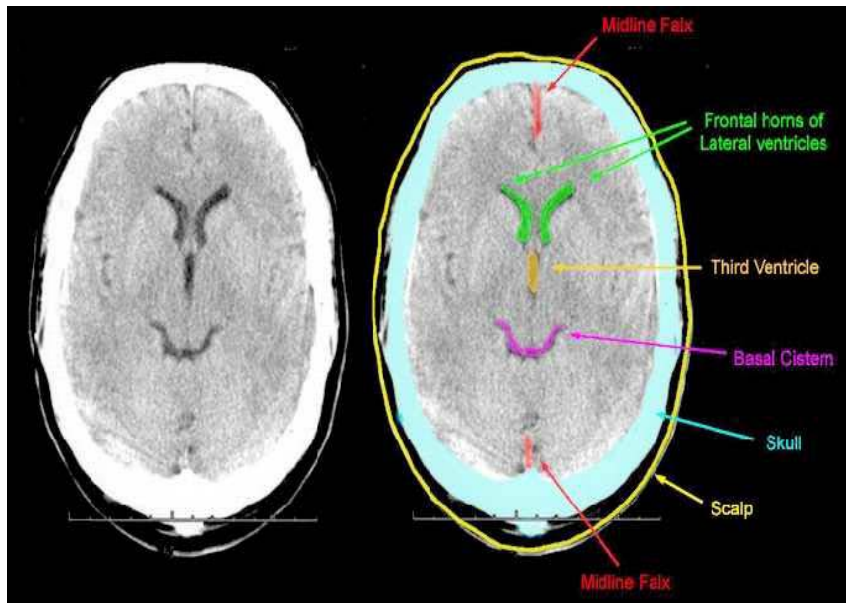
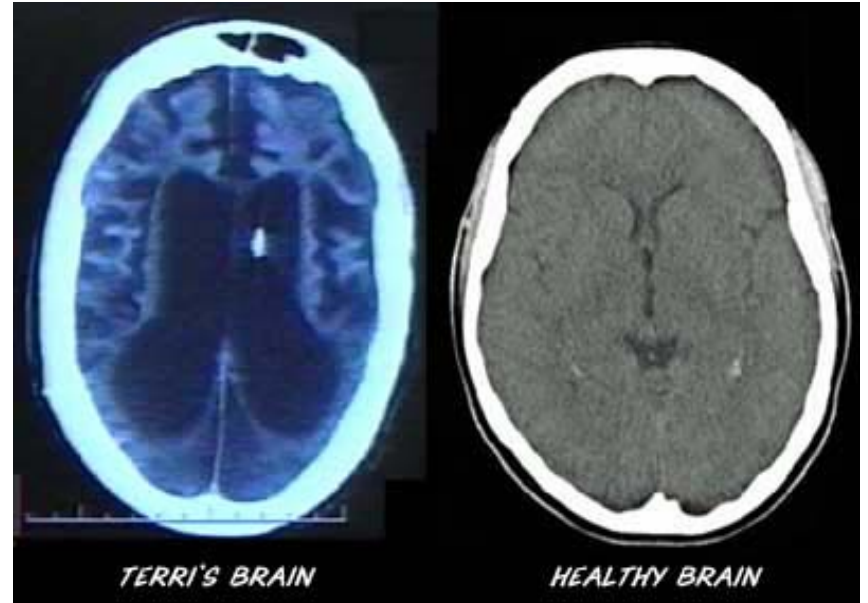
- Dilates pupil
- Inhibits tears
- Inhibits salivation
- Activates sweat glands
- Increases heart rate
- Increases respiration
- Inhibits digestion
- Release of adrenaline
- Release of sugar from liver
- Relaxes bladder
- Inhibits elimination
- Inhibits genitals
- Ejaculation in males

Researching the Brain

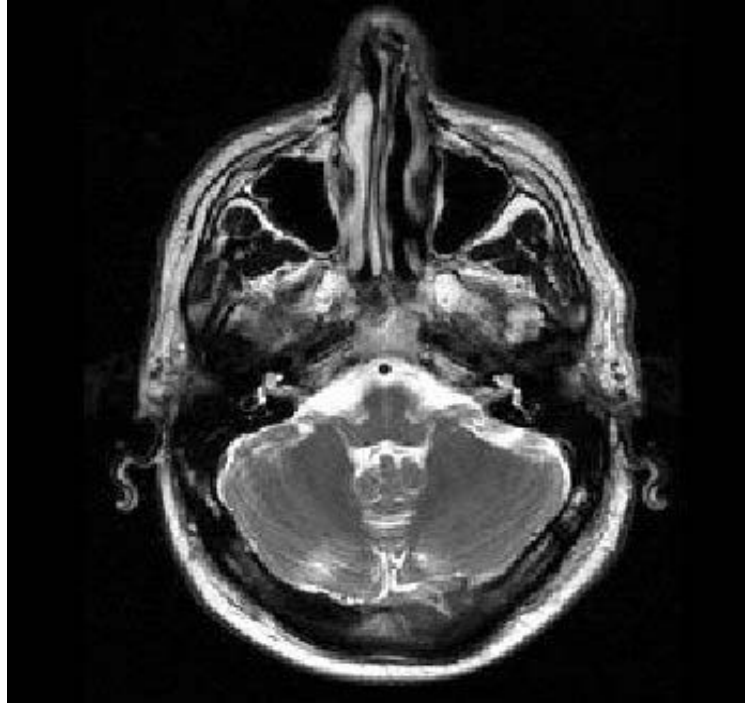
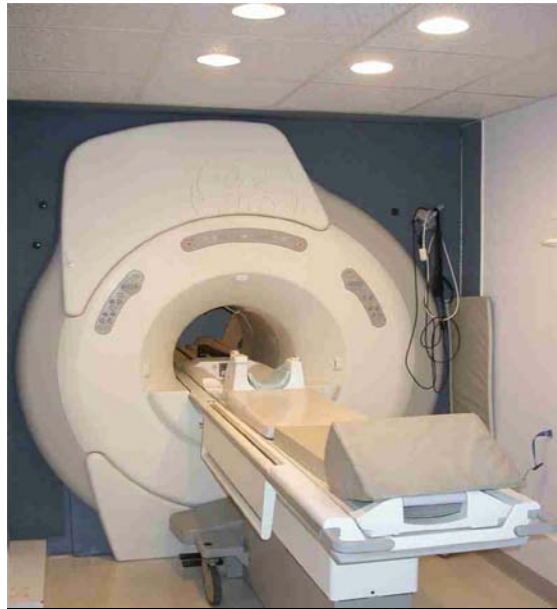
- Computed Tomographic Scanning (CT): Computer-enhanced X-ray image of the brain or body
- Magnetic Resonance Imaging (MRI): Uses a strong magnetic field, *not an X-ray*, to produce an image
- Functional MRI (fMRI): MRI that also records brain activity
- Positron Emission Tomography (PET): Computer-generated color image of brain activity, based on glucose consumption in the brain



CAT Scan



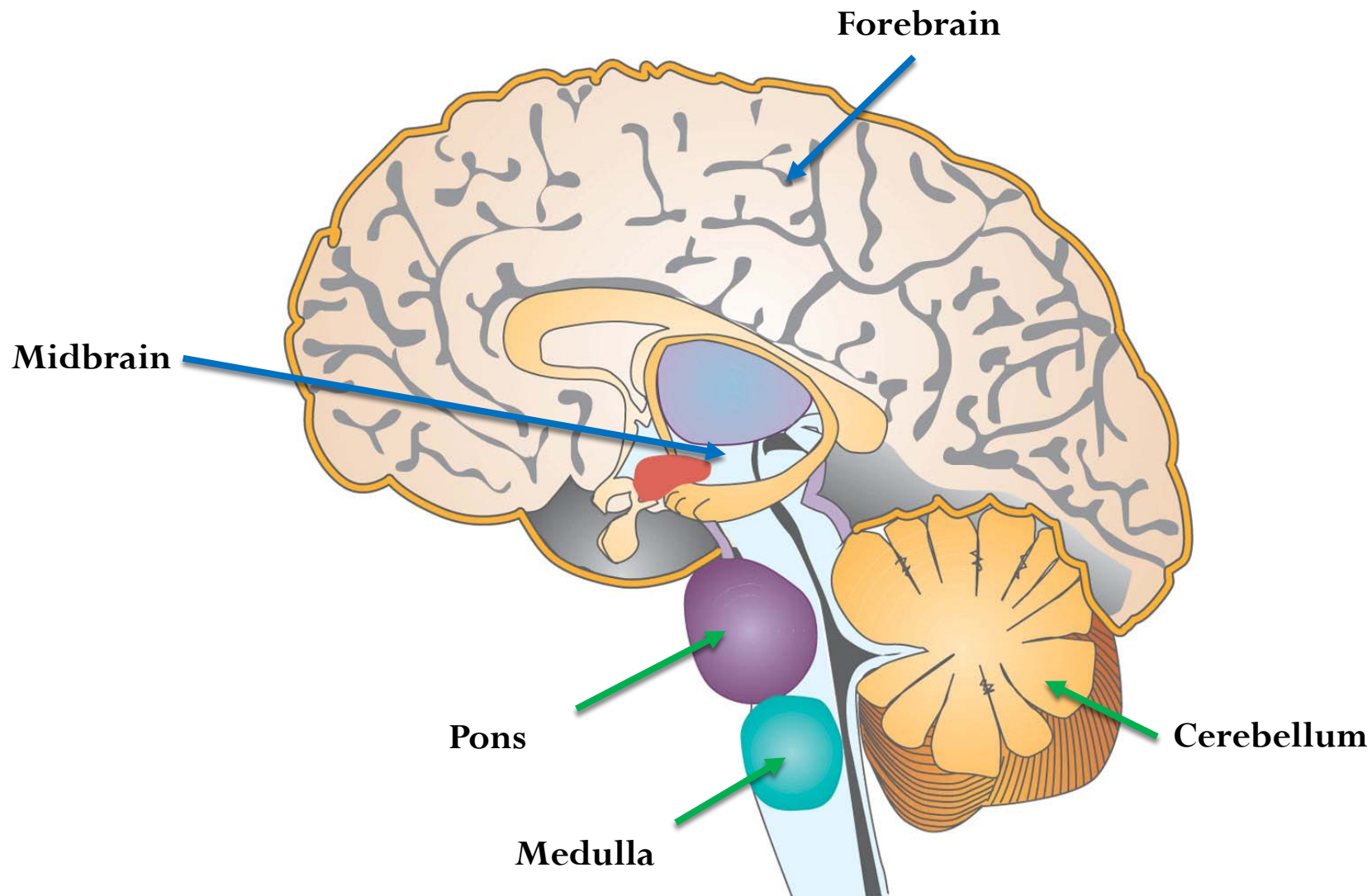
MRI



Structure of the brain

ORGANIZATION OF THE BRAIN (CONT.)

- Major Parts of the Brain
 - Forebrain
 - Midbrain
 - Hindbrain
 - pons
 - medulla
 - cerebellum



ORGANIZATION OF THE BRAIN (CONT.)

- Forebrain
 - largest part of the brain
 - has right and left sides called hemispheres
 - hemispheres are responsible for a number of functions, including learning and memory, speaking and language, emotional responses, experiencing sensations, initiating voluntary movements, planning, and making decisions

ORGANIZATION OF THE BRAIN (CONT.)

- Midbrain
 - has a reward or pleasure center, which stimulated by food, sex, money, music, looking at attractive faces, and some drugs (cocaine)
 - has areas for visual and auditory reflexes
 - contains the reticular formation, which arouses the forebrain so that it is ready to process information from the senses

ORGANIZATION OF THE BRAIN (CONT.)

- Hindbrain
 - Has three distinct structures:
 - Pons
 - Medulla
 - cerebellum

ORGANIZATION OF THE BRAIN (CONT.)

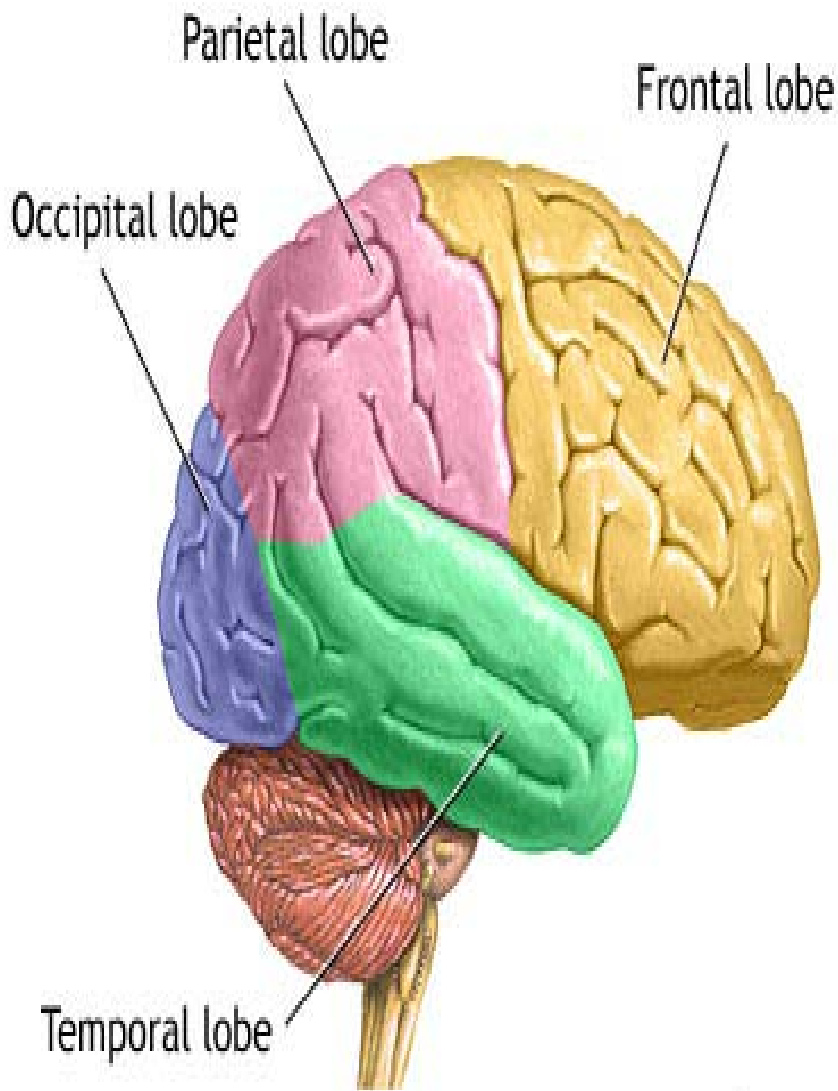
- Pons
 - functions as a bridge to interconnect messages between the spinal cord and brain
- Medulla
 - located on top of the spinal cord
 - includes a group of cells that control vital reflexes, such as respiration, heart rate, and blood pressure
- Cerebellum
 - located in the very back and underneath the brain
 - involved in coordinating motor movements but not in initiating voluntary movements

CONTROL CENTERS: FOUR LOBES

- Wrinkled cortex
 - a thin layer of cells that essentially covers the entire surface of the forebrain

CONTROL CENTERS: FOUR LOBES (CONT.)

- Four lobes
 - Frontal lobe
 - Parietal lobe
 - Occipital lobe
 - Temporal lobe



Left Hemisphere

Right Hemisphere

language

spatial reasoning

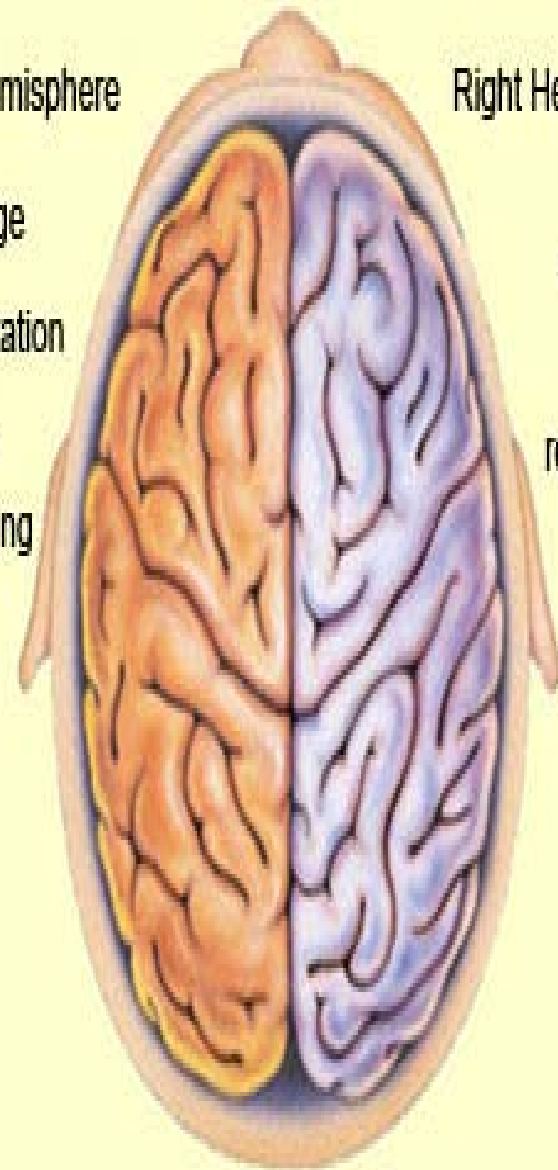
computation

face

logical reasoning

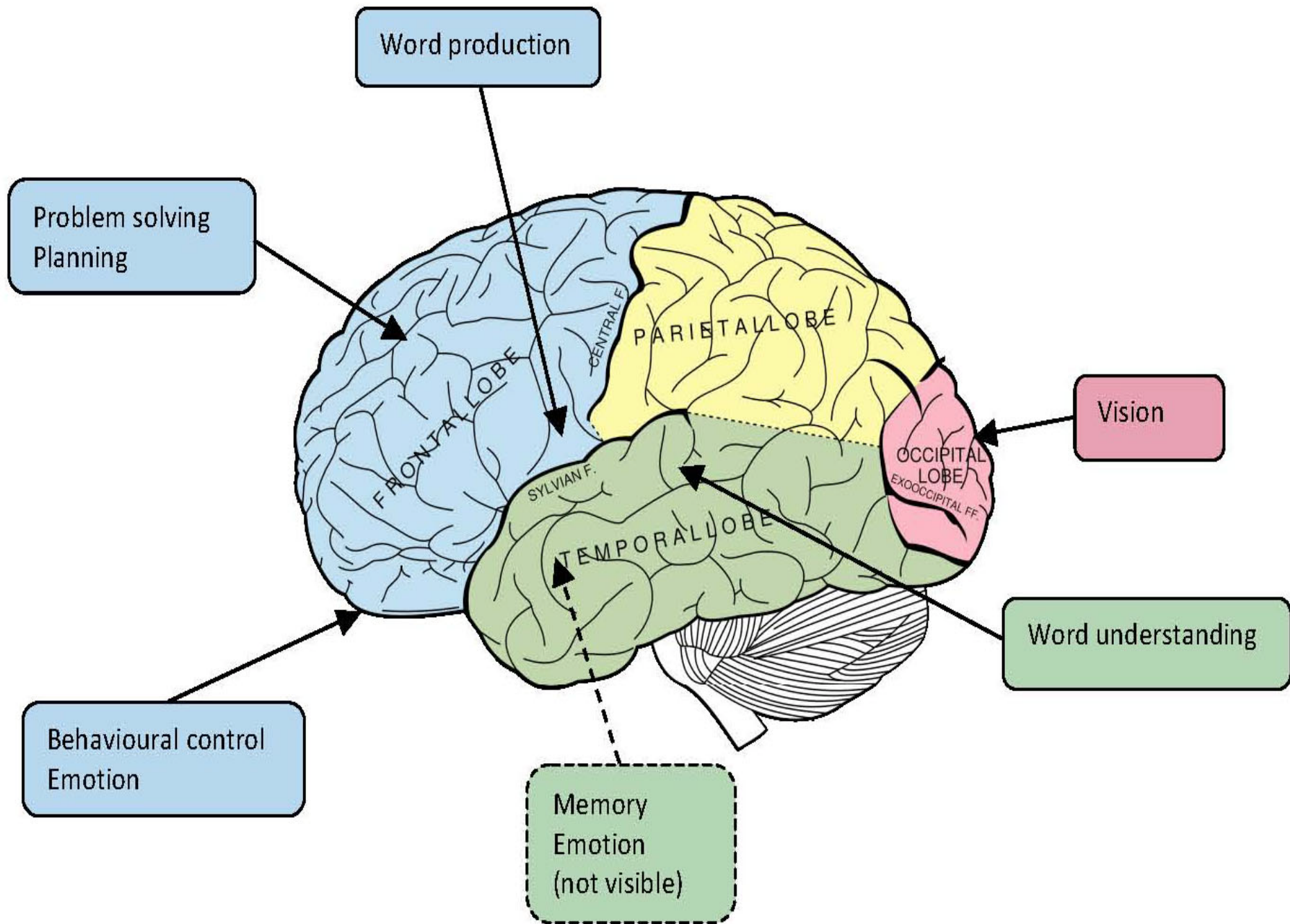
recognition

music



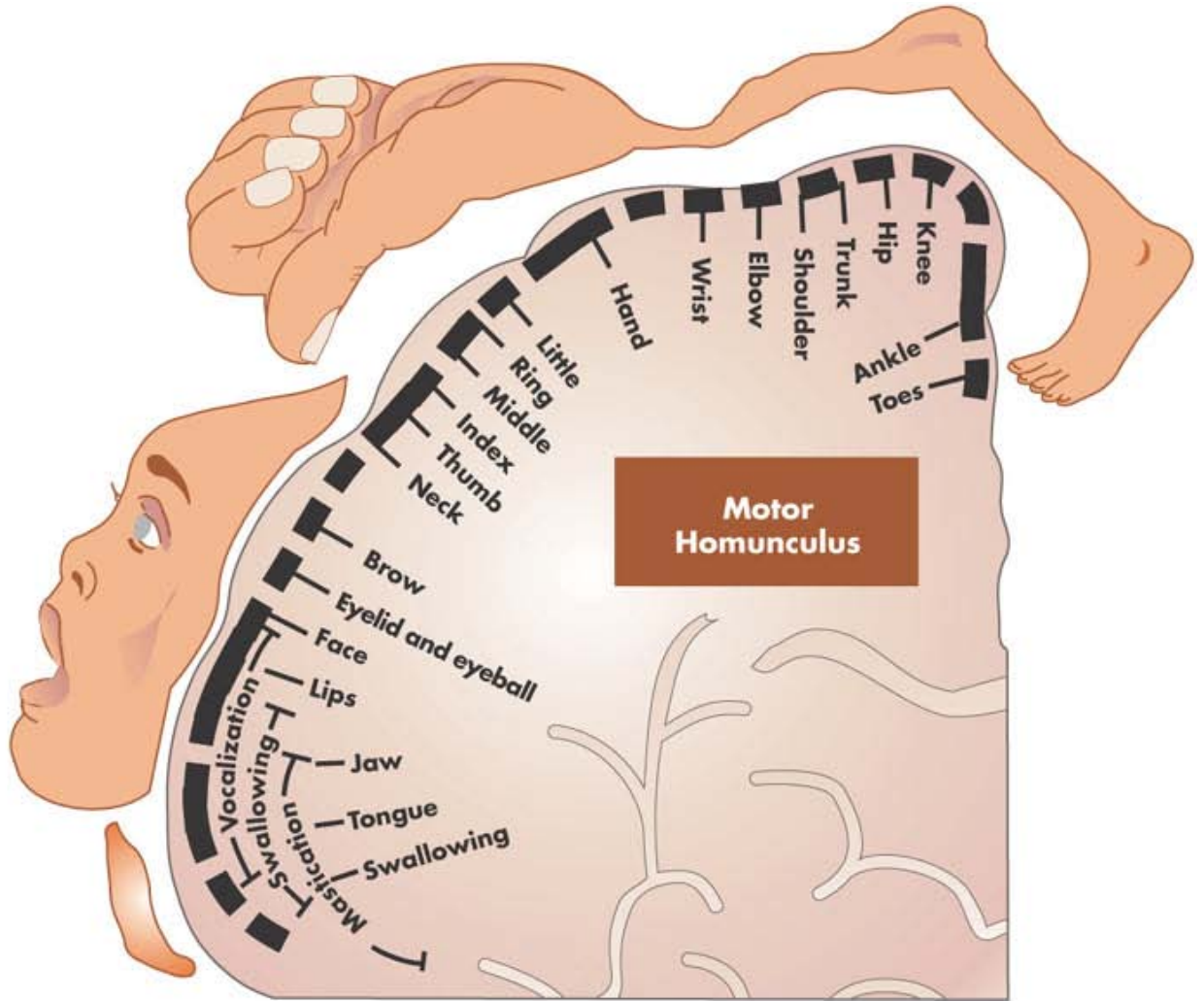
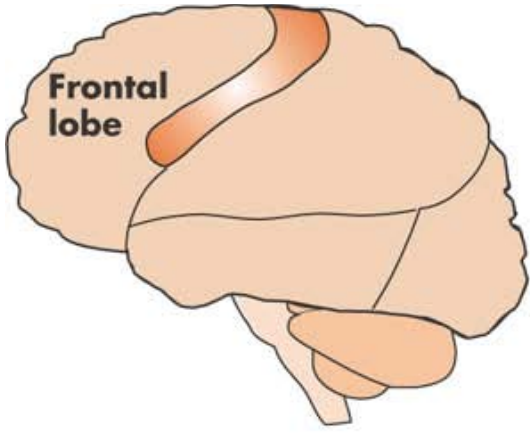
CONTROL CENTERS: FOUR LOBES (CONT.)

- Frontal lobe
 - involved with plan making, decision making, solve problems, personality, emotions, and motor behaviors
- Parietal lobe
 - involved with perception and sensory experiences
- Occipital lobe
 - involved with visual processing
- Temporal lobe
 - involved with hearing and speaking



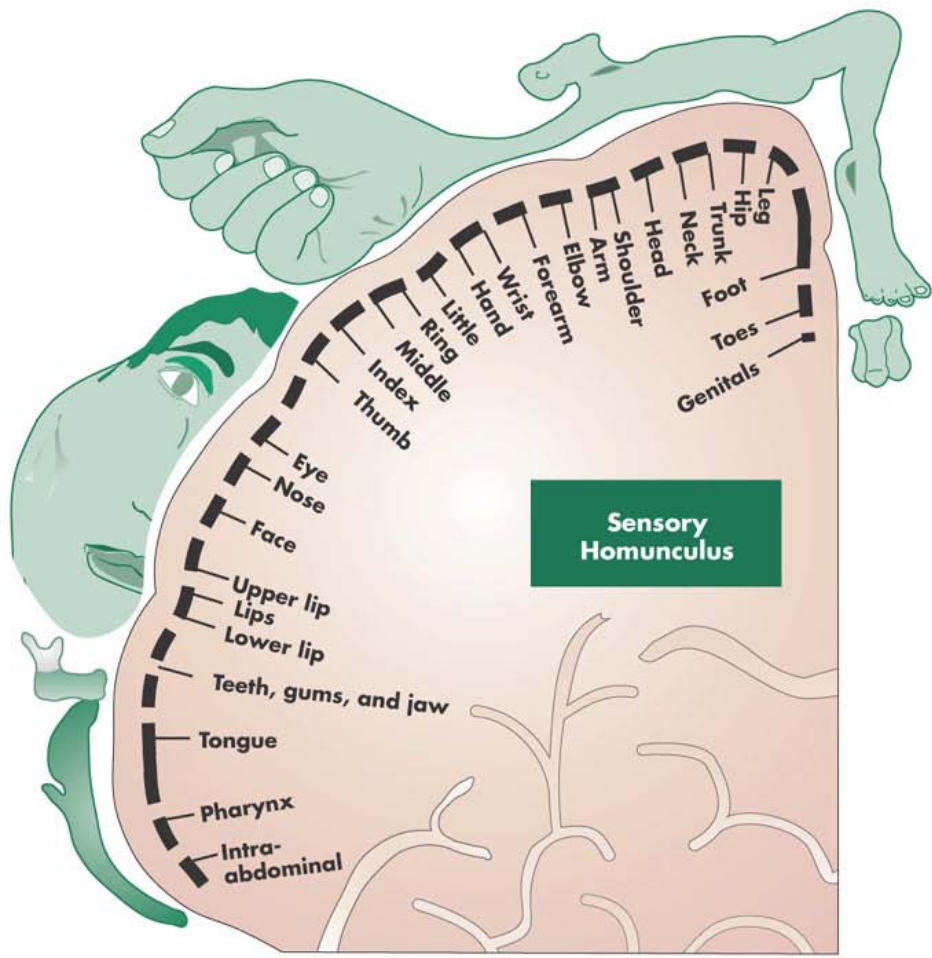
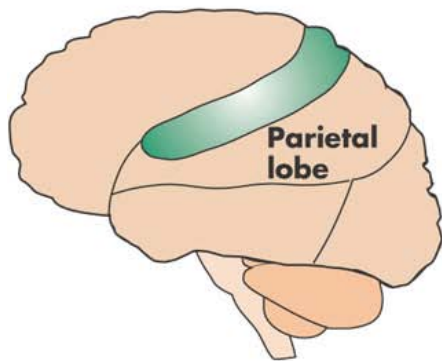
CONTROL CENTERS: FOUR LOBES (CONT.)

- Frontal lobe: functions
 - motor cortex
 - narrow strip of cortex that is located on the back edge of the frontal lobe and extends down its side
 - involved in the initiation of all voluntary movements
 - right side controls left
 - left side controls right
 - organization and function of motor cortex



CONTROL CENTERS: FOUR LOBES (CONT.)

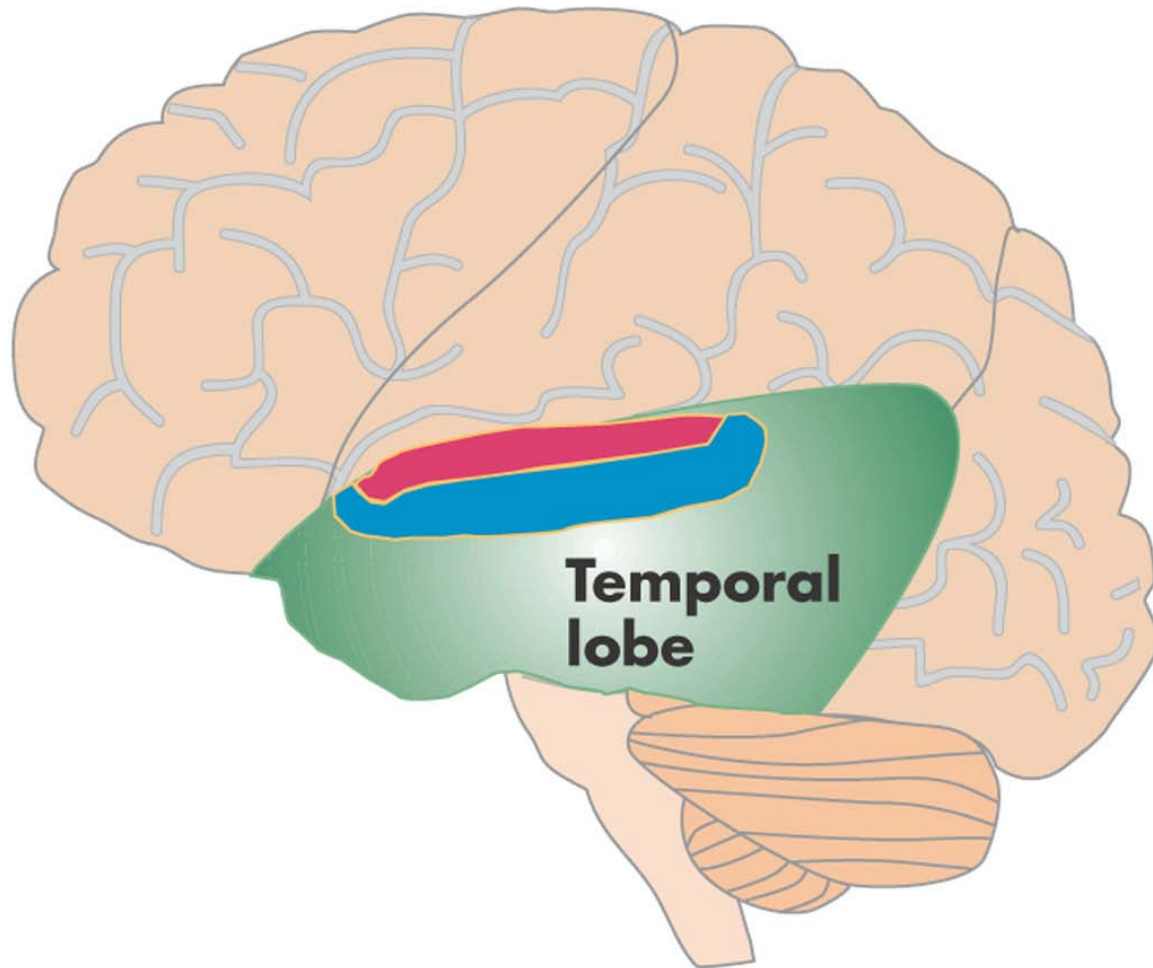
- Parietal lobe: function
 - location of somatosensory cortex
 - narrow strip of cortex that is located on the front edge of the parietal lobe and extends down its side
- Other functions of parietal lobe
 - involved in several cognitive functions, including recognizing objects, remembering items, and perceiving and analyzing objects in space



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CONTROL CENTERS: FOUR LOBES (CONT.)

- Temporal lobe: functions
 - primary auditory cortex
 - located on top edge of each temporal lobe, receives electrical signals from receptors in the ears and transforms these signals into meaningful sound sensations, such as vowels and consonants



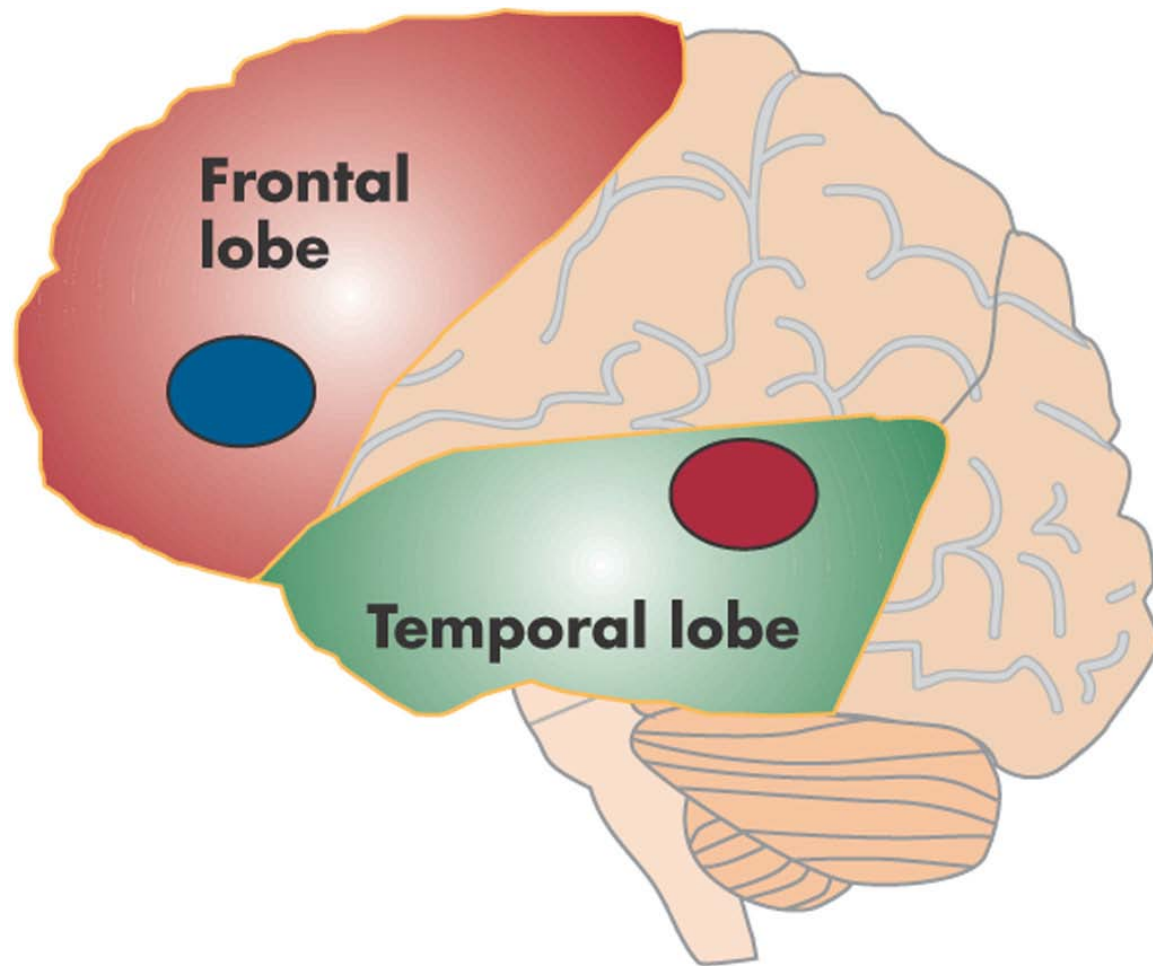
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CONTROL CENTERS: FOUR LOBES (CONT.)

- Temporal lobe: functions
 - auditory association area
 - located directly below the primary auditory cortex
 - transforms basic sensory information, such as noises or sounds, into recognizable auditory information, such as words or music

CONTROL CENTERS: FOUR LOBES (CONT.)

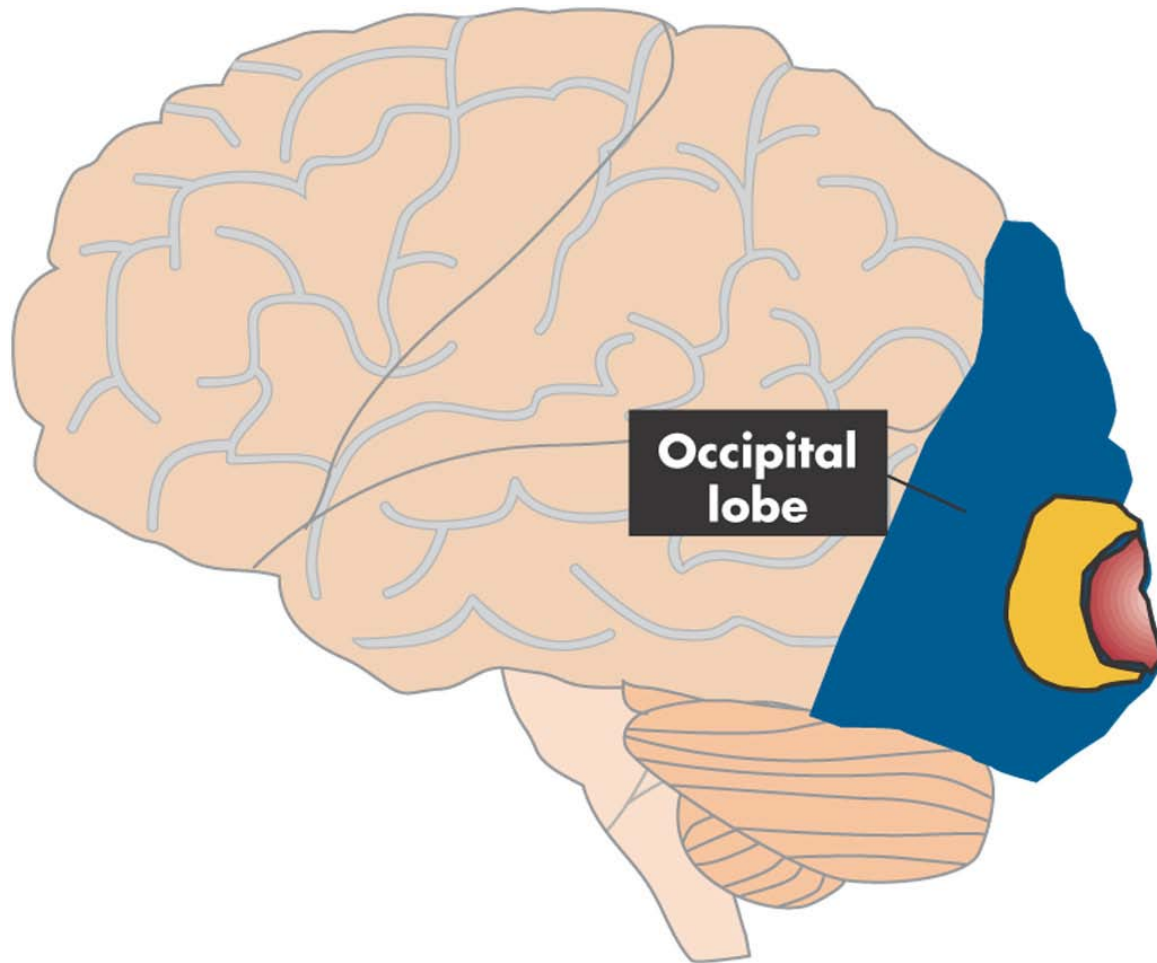
- Temporal lobe: functions
 - Broca's area - frontal lobe
 - located in left frontal lobe
 - necessary for combining sounds into words and arranging words into meaningful sentences
 - Wernicke's area
 - located in the left temporal lobe
 - necessary for speaking in coherent sentences and for understanding speech



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CONTROL CENTERS: FOUR LOBES (CONT.)

- Occipital lobe: functions
 - vision
 - primary visual cortex
 - located at the very back of the occipital lobe
 - receives electrical signals from receptors in the eyes and transforms these signals into meaningless basic visual sensations, such as lights, lines, shadows, colors, and textures



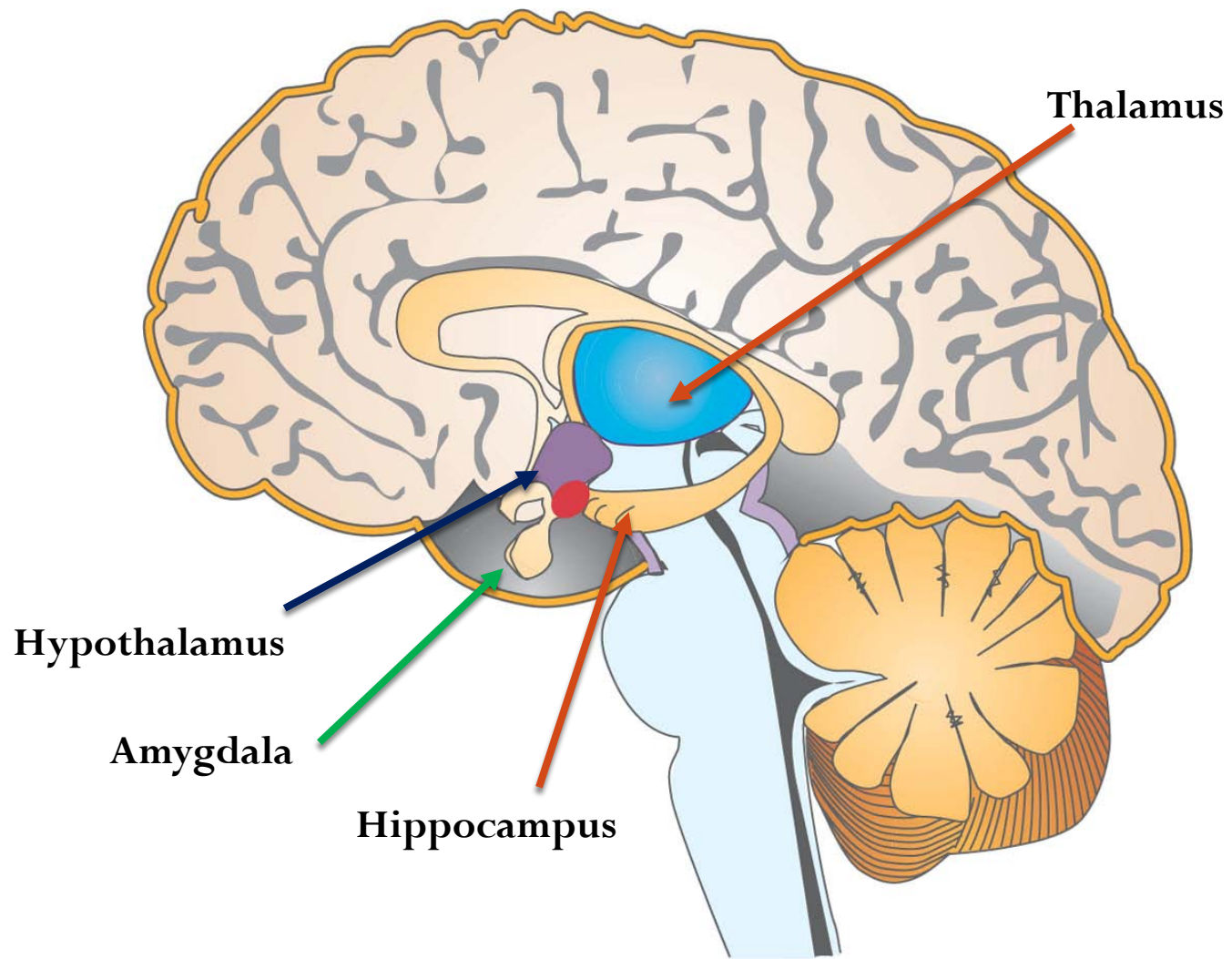
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CONTROL CENTERS: FOUR LOBES (CONT.)

- Occipital lobe: functions
 - visual association area
 - transforms basic sensations, such as lights, lines, colors, and textures, into complete, meaningful visual perceptions, such as persons, objects, or animals

LIMBIC SYSTEM: OLD BRAIN

- Structures and functions
 - Hypothalamus
 - Amygdala
 - Thalamus
 - Hippocampus



Thalamus

Hypothalamus

Amygdala

Hippocampus

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p80 LIMBIC SYSTEM

LIMBIC SYSTEM: OLD BRAIN (CONT.)

- Hypothalamus
 - regulates many motivational behaviors, including eating, drinking, and sexual responses; emotional behaviors such as arousing the body when fighting or fleeing, and secretion of hormones, such as occurs at puberty
- Amygdala
 - located in the tip of the temporal lobe
 - receives input from all the senses
 - evaluates the emotional significance of stimuli and facial expressions, especially those involving fear, distress, or threat

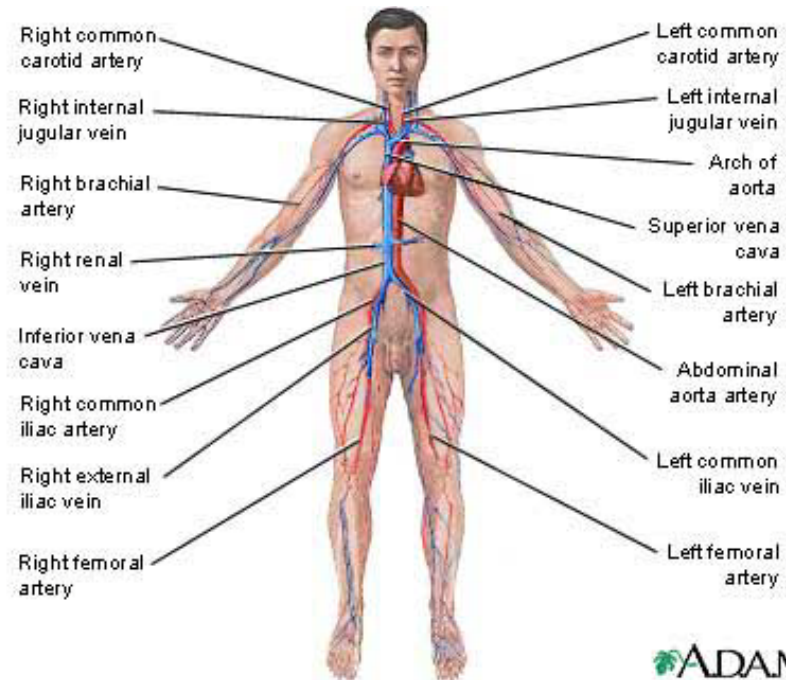
LIMBIC SYSTEM: OLD BRAIN (CONT.)

- Thalamus
 - gathers and processes information from the senses
 - involved in receiving sensory information, doing some initial processing, and then relaying the sensory information to areas of the cortex
- Hippocampus
 - curved structure inside the temporal lobe
 - Involved in saving many kinds of fleeting memories by putting them into permanent storage in various parts of the brain

Endocrine System

What is the endocrine system and how does it influence behavior?

- the **endocrine system** is the body's system of ductless (no passageways) glands that secrete *hormones* and release them directly into the bloodstream.



Hypothalamus

Pineal gland

Pituitary gland

Parathyroid glands

Thyroid glands

Thymus

Liver

Adrenal gland

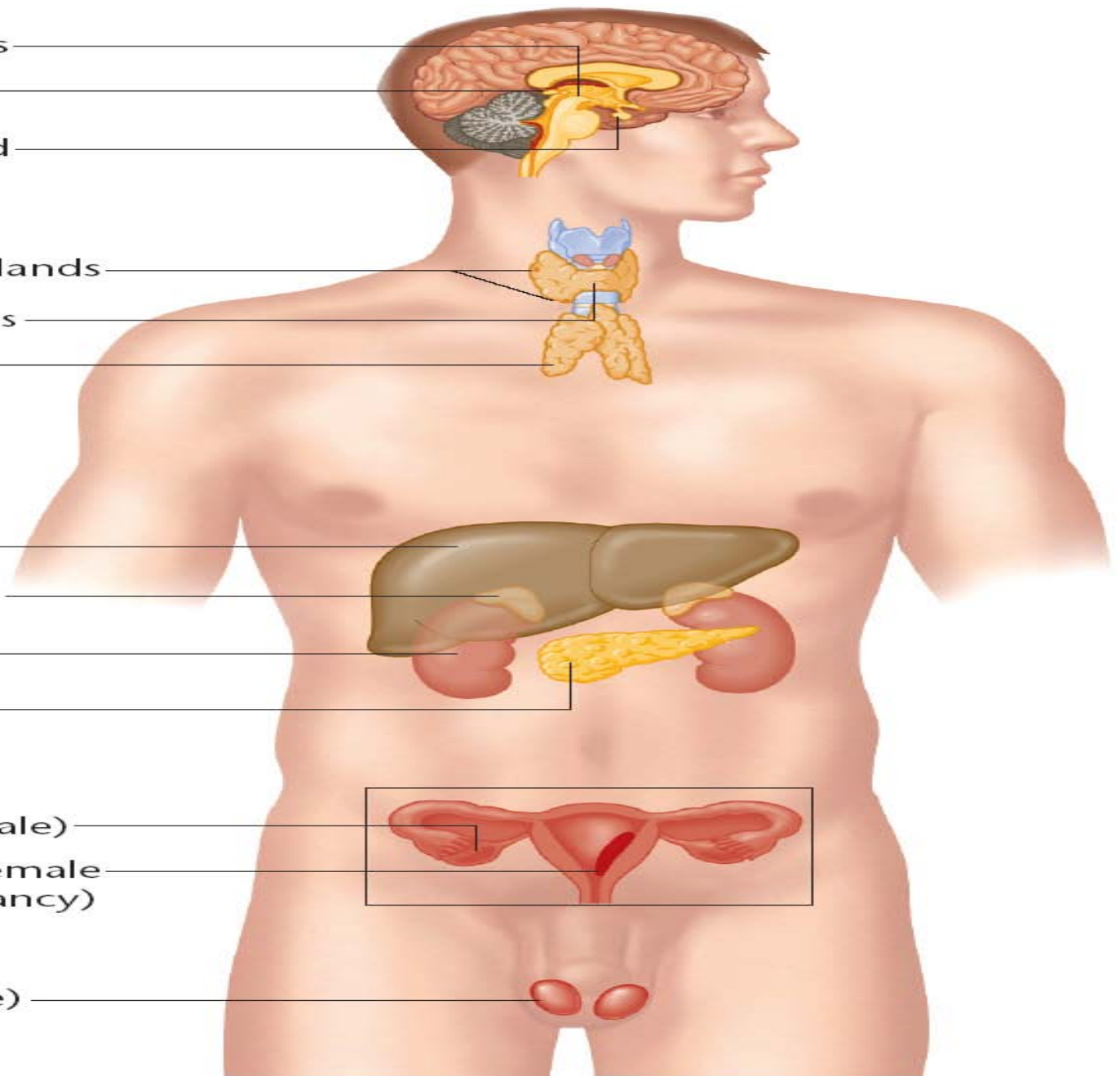
Kidney

Pancreas

Ovary (in female)

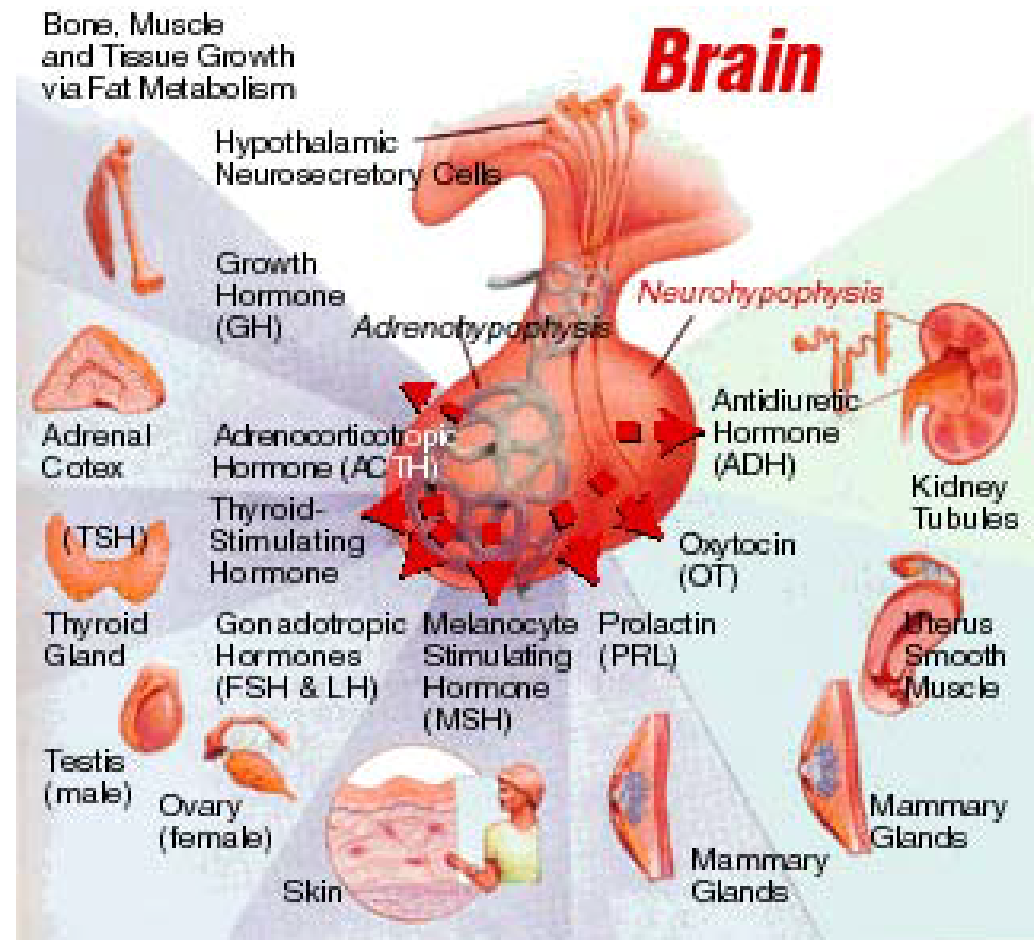
Placenta (in female during pregnancy)

Testis (in male)



What is the endocrine system and how does it influence behavior?

- *Hormones* are substances that regulate various bodily functions. When there is an imbalance in a function (temperature, blood sugar, fluid levels), hormones are released to restore the balance

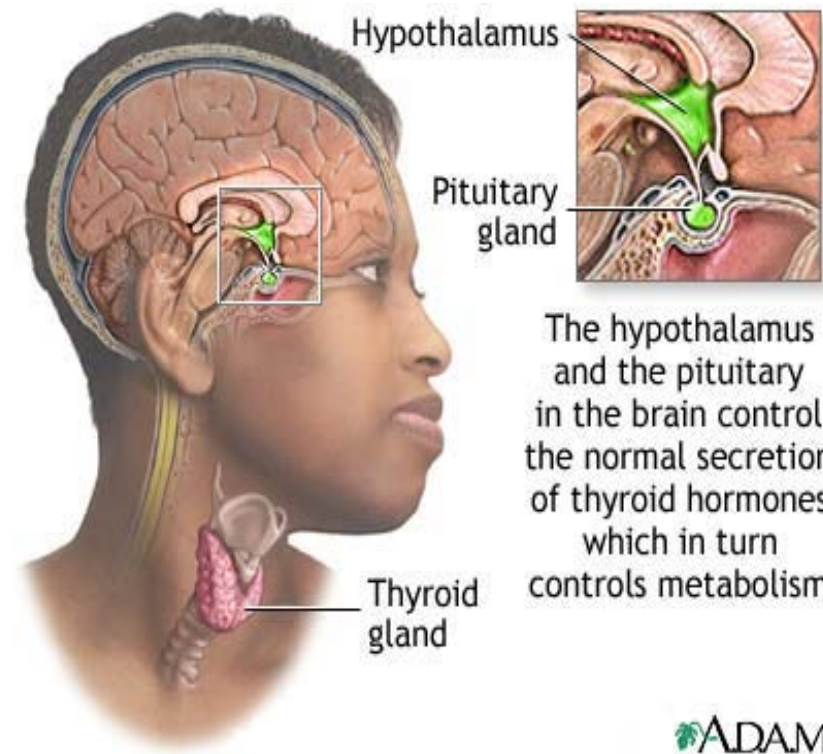
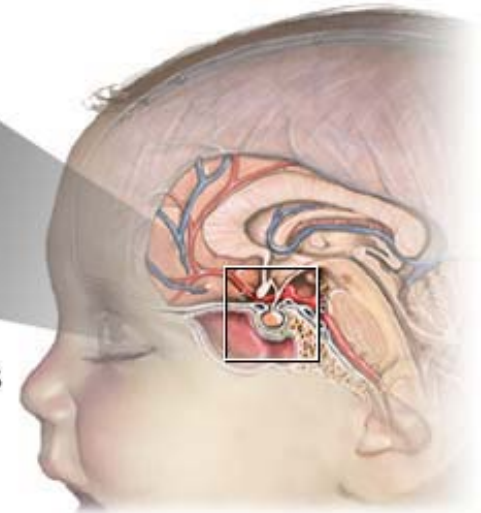


What is the endocrine system and how does it influence behavior?

- The **pituitary gland**, regulated by the hypothalamus, is the ‘master gland’ that releases hormones influencing growth, maternal behavior, sleep-wake cycles, onset of puberty, etc.



The pituitary secretes hormones that are essential to growth and reproduction



The hypothalamus and the pituitary in the brain control the normal secretion of thyroid hormones which in turn controls metabolism

THE ENDOCRINE SYSTEM

HYPOTHALAMUS

Regulates hunger, thirst, sleep and wakefulness plus most of your involuntary mechanisms including body temperature.

PITUITARY GLAND

Controls all other endocrine glands; influences growth, metabolism and regeneration.

THYROID GLANDS

Regulates your energy and your metabolism.

PARATHYROID

Secretes the hormones necessary for calcium absorption.

PANCREAS

Aids in the digestion of protein, fats and carbohydrates. Produces insulin which controls blood sugar levels.

THYMUS

Helps build resistance to disease.

OVARIES

Influences how your blood circulates and determines your mental vigor and your sex drive. (Testes in males.)

ADRENAL GLANDS

Secretes hundreds of compounds including cortisone & adrenaline which helps you react to emergencies. Regulates your metabolic processes in the cells, water balance, blood pressure, etc.

METABOLISM - The conversion of nutrients into energy and building materials to meet your body's needs.

