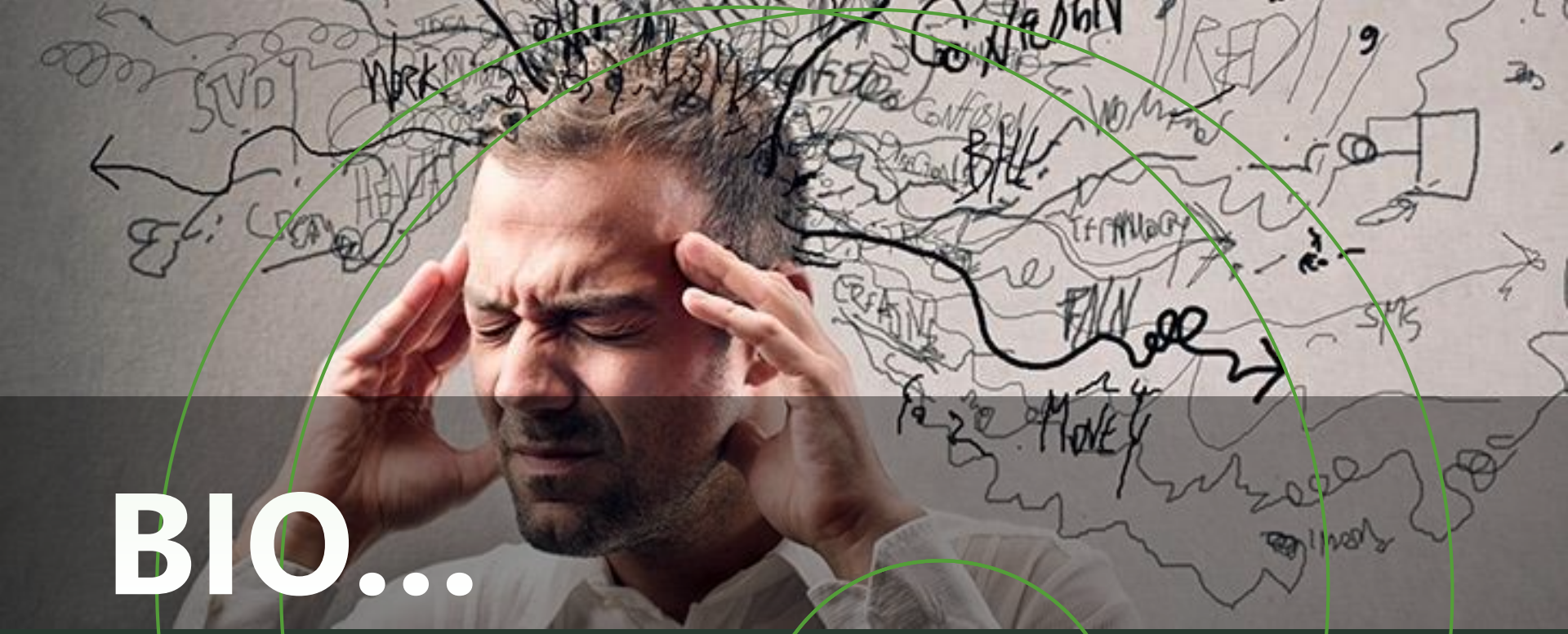


BIO...

PSYCHOLOGY!

Muhammad Asim

The Nervous System

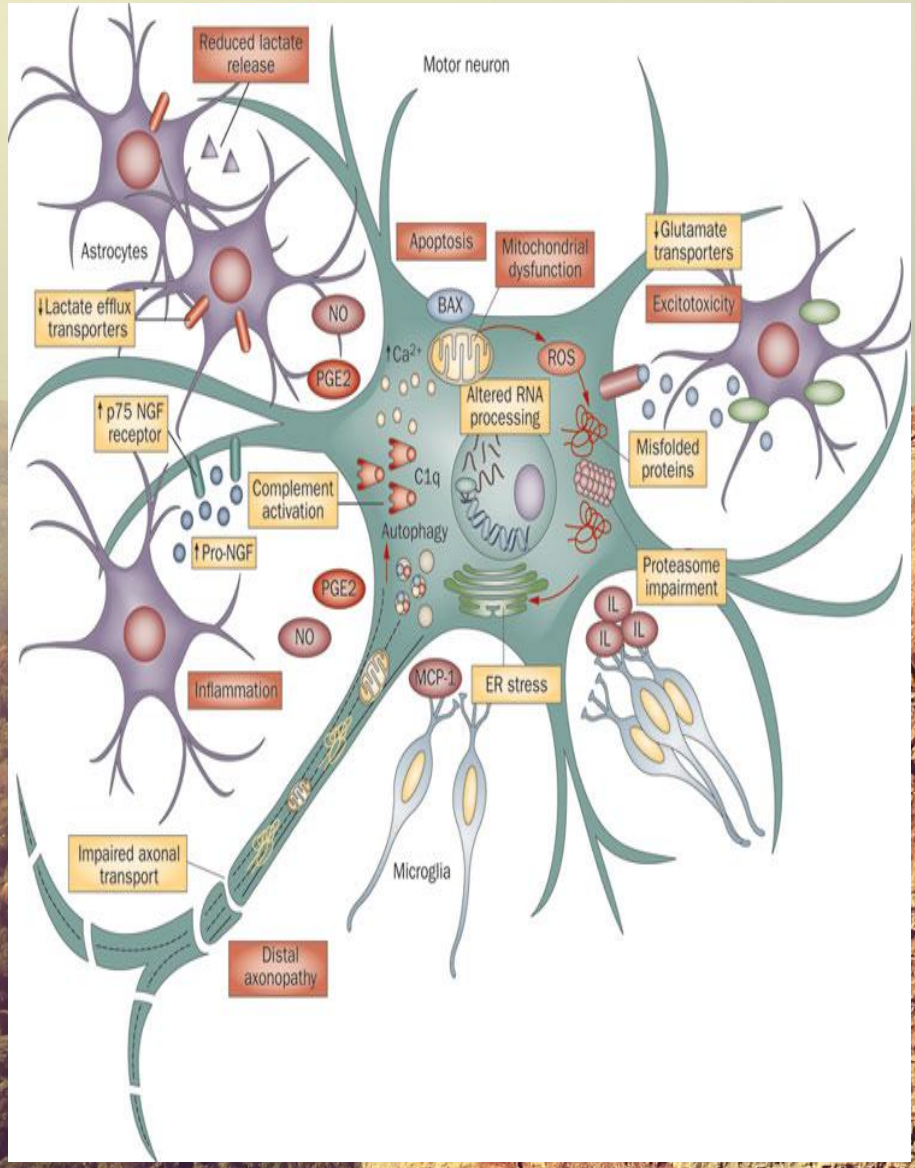
An extensive network of specialized cells that carry information to and from all parts of the body.

Composed of 2 basic cells:

Glial and neurons

DID YOU KNOW:

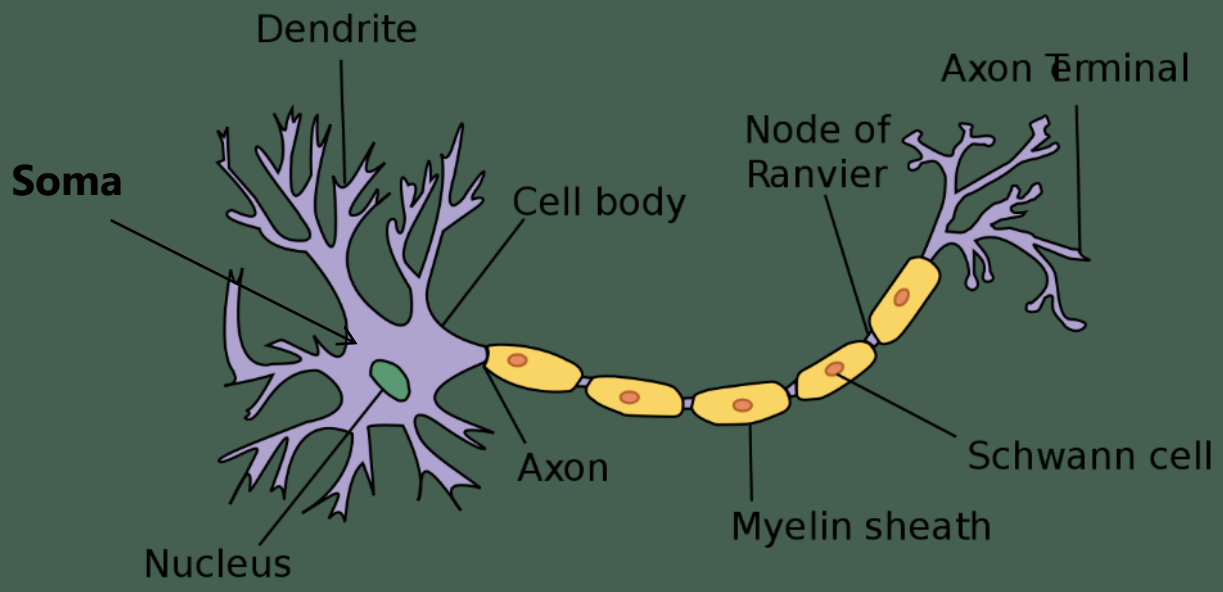
There are about **100 billion neurons** *in the brain, but they make up only 10% of cells in that region (the other 90% are made up of glial cells).*



TWO TYPES OF CELLS

GLIAL CELLS
(supports neuron)

1. **DO NOT Conduct electrical pulses**
2. Provide support for the neurons to grow around
3. Deliver nutrients to neurons
4. Cleans up waste products



BASIC CELL that makes up the nervous system = D.A.M.S.

NEURONS
(Transmits neurons)

Dendrites- Receives signals

Axon- Sends signal → neurons.

Myelin Sheath- Fatty substance. Coats the axon.

Soma- body of the cell.

HOW DO NEURONS COMMUNICATE?

ELECTRICITY AND CHEMICALS

Ions

Charged molecules (atoms)

Resting Potential

The state of the neuron when not firing a neural impulse

Action Potential

The release of the neural impulse consisting of reversal of the electrical charge within the axon

All or None

Refers to the fact that a neuron either fires completely or does not fire at all.

Return to resting potential.

NEUROTRANSMITTERS

What are they?

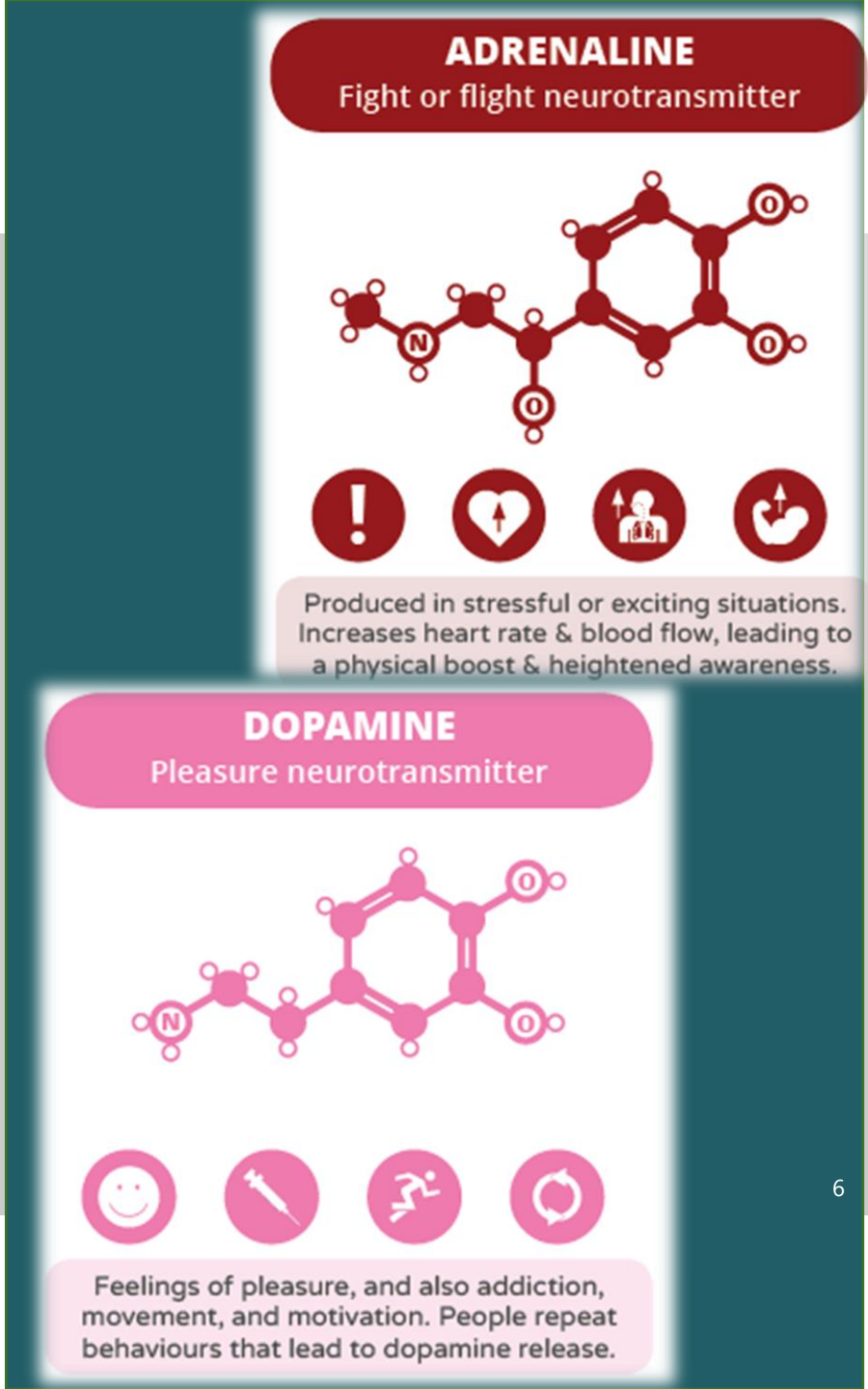
Neurotransmitters

(Chemical Messengers)

...are the brain chemical messengers, to communicate information throughout our brain and body.

NEURON TO TARGET CELL

There are at least 100 identified neurotransmitters in the body.



Types of Neurotransmitters

Neurotransmitter	Involved in	Potential Effect on Behavior
Acetylcholine	Muscle action, memory	Increased arousal, enhanced cognition
Beta-endorphin (Endorphin)	Pain, pleasure	Decreased anxiety, decreased tension
Dopamine	Mood, sleep, learning	Increased pleasure, suppressed appetite
Gamma aminobutyric acid (GABA)	Brain function, sleep	Decreased anxiety, decreased tension
Glutamate	Memory, learning	Increased learning, enhanced memory
Norepinephrine	Heart, intestines, alertness	Increased arousal, suppressed appetite
Serotonin	Mood, sleep	Modulated mood, suppressed appetite

Neurotransmitters and Drugs

Psychologists who take a biological approach to understanding behavior propose that psychological disorders (e.g., depression) are the result of imbalances in one or more type of neurotransmitter.

Psychotropic medications are drugs used to treat psychological disorders by helping to restore neurotransmitter balance.

Neuron Communication

Excitatory neurotransmitter/synapse

the effect of a neurotransmitter that causes the receiving cell to fire (probability of potential action)

Inhibitory neurotransmitter/synapse

The effect of a neurotransmitter that causes the receiving cell to stop firing

Chemical substances can affect neuronal communication.

Agonists – Activates receptors. Stimulates action. Produces a physiological response.

Antagonists - interferes with or inhibits the physiological action of another.

Overview
OF THE NERVOUS SYSTEM

brain

spinal cord

central nervous system

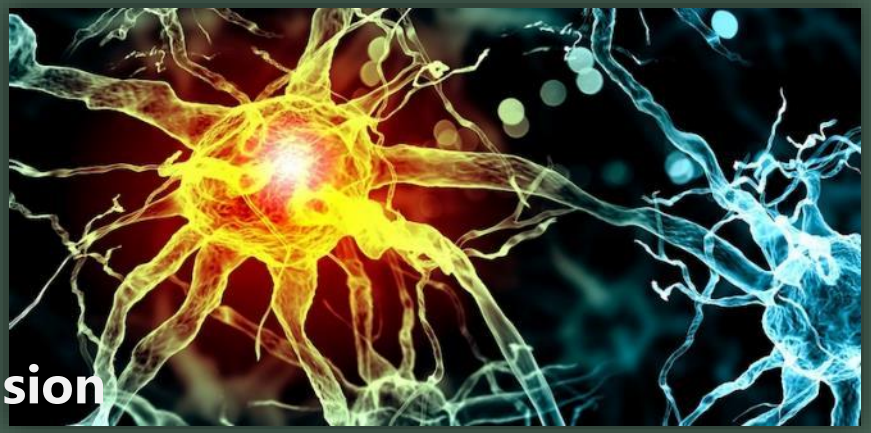
autonomic nervous system

peripheral nervous system

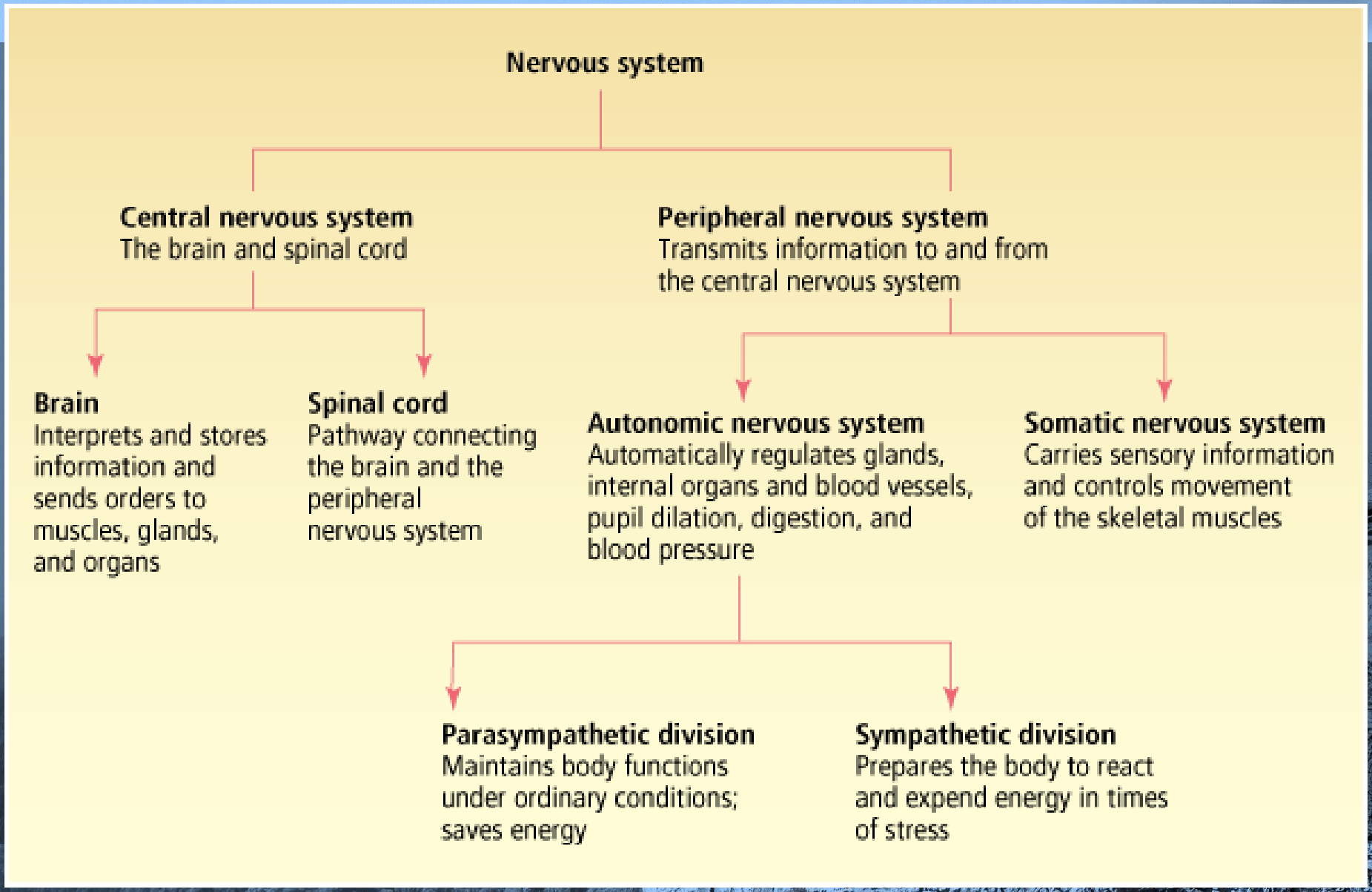
The nervous system is an extensive network of specialized cells that carry information to and from all parts of the body.

parasympathetic division

somatic nervous system



sympathetic division

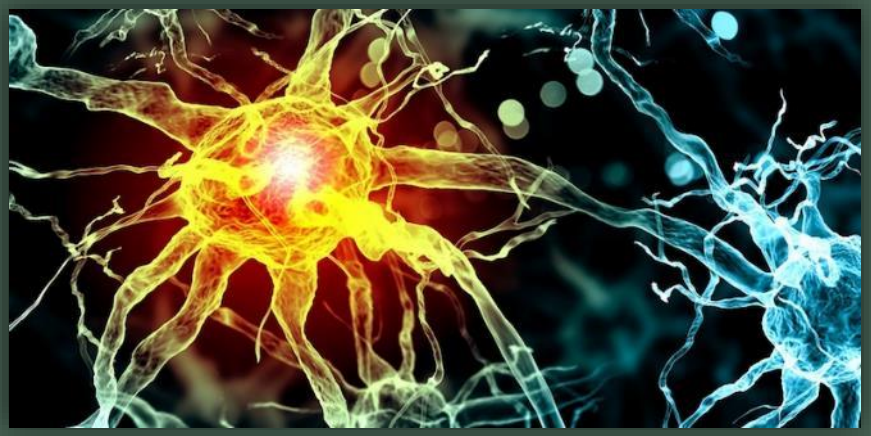

Nervous system
Central nervous system
The brain and spinal cord
Peripheral nervous system
Transmits information to and from the central nervous system
Brain
Interprets and stores information and sends orders to muscles, glands, and organs
Spinal cord
Pathway connecting the brain and the peripheral nervous system
Autonomic nervous system
Automatically regulates glands, internal organs and blood vessels, pupil dilation, digestion, and blood pressure
Somatic nervous system
Carries sensory information and controls movement of the skeletal muscles
Parasympathetic division
Maintains body functions under ordinary conditions; saves energy
Sympathetic division
Prepares the body to react and expend energy in times of stress

Overview
OF THE NERVOUS SYSTEM

!

Neuroscience

Study of structure and function of nervous system



Peripheral Nervous System

all nerves ~~outside of the brain~~ and spinal cord

Somatic nervous system

Autonomic nervous system

Nervous Systems

Somatic Nervous System (SNS)
(Soma=body)

1. Voluntary control of body movements
2. Sensory\motor nerves
3. Controls all voluntary muscular systems

Regulates the body's unconscious actions

Autonomic Nervous System

1. Control system
2. Influences function of internal organs
    1. Breathing
    2. Heartbeat
    3. Digestive process

Autonomic Nervous System

Sympathetic nervous system (fight-or-flight) - responsible for reacting to stressful events and bodily arousal.

Parasympathetic nervous system

a. restores the body to normal functioning after arousal

b. responsible for the day-to-day functioning of the organs and glands.

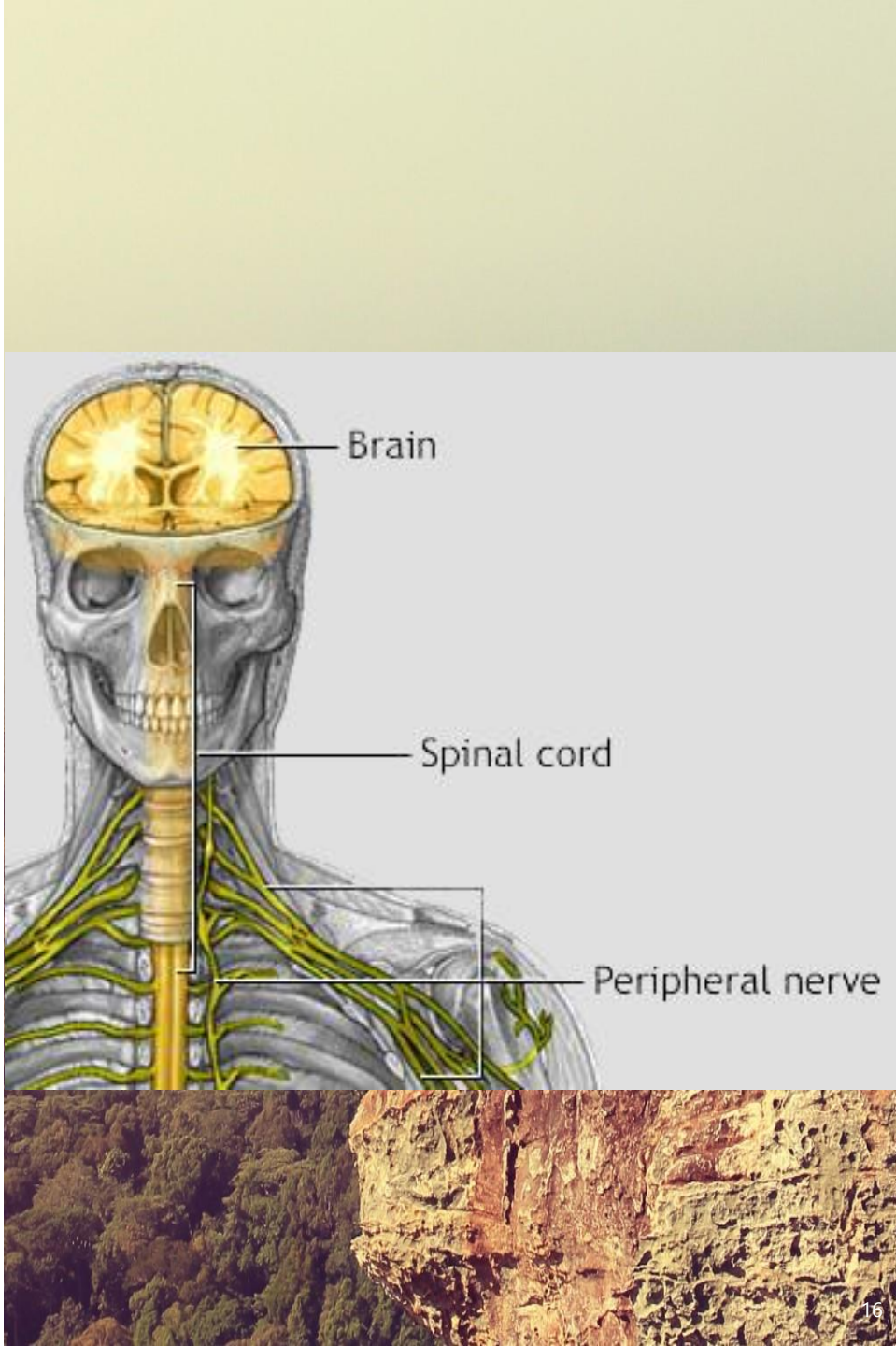
Both systems work together to maintain the body's homeostasis (balance).

The Central Nervous System

part of the nervous system consisting of the brain and spinal cord.

SPINAL CORD

- a long bundle of nervous tissue and support sells
- carries messages to and from the body to the brain that is responsible for very fast, lifesaving reflexes.



Types of Neurons

Sensory Neuron

1. Carries impulses from sensory stimuli towards central nervous system and brain
2. Also called afferent neuron.

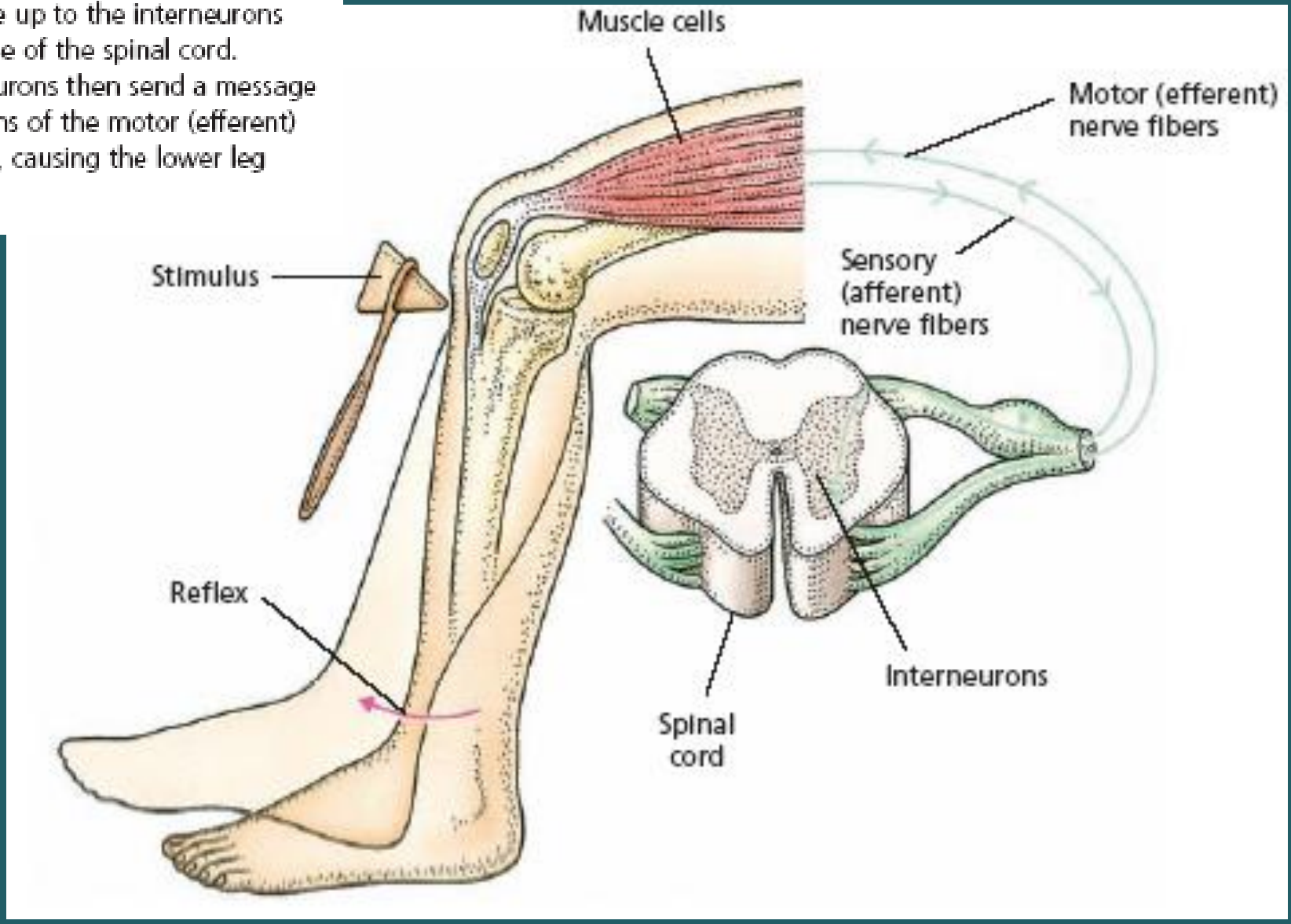
Interneuron

1. a neuron found in the center of the spinal cord
2. receives information from the sensory neurons and sends commands to the muscles through the motor neurons (connect the sensory and motor neurons)
3. Interneurons are found both in the spinal cord and the brain)

Motor Neuron

1. a neuron that carries messages from the central nervous system (spinal cord) to the muscles and glands of the body.
2. Also called efferent neuron.

FIGURE 2.5 **The Spinal Cord Reflex**
The hammer tap just below the kneecap stimulates the sensory (afferent) nerve fibers, which carry the message up to the interneurons in the middle of the spinal cord. The interneurons then send a message out by means of the motor (efferent) nerve fibers, causing the lower leg to jerk.

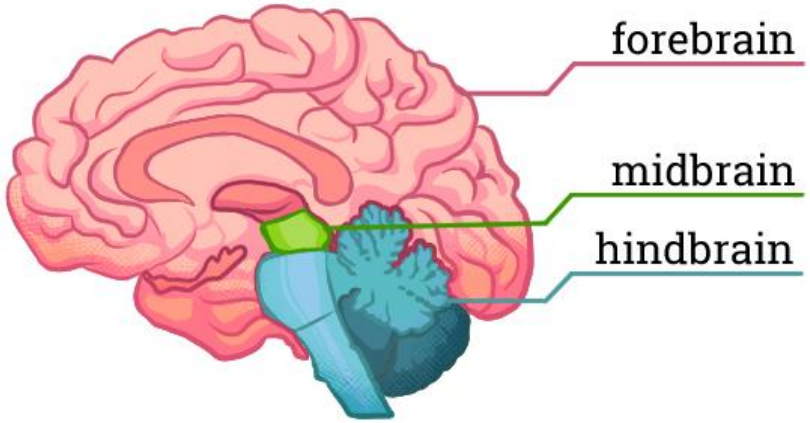



DIVISIONS
of The Brain

DIVISIONS OF THE BRAIN
The Forebrain, the Midbrain, and the Hindbrain

The Forebrain

- Largest part of the brain
- Controls thinking, decision making, behavior etc. (cerebrum)



The Hindbrain

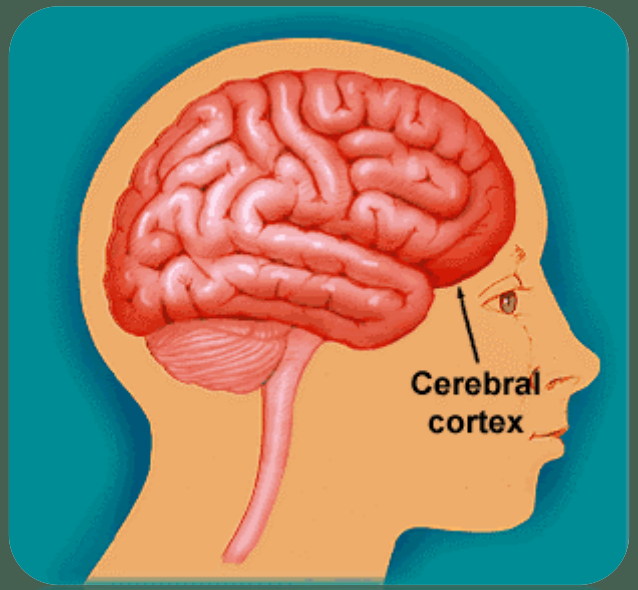
- Controls breathing, heartbeat, and blood flow

Midbrain

- Controls auditory and visual functioning
- Motor movement

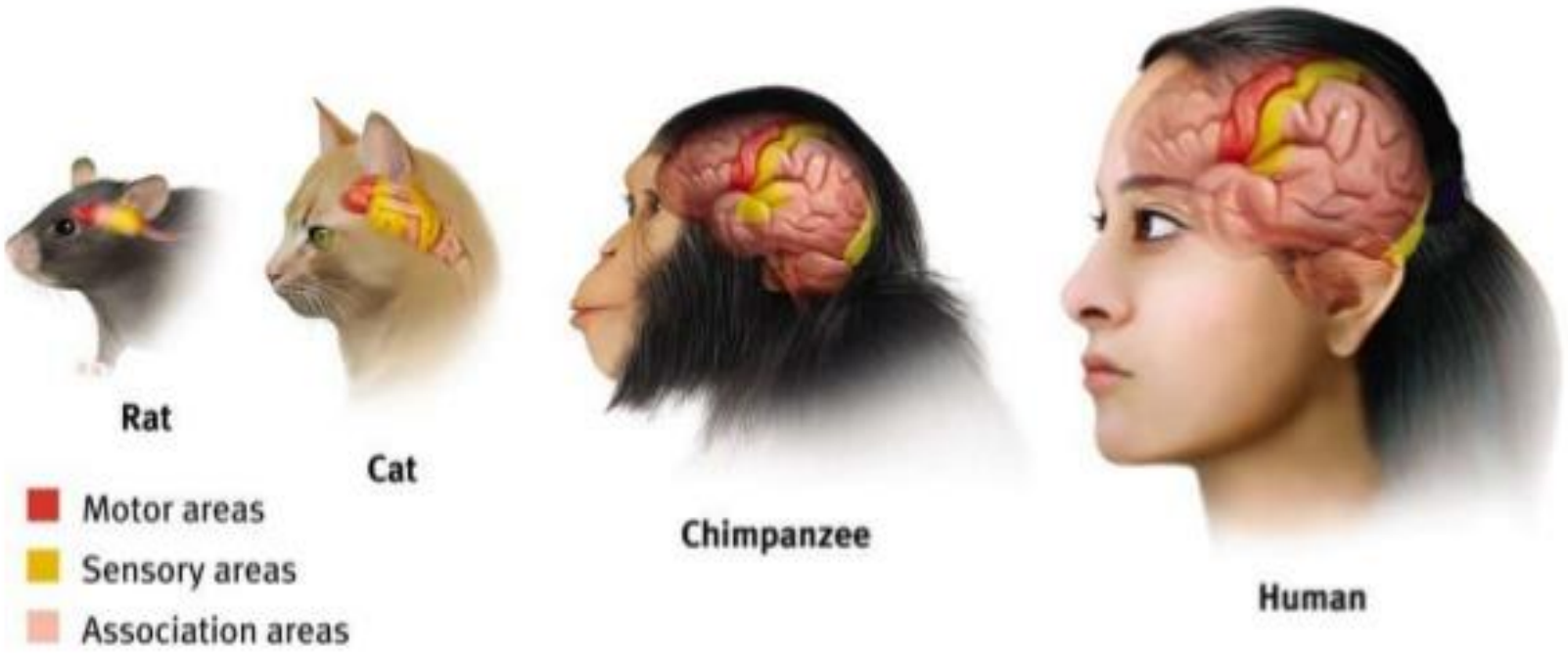
Cerebral Cortex

outermost covering of the brain consisting of densely packed neurons, responsible for higher thought processes and interpretation of sensory input

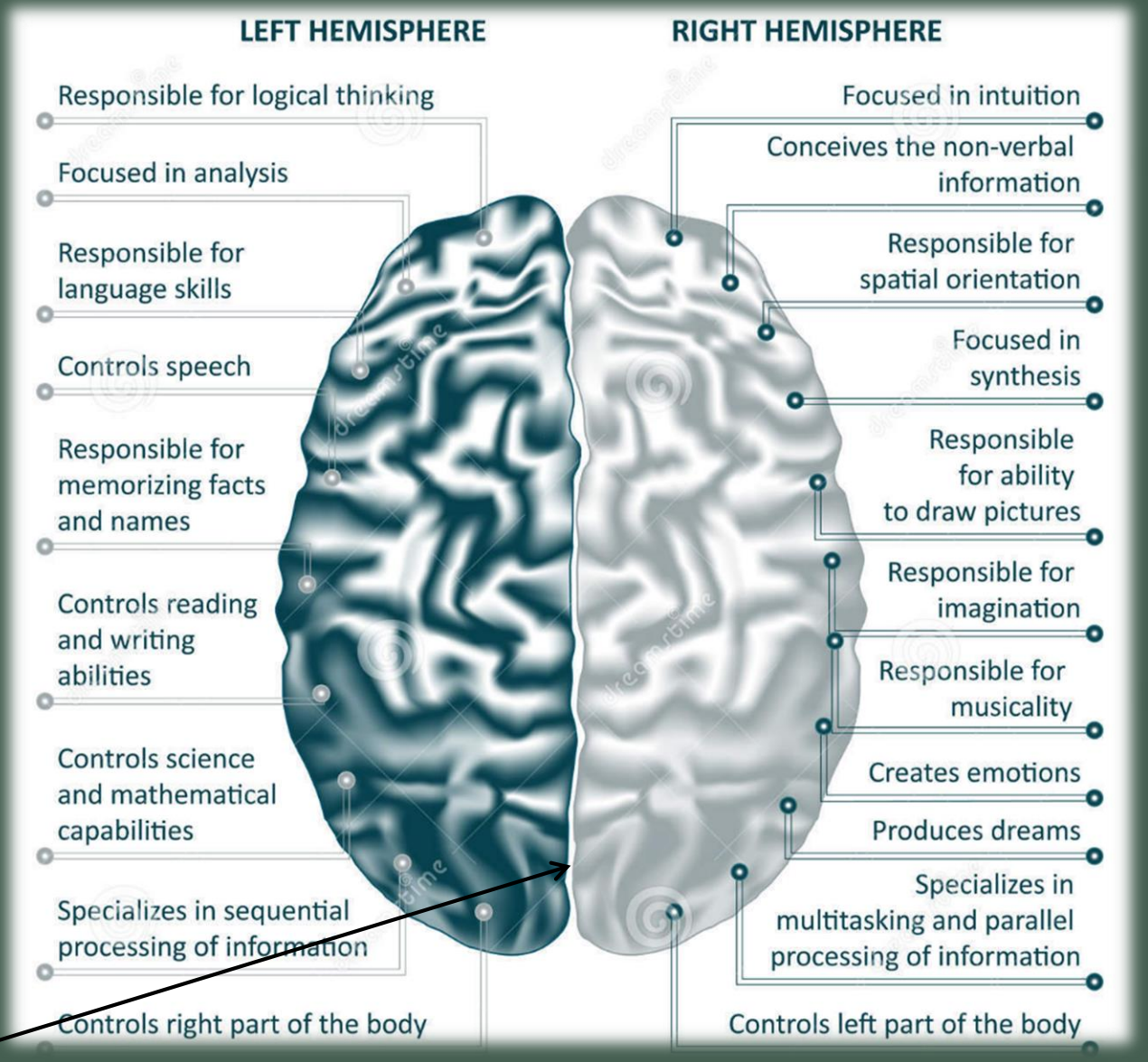


Association function of the cortex

More complex animals have more cortical space devoted to integrating/associating information



Analyzing the Hemispheres: Results of Split Brain Research



<u>Longitudinal Fissure</u>
Deep grooves

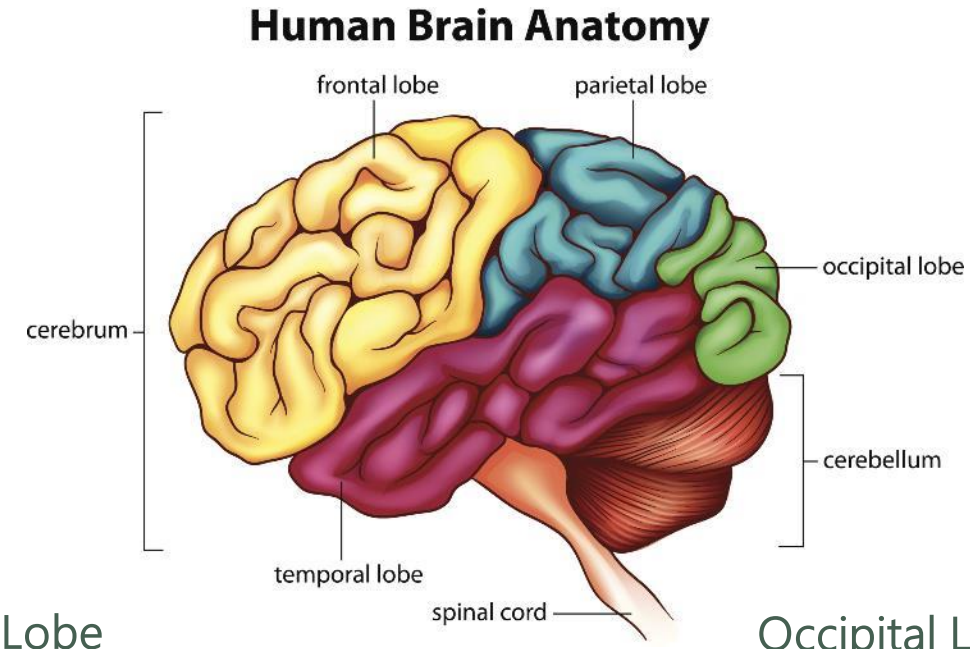
FOUR LOBES OF THE BRAIN

Frontal Lobe

- Behavior
- Learning
- Personality
- Movement

Parietal (pa·ri·e·tal) Lobe (top)

- Reception and correlation of sensory information



Temporal Lobe (under temple)

- Understanding
- Speech

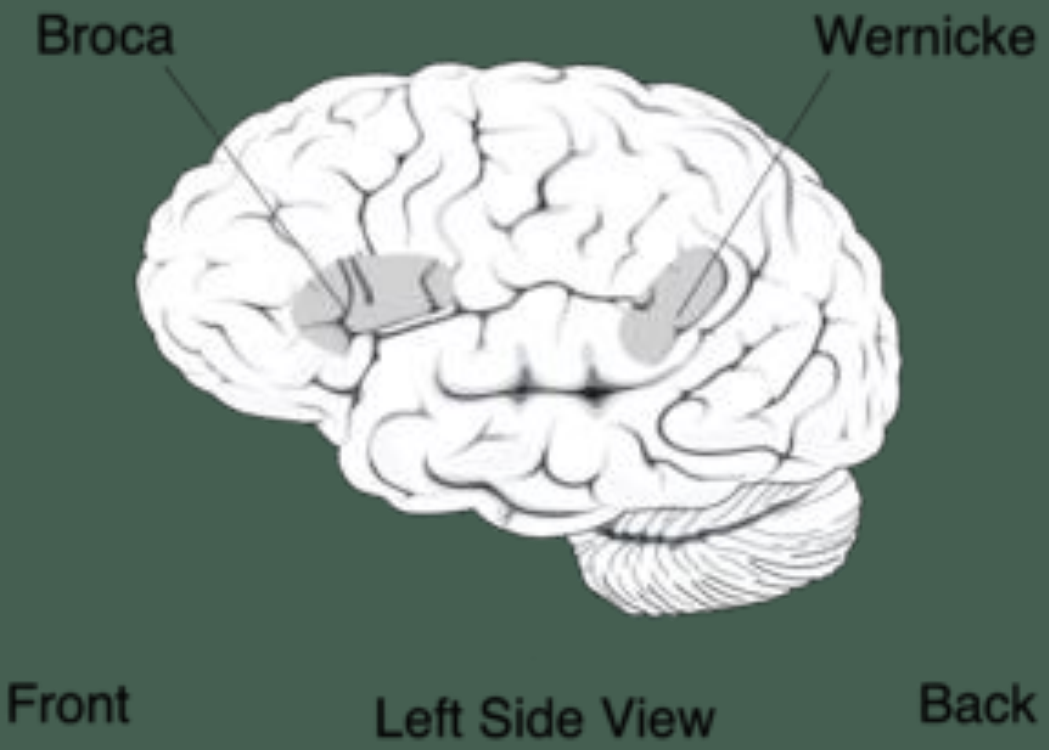
Occipital Lobe

- Visual processing center
- Helps to understand what your eyes are seeing

Association areas

Links and coordinating sensory and motor

Interpretation (sensory and motor)



Broca's aphasia (speech)
condition resulting from damage to Broca's area (usually in left frontal lobe), causing the affected person to be unable to speak fluently, to mispronounce words, and to speak haltingly

Wernicke's aphasia (comprehension)
condition resulting from damage to Wernicke's area (usually in left temporal lobe), causing the affected person to be unable to understand or produce meaningful language

STRUCTURES OF THE CORTEX

What should you know?

LIMBIC SYSTEM

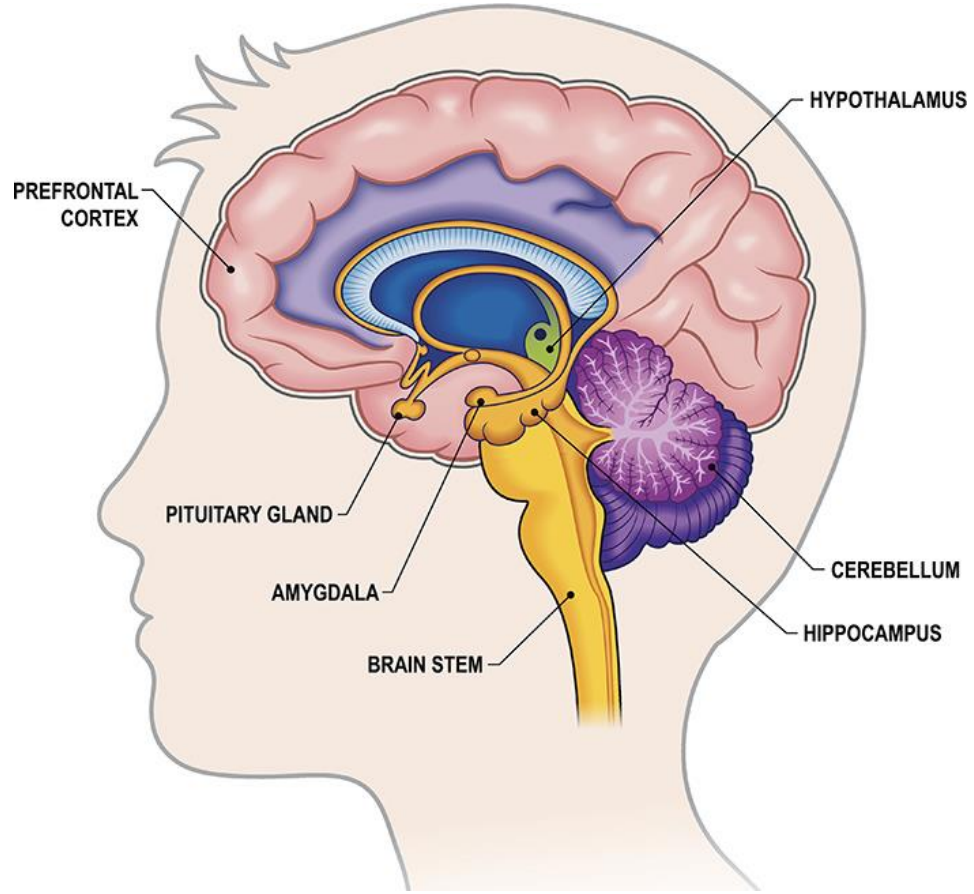
- Deals with instinct and mood: controls basic emotions and drives (sex, hunger, care for offspring)

THALAMUS

- Receives and process sensory signals
- Regulation of consciousness, sleep, alertness (arousal, awareness, activity)

Structures of the Limbic System

AHH (A.H.H.)



Hypothalamus

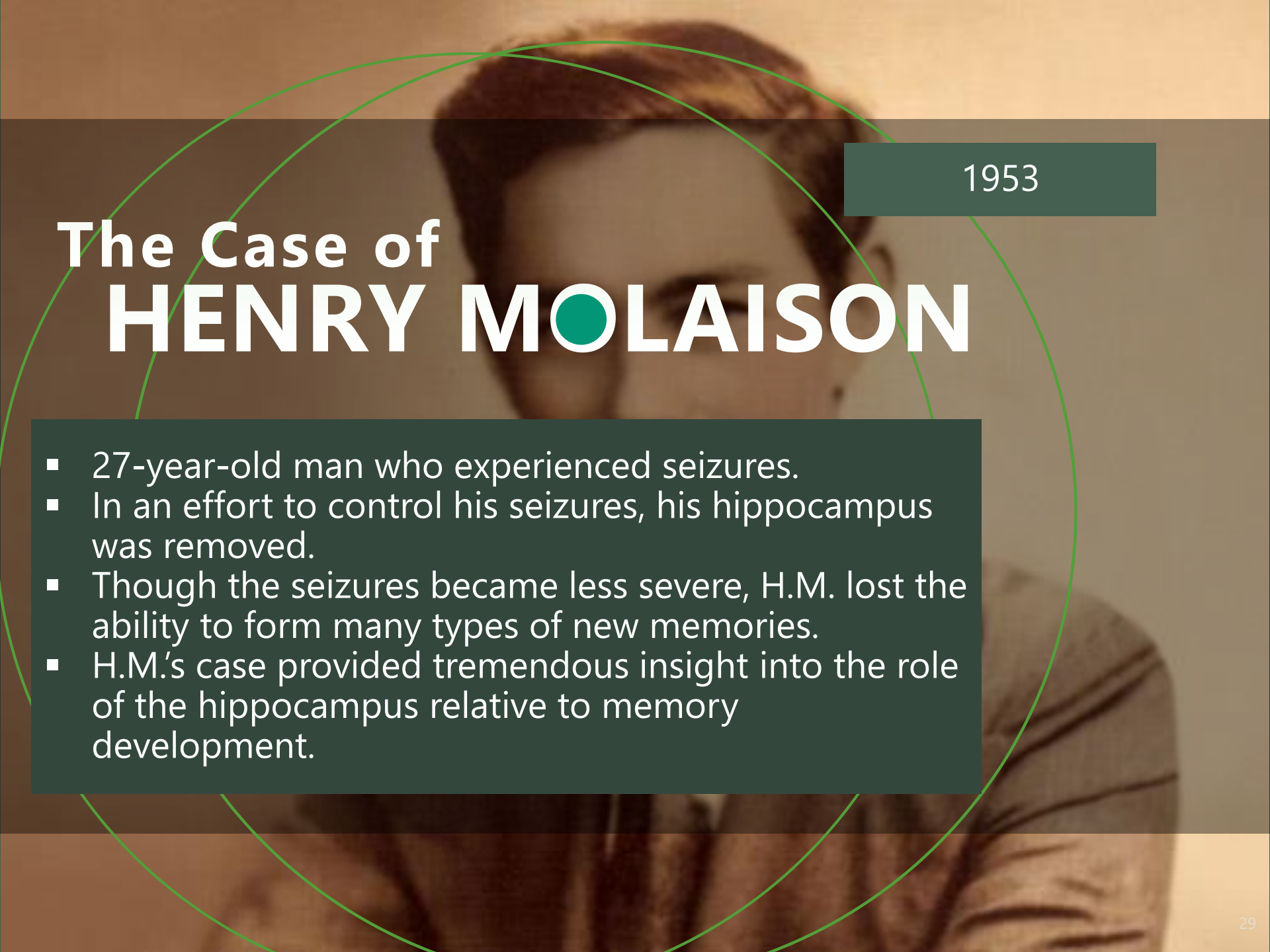
responsible for motivational behavior such as sleep, hunger, thirst, and sex

Hippocampus

thought to be the center of emotion, memory, and the autonomic nervous system

Amygdala

responsible for fear responses and memory of fear



1953

The Case of HENRY MOLAISON

- 27-year-old man who experienced seizures.
- In an effort to control his seizures, his hippocampus was removed.
- Though the seizures became less severe, H.M. lost the ability to form many types of new memories.
- H.M.'s case provided tremendous insight into the role of the hippocampus relative to memory development.

The Brain Stem

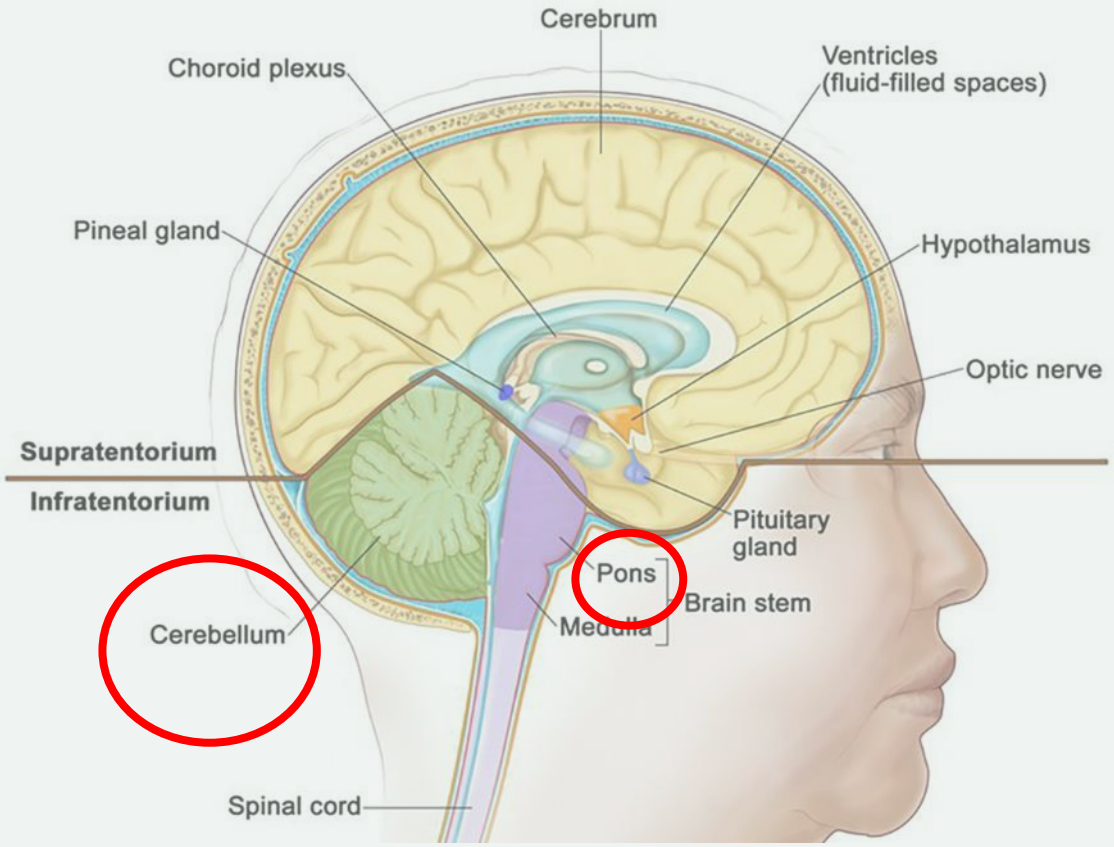
… controls flow from brain to rest of body

… is a section of the brain that connects directly to the spinal cord

… regulates vital functions such as breathing, the heart, reflexes and level of alertness

… includes structures from both the midbrain and hindbrain

The Brain Stem



Pons

- Control of breathing and communication
- Controls sensations of hearing, taste and balance

Cerebellum

- Coordinate and regulate muscle activity

Taking a Peek Inside of the Brain

Methods used to study the brain

Computed tomography (CT)

- brain-imaging method using computer controlled X-rays of the brain
- 3 dimensional

Electroencephalograph

e·lec·tro·en·ceph·a·lo·graph

(EEG)

machine designed to record the brain wave patterns produced by electrical activity of the surface of the brain

Magnetic resonance imaging (MRI)

brain-imaging method using radio waves and magnetic fields of the body to produce detailed images of the brain.

Functional MRI (fMRI) – computer makes a sort of "movie" of changes in the activity of the brain using images from different time periods.

Taking a Peek Inside of the Brain

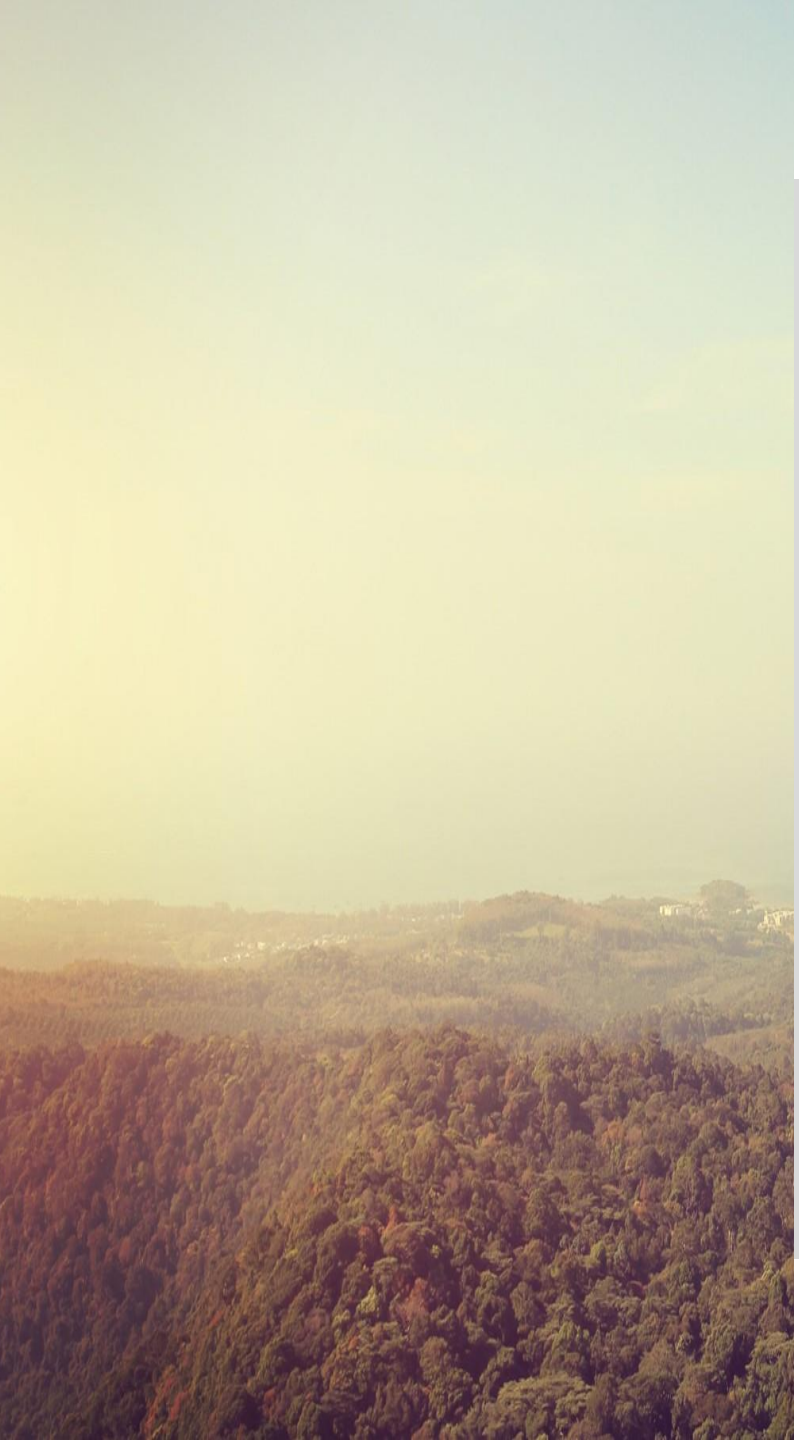
Methods used to study the brain

Functional magnetic resonance imaging (fMRI)

- observe activity in the brain
- shows which structures are active during particular mental operations using the same basic procedure as MRI

Positron emission tomography (PET)

- brain-imaging method in which a radioactive material is injected into the subject and a computer compiles a color-coded image of the activity of the brain with lighter colors indicating more activity.



The Endocrine System

…group of glands

…secretes chemicals called hormones directly into the bloodstream

HORMONES

- Signaling molecules
- chemicals released into the bloodstream by endocrine glands
- Targets organs to regulate physiology or behavior

The Endocrine System

The Glands Include:

PITUITARY GLAND

gland located in the brain that secretes human growth hormone and influences all other hormone-secreting glands (also known as the master gland).

PINEAL GLAND

endocrine gland located near the base of the cerebrum that secretes melatonin.

Regulates sleep patterns

THYROID GLAND

endocrine gland found in the neck that regulates metabolism.

Regulates growth and development

The Endocrine System

The Glands Include:

ADRENAL GLAND

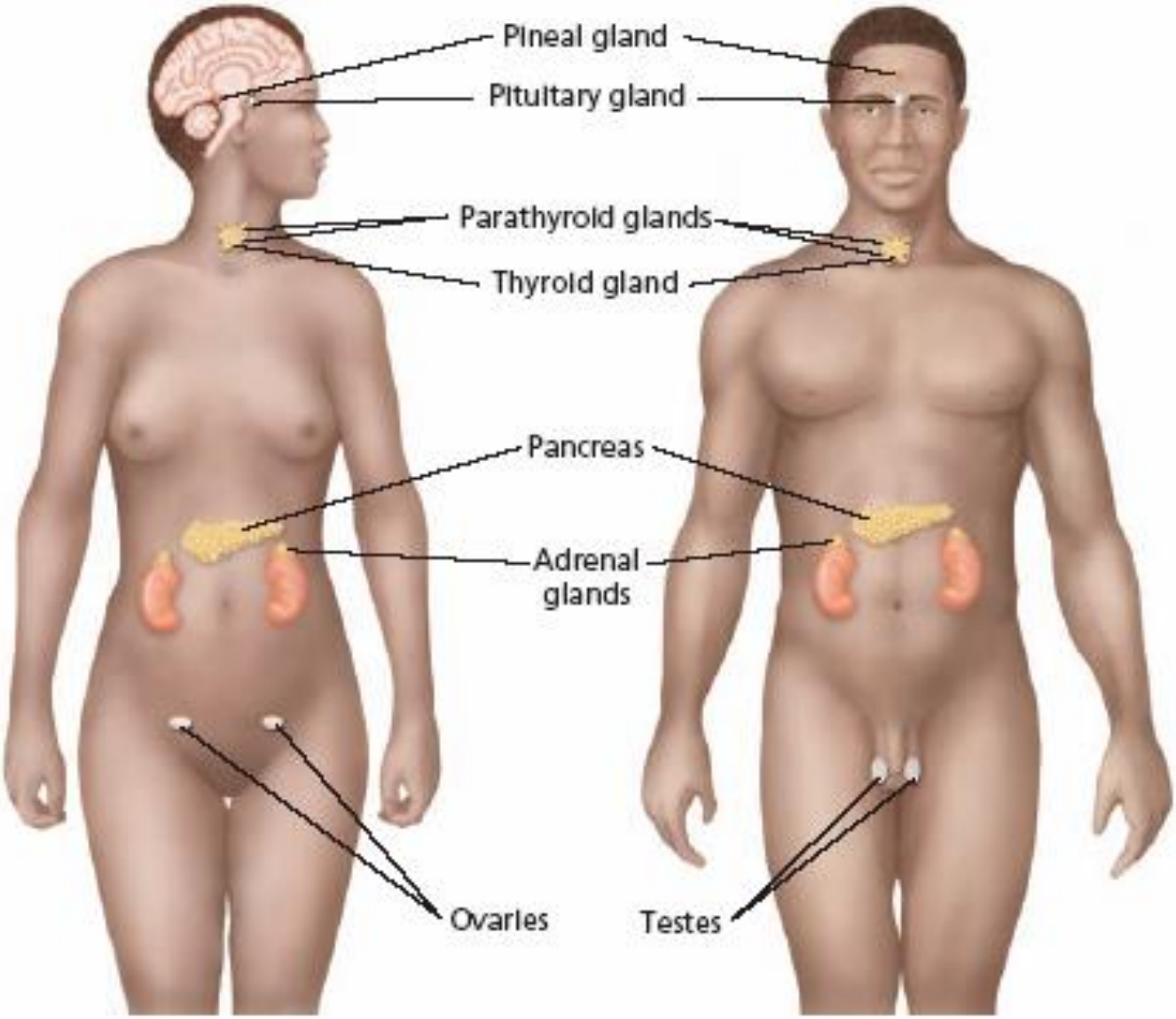
- Located in the superior kidney
- Produces hormones cortisol (metabolism\stress) and aldosterone (helps control blood pressure)

PANCREAS

- Secretes digestive juices
- endocrine gland that controls the levels of sugar in the blood

GONADS GLAND

- the sex glands that secrete hormones that regulate sexual development and behavior as well as reproduction


Pineal gland
Pituitary gland
Parathyroid glands
Thyroid gland
Pancreas
Adrenal glands
Ovaries
Testes

Hormones	Neurotransmitters
❖ Secreted directly into the bloodstream; more widespread ❖ Slower to take effect ❖ Tend to be longer lasting	❖ Passed along to the receiving neuron ❖ Take effect more quickly ❖ Tend to be shorter lasting

Questions?