Chapter 3

Biology and Behavior

The Nervous System

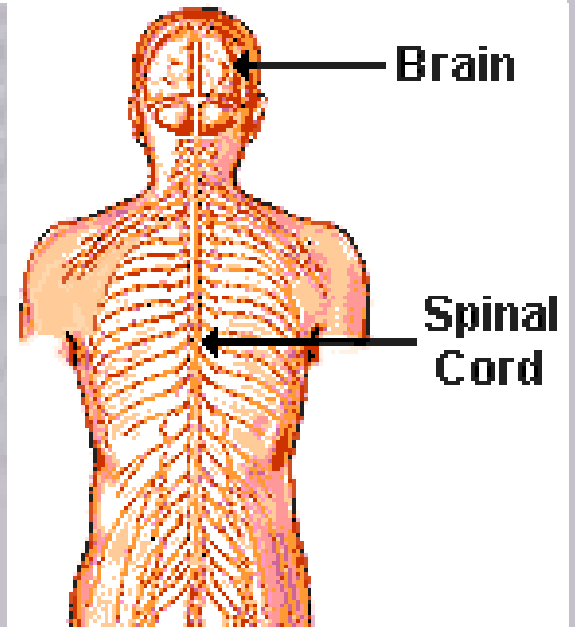
- Thinking
- Dreaming
- Feeling
- Moving
- Much More

The Nervous System

- The Nervous system is made up of two parts;
  - Central Nervous System
  - Peripheral Nervous System

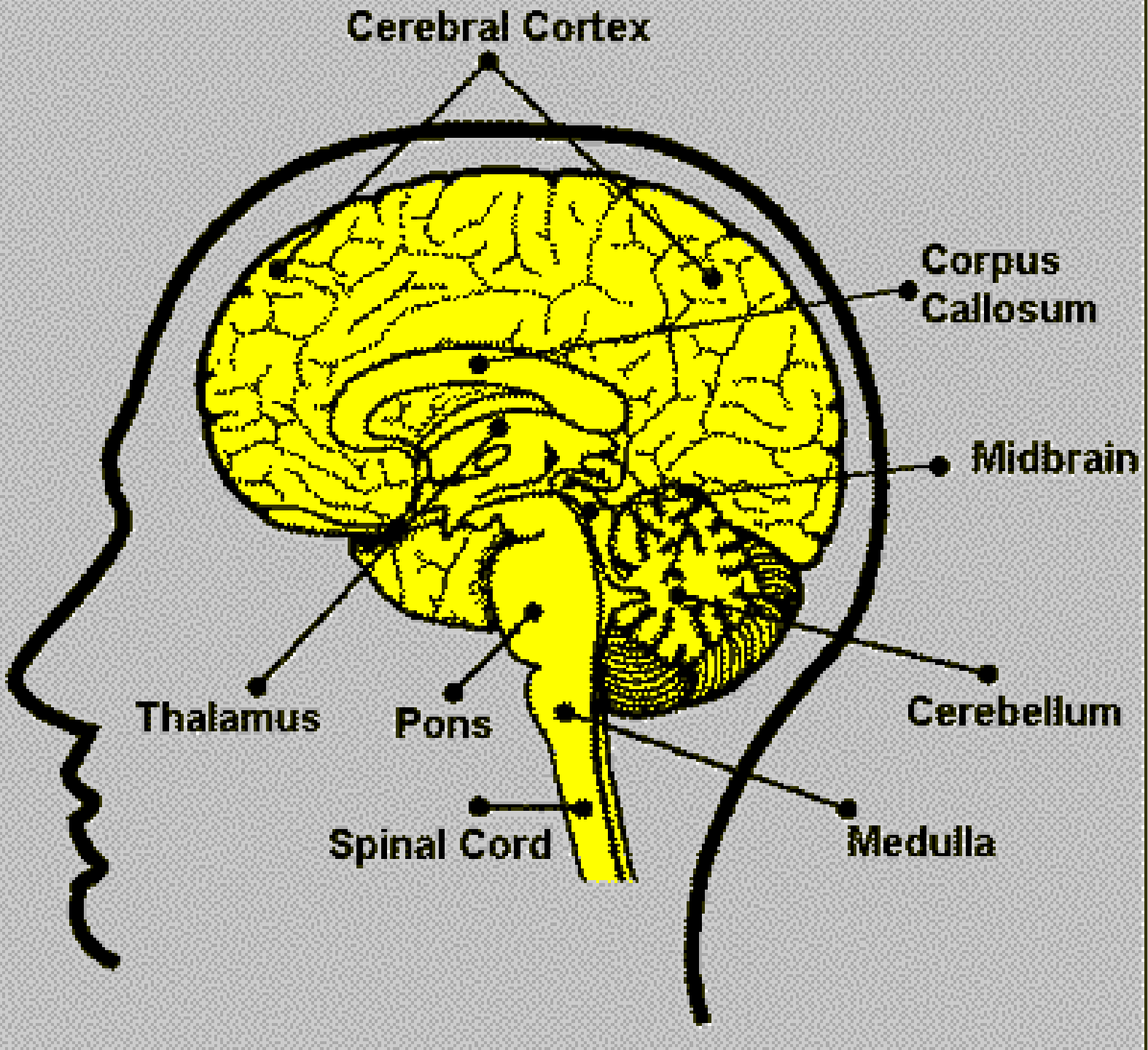
Central Nervous System

- **Two Main Parts:**
  - **Brain**
  - **Spinal Cord**



The Brain

Known as our “Control Center”

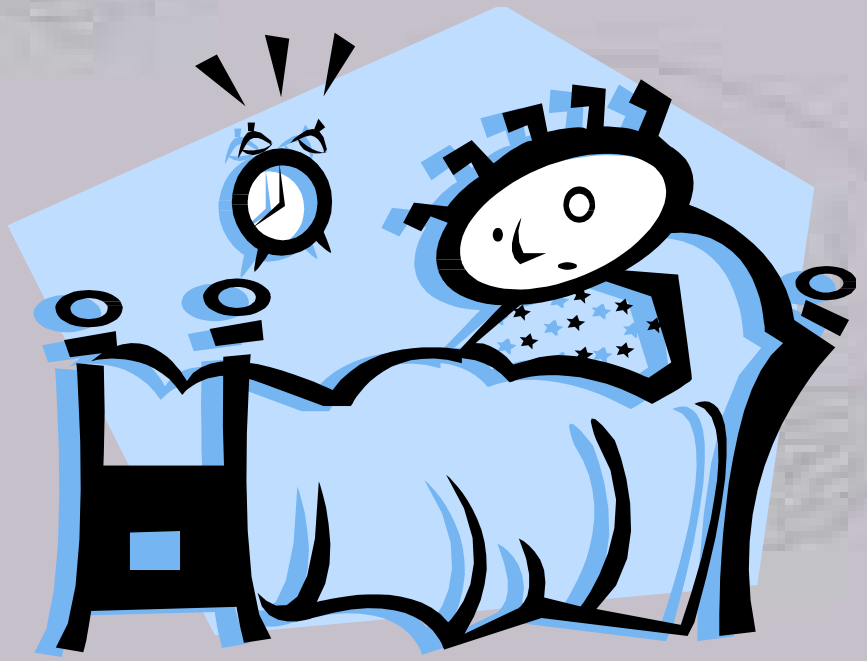

Cerebral Cortex
Corpus Callosum
Midbrain
Thalamus
Pons
Cerebellum
Spinal Cord
Medulla

The Hindbrain

- Medulla- vital function (i.e. Heart rate)
- Pons- regulating body movement, attention, sleep, and alertness
- Cerebellum- balance and coordination

The Midbrain- involved in vision and hearing.

- **Reticular activating system-** important for attention, sleep, and arousal.



<u>The Forebrain-</u> Four portions to the forebrain, important for humans to engage in complex thinking processes

The Forebrain contains:

- Thalamus
- Hypothalamus
- Limbic System
- Cerebrum

Thalamus

Relay station for sensory stimulation

Hypothalamus

- involved in many aspects of behavior and psychological functions
- Such as:
  - Regulates body temperature
  - Storage of nutrients
  - Various aspects of motivation and emotion
  - Hunger
  - Thirst
  - Sexual behavior
  - Caring for offspring
  - Aggression

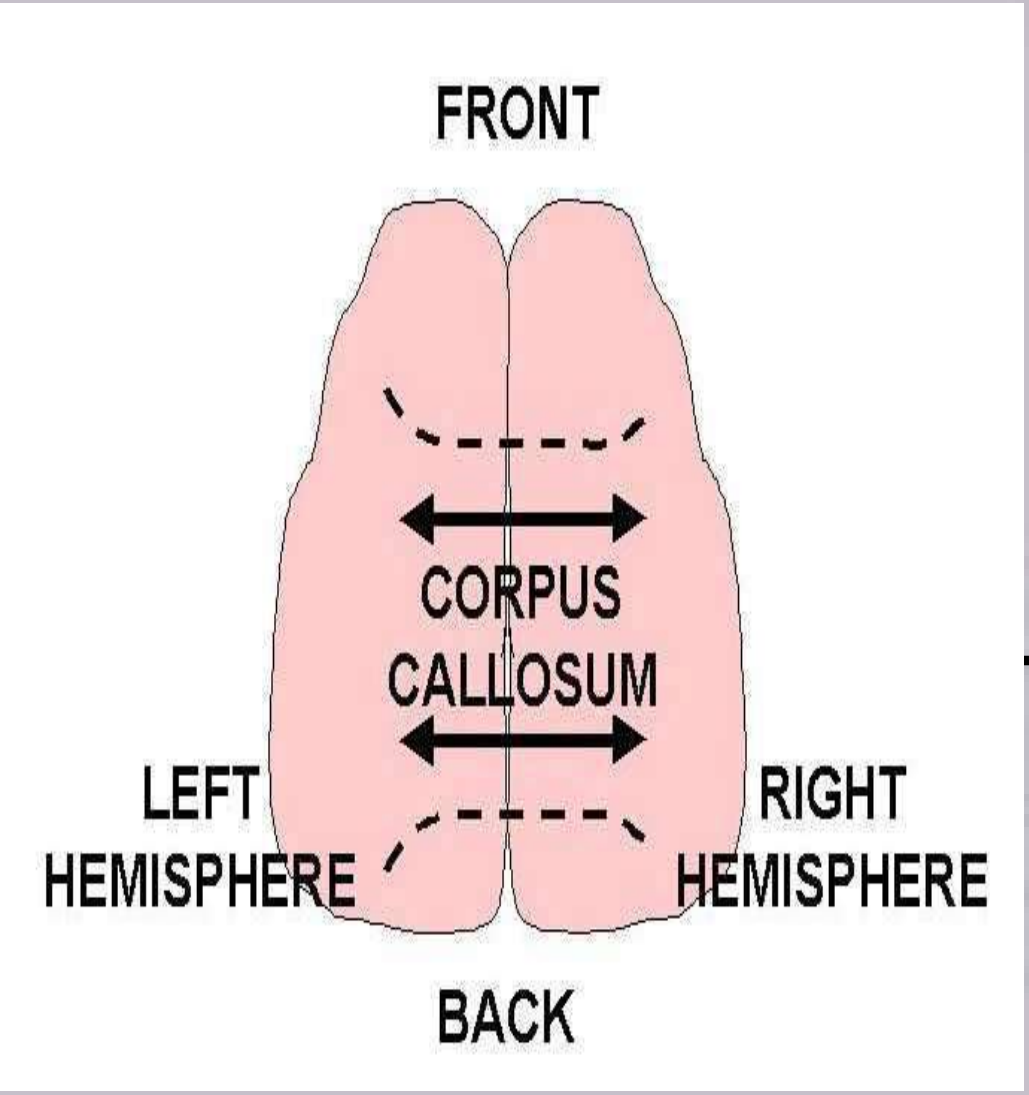
Limbic System

learning and memory, emotion, hunger, sex and aggression.

Cerebrum

- Latin for “the brain”
- Accounts for 70% of the brain
- Its surfaces is the Cerebral Cortex
  - Concerned with:
    - Memory, Language, emotions, complex motor functions, perception, and much more.
  - Cerebral Cortex has two sides- hemispheres
    - Left Hemisphere
    - Right Hemisphere
    - Attached to each other with the corpus callosum

Hemisphere Transmitting

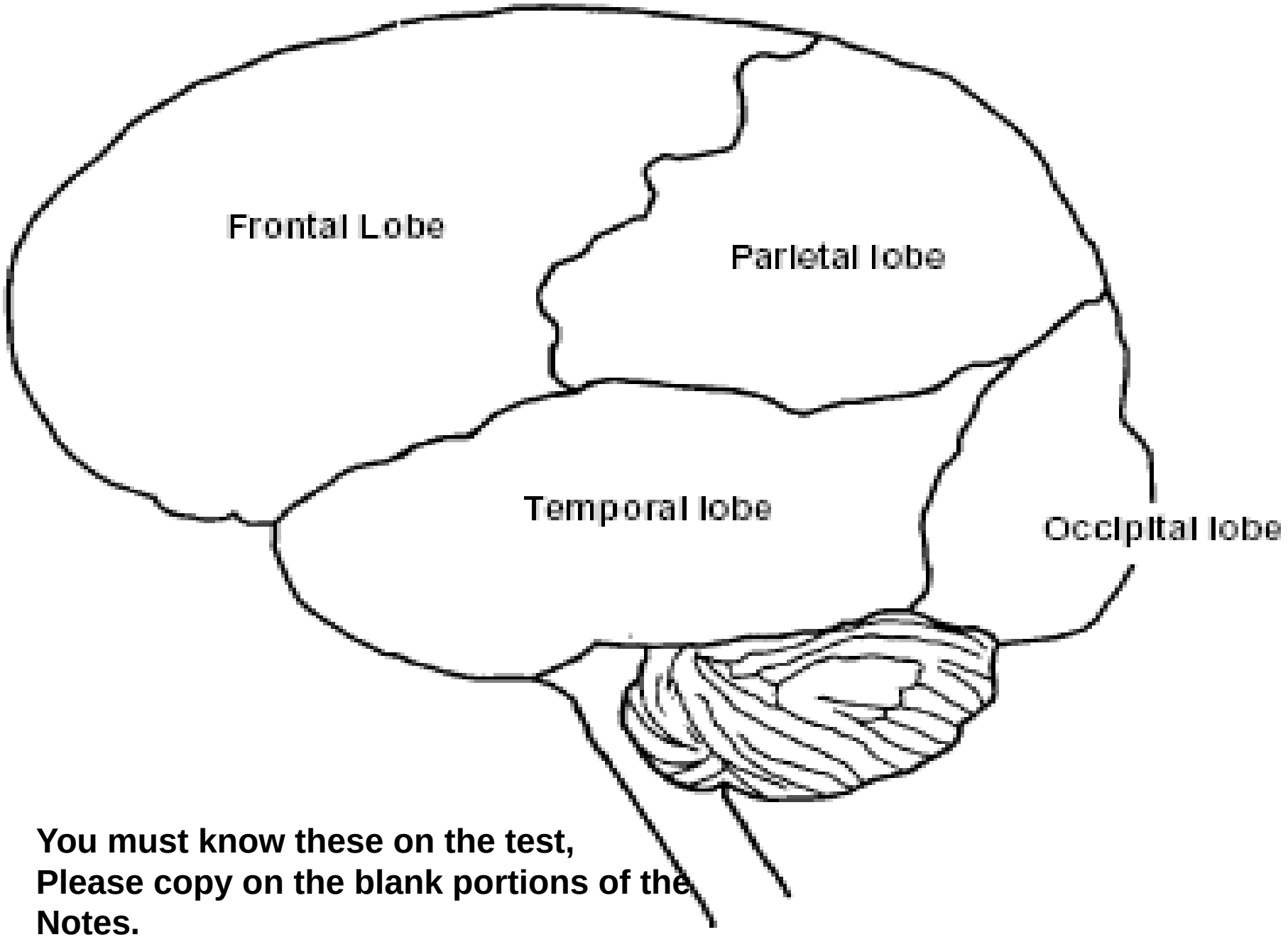


Information received on one side of the body is transmitted to the opposite hemisphere of the brain.

The corpus callosum aids in getting information from one side to another.

The four parts (lobes) of each hemisphere

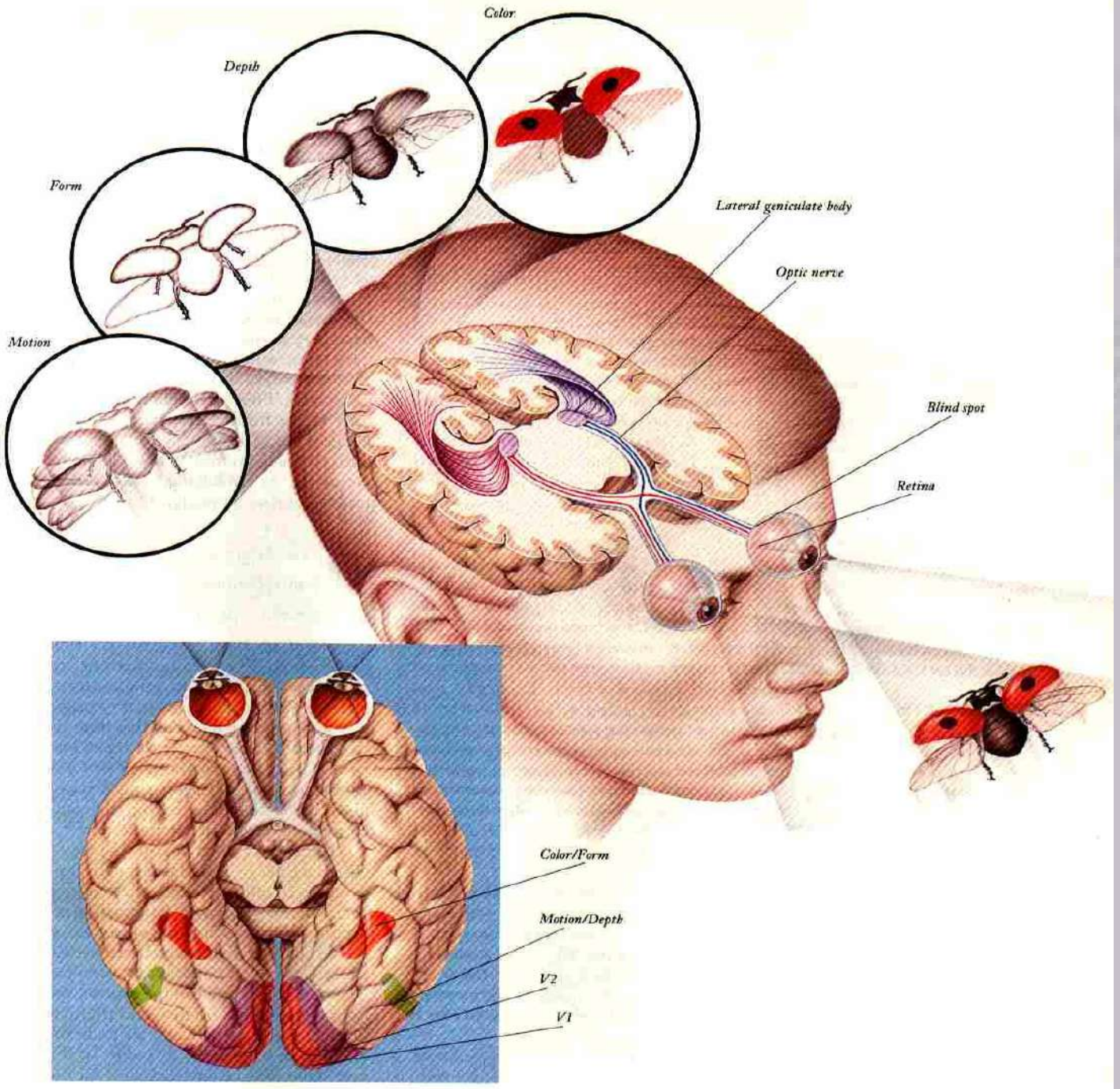
- Frontal Lobe
- Parietal Lobe
- Temporal Lobe
- Occipital Lobe



You must know these on the test,
Please copy on the blank portions of the Notes.

Senses and Motor behavior

- **Occipital lobe – Visual area**
- Damage to this area of the brain can cause lack of differentiation of objects


Color
Depth
Form
Motion
Lateral geniculate body
Optic nerve
Blind spot
Retina
Color/Form
Motion/Depth
V2
V1

Senses and Motor behavior

- **Temporal Lobe- Hearing**
- **Sounds are relayed form the ears to the thalamus to the auditory area**
- **When damaged, the person may not be able to recognize common sounds**

Senses and Motor behavior

- **Parietal Lobe- skin senses**
- **Warmth, cold, touch, and pain**

Senses and Motor behavior

- **Frontal Lobe- Motor (movement)**
- Like clapping your hands

Cerebral Cortex Association Areas

- These are areas of the brain that shape information into something meaningful on which we can act.
- Can make sense of:
  - Letters
  - Shapes
  - Language
  - Thought

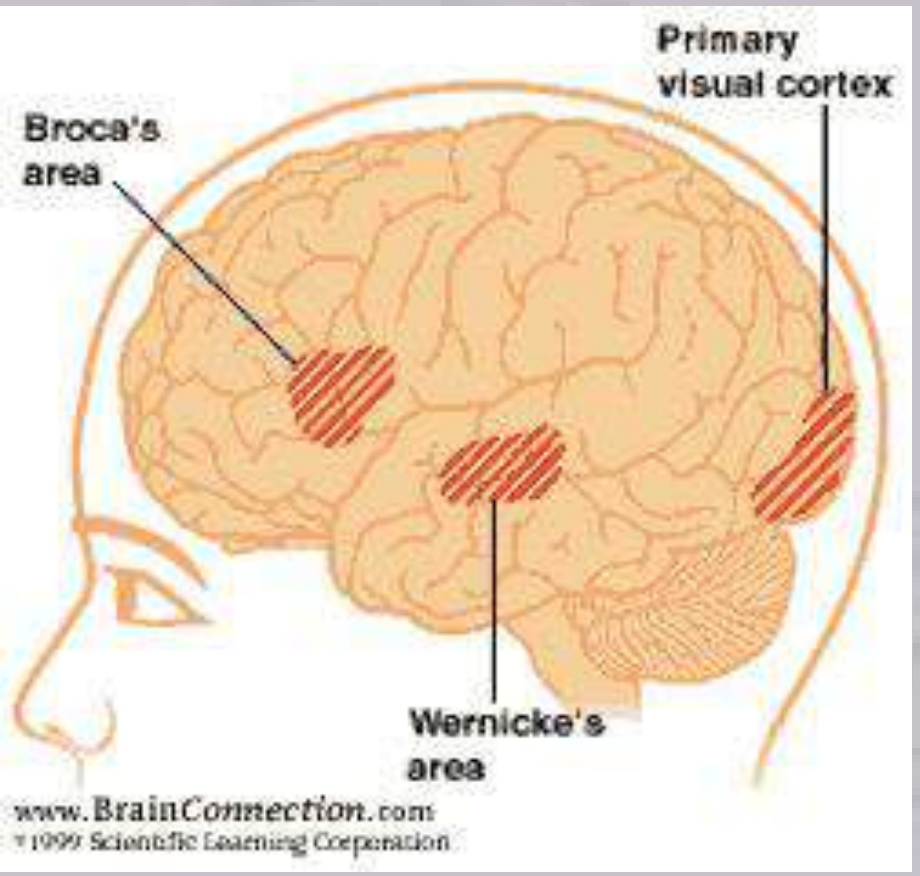
Cerebral Cortex- Hemisphere differences

- For nearly all right handed people, language functions are based in the left hemisphere.
- For two out of three left handed people, language functions are also based in the left hemisphere.

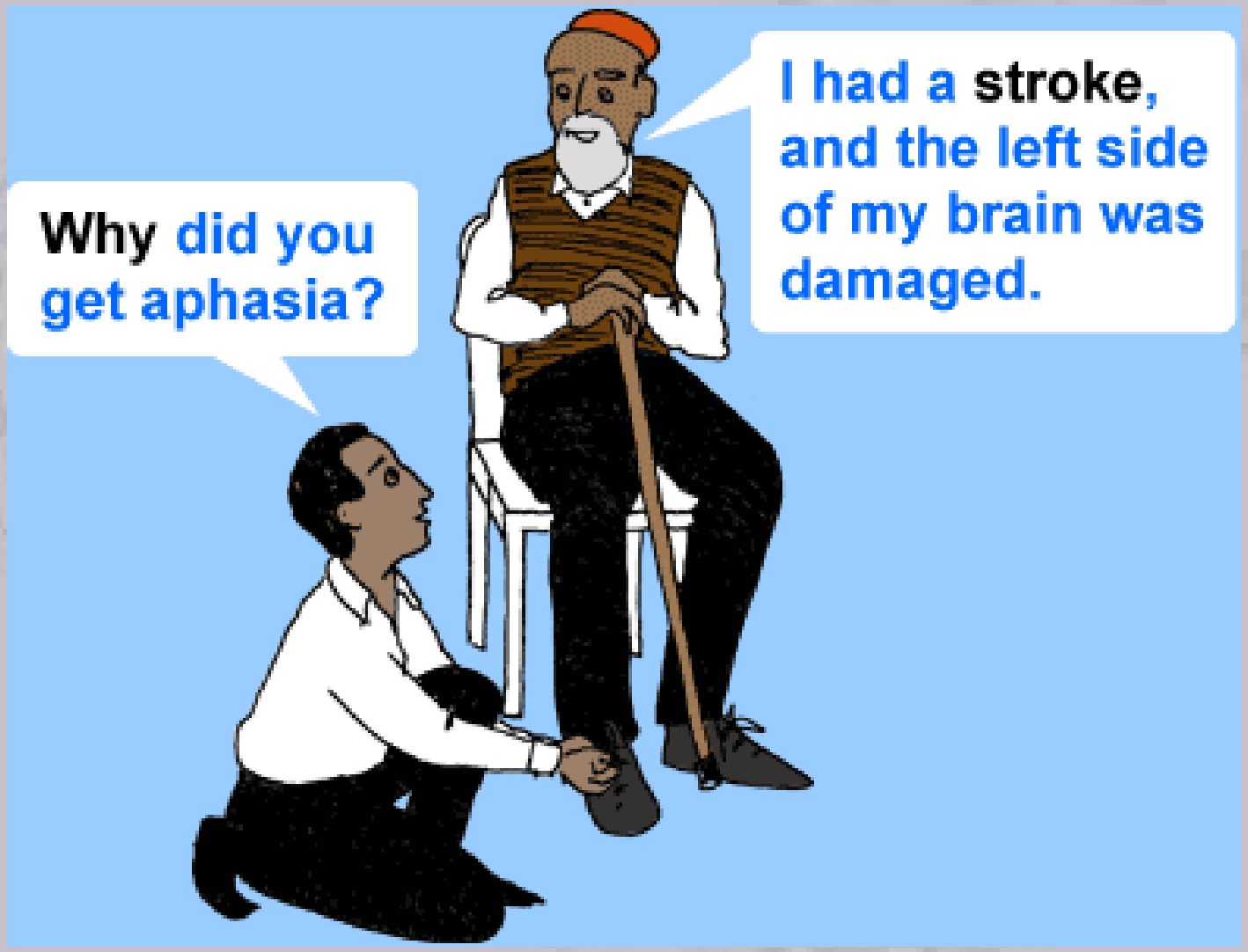
Cerebral Cortex- Language Function Areas

- **Broca's Area**: locted in the frontal lobe, near the part of the motor cortex that controls the areas of the face used to speak.
  - Damage to this area could cause laborious speaking
- **Wernicke's Area**: located in the temporal lobe pieces together sounds and sights.
  - Damage to this area could cause the person to fid it difficult to understand speech or they speak in meaningless speech.

Aphasia



- Difficulty with specific aspects of understanding or producing language.


I had a stroke, and the left side of my brain was damaged.
Why did you get aphasia?

Three types of Aphasia

- **<u>Fluent</u>- can speak well, but has a hard time with only sections of sentences, like nouns.**
- **<u>Non fluent-</u> has a lot of pausing and hesitations**
- **<u>Global-</u> which is impairments with all language modalities (i.e., reading, writing, speaking, and understanding).**

Hemisphere Dominance?

- Are you left brained or right brained?
  - –It is said that people who are **logical** are left brained
  - –While people who are **creative** are right brained

Find a partner!!!
Or a mirror!!!

As you look in pairs of eyes, you will notice that people's left and right eyes are rarely the same - it is this difference that reflects differences in the way they use their hemispheres.

You are constructed in a cross-linked fashion - your left eye is connected to your right brain hemisphere and vice-versa. This means that the left eye indicates your right-hemisphere activity and your right-eye indicates your left-brain activity.

You can generally estimate how strongly people use their hemispheres by the "strength of their gaze" when they look into your eyes. Please note that some cultures regard looking directly into an individual's eyes as a confronting and aggressive act, so please make sure you are welcome before peering through the windows of another's soul.

Right Brain Dominance in the Eyes

- **right-brain dominant Jewel structure**
- **notice there are more/larger/stronger brown dots (jewels) in the left iris indicating more activity in the right hemisphere.**

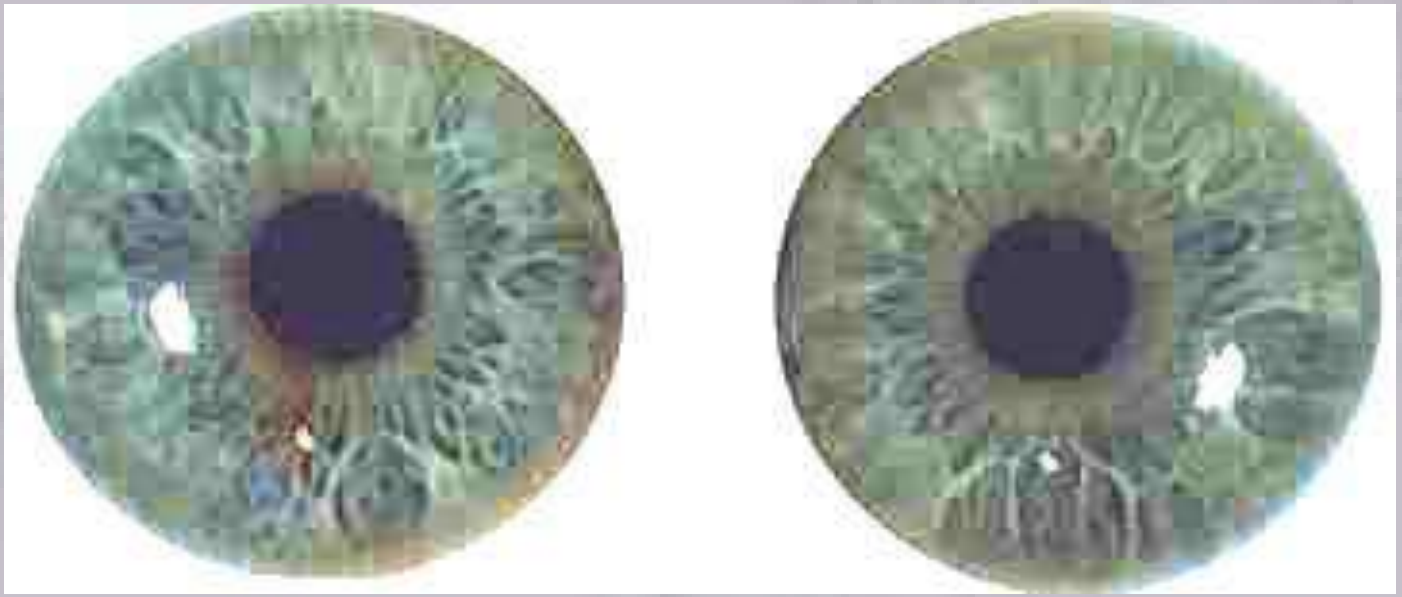
Right Brain Dominance in the Eyes

- **A right-brain dominant Flower structure**
- **notice there are more/larger/stronger fiber petals (flowers) in the left iris indicating more activity in the right hemisphere.**

Left Brain Dominance in the Eyes

- **A left-brain dominant Jewel structure**
- **notice there are more/larger/stronger jewels in the right iris indicating more activity in the left hemisphere.**

Left Brain Dominance in the Eyes



- **A left-brain dominant Flower structure**
- **notice there are more/larger/stronger flowers in the right iris indicating more activity in the left hemisphere.**

Generally this thumb is an indication of the non-dominant hemisphere (higher moon in left thumb = right hemisphere dominant; higher moon in right thumb = left hemisphere dominant). You might prefer to regard it as the "pointier" moon indicates the dominant hemisphere. This indicator does take some time to reflect a shift in dominance.

- " Which leg do you pref
- If it is your right leg, the left brain dominant, co preference sugges hemispheric preferenc attempt this test with a or an injury in one leg more likely to be deter or injury than the domina

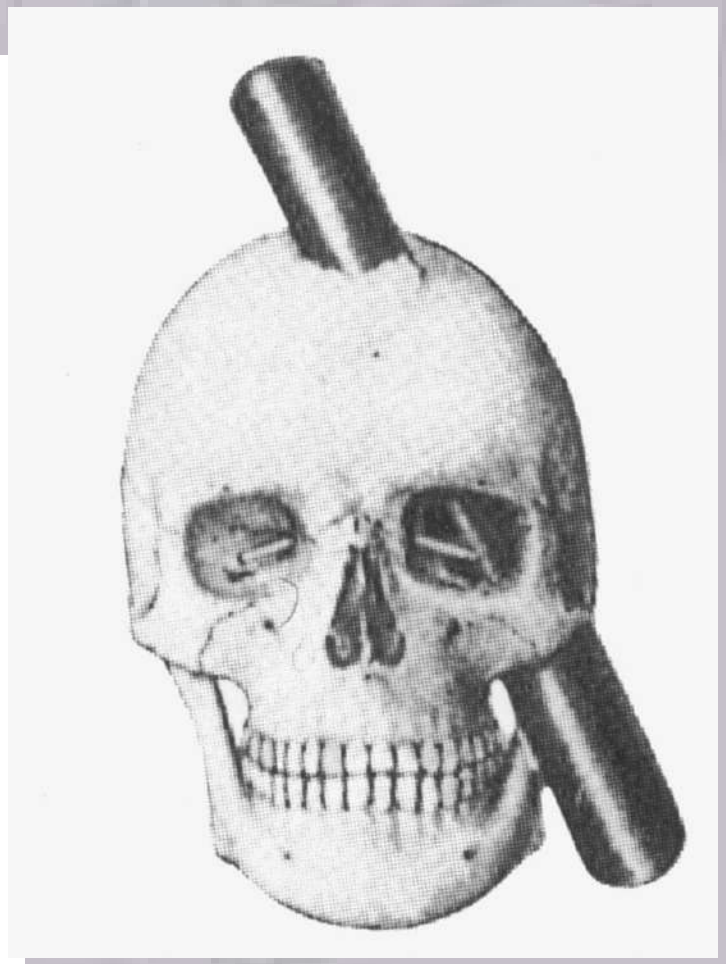
Biology and Behavior Chapter 3

Essential question: What ways do we study the brain?

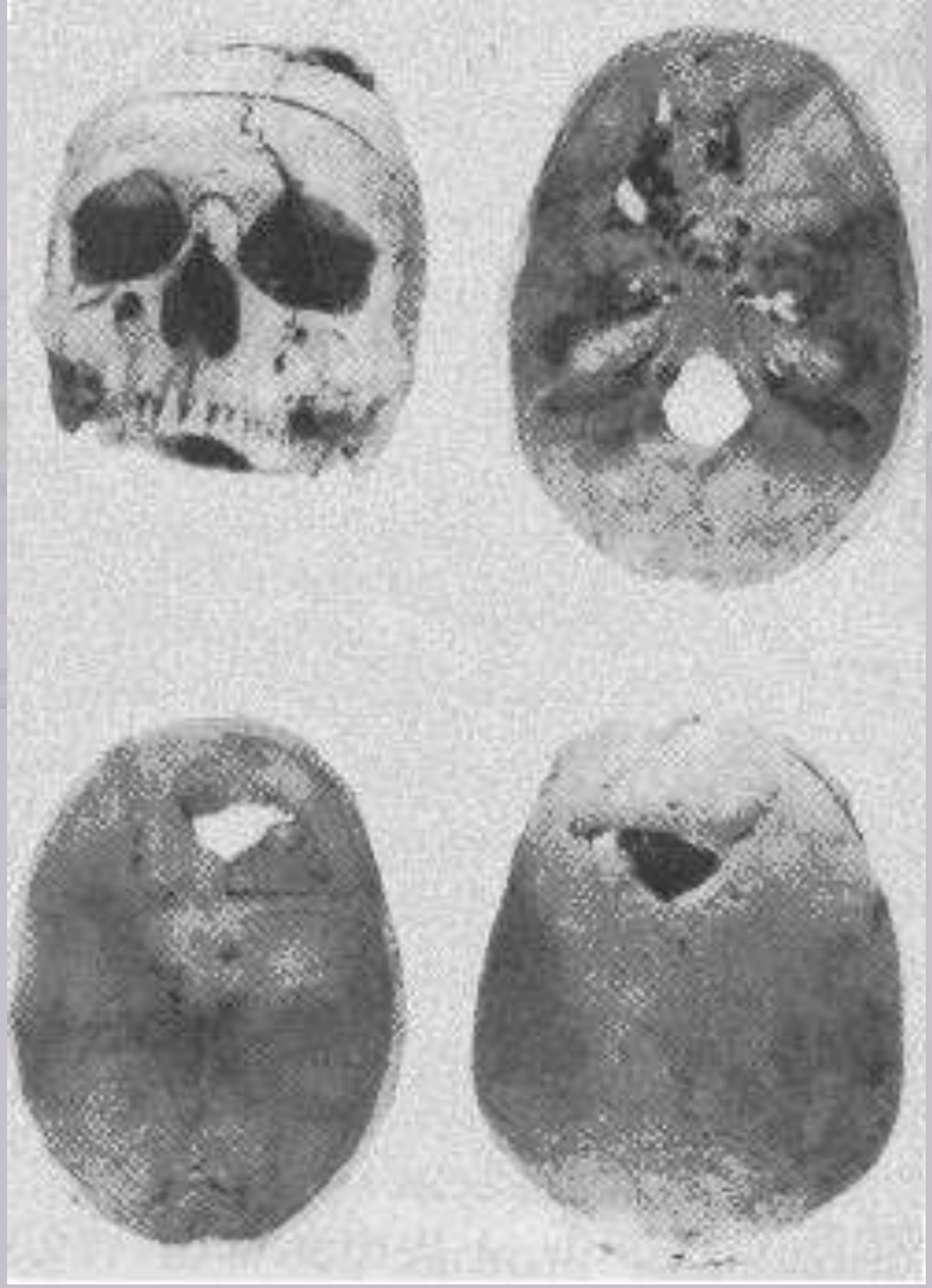
Methods of Studying the Brain

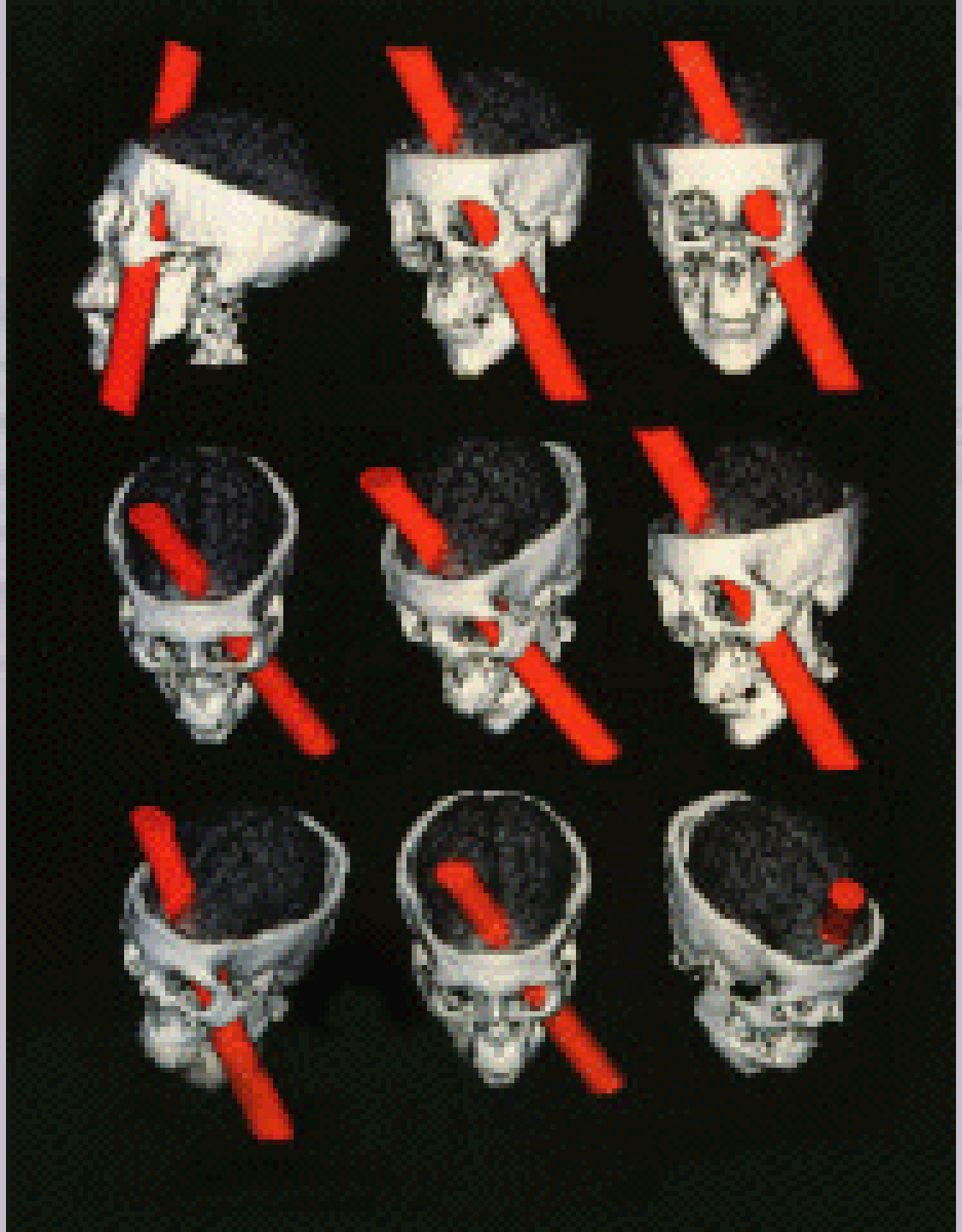
- Accidents
- Electrical stimulation of the brain
- Electroencephalogram (EEG)
- Scans

The Case of Phineas Gage




B



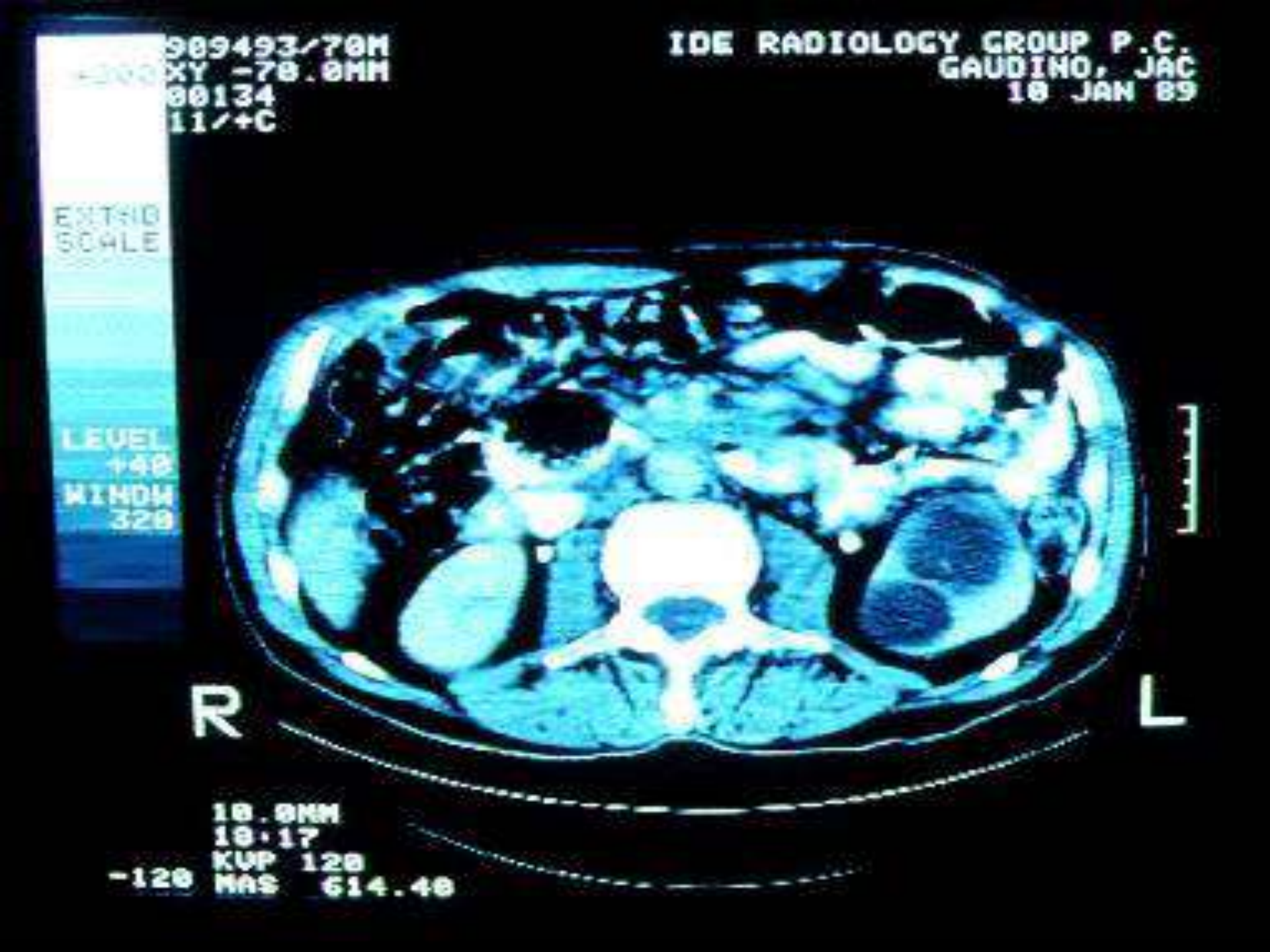


“This is the bar that was shot through the head of Mr. Phinehas P. Gage at Cavendish, Vermont, Sept. 14, 1848. He fully recovered from the injury & deposited this bar in the Museum of the Medical College of Harvard University.
Phinehas P. Gage Lebanon Grafton Cy N-H Jan 6 1850.”

Types of Scans

- Computerized Axial Tomography (CAT)
- Magnetic Resonance Imaging (MRI)
- Positron Emission Tomography (PET)

Computerized Axial Tomography (CAT)


909493/70M
XY -70.0MM
00134
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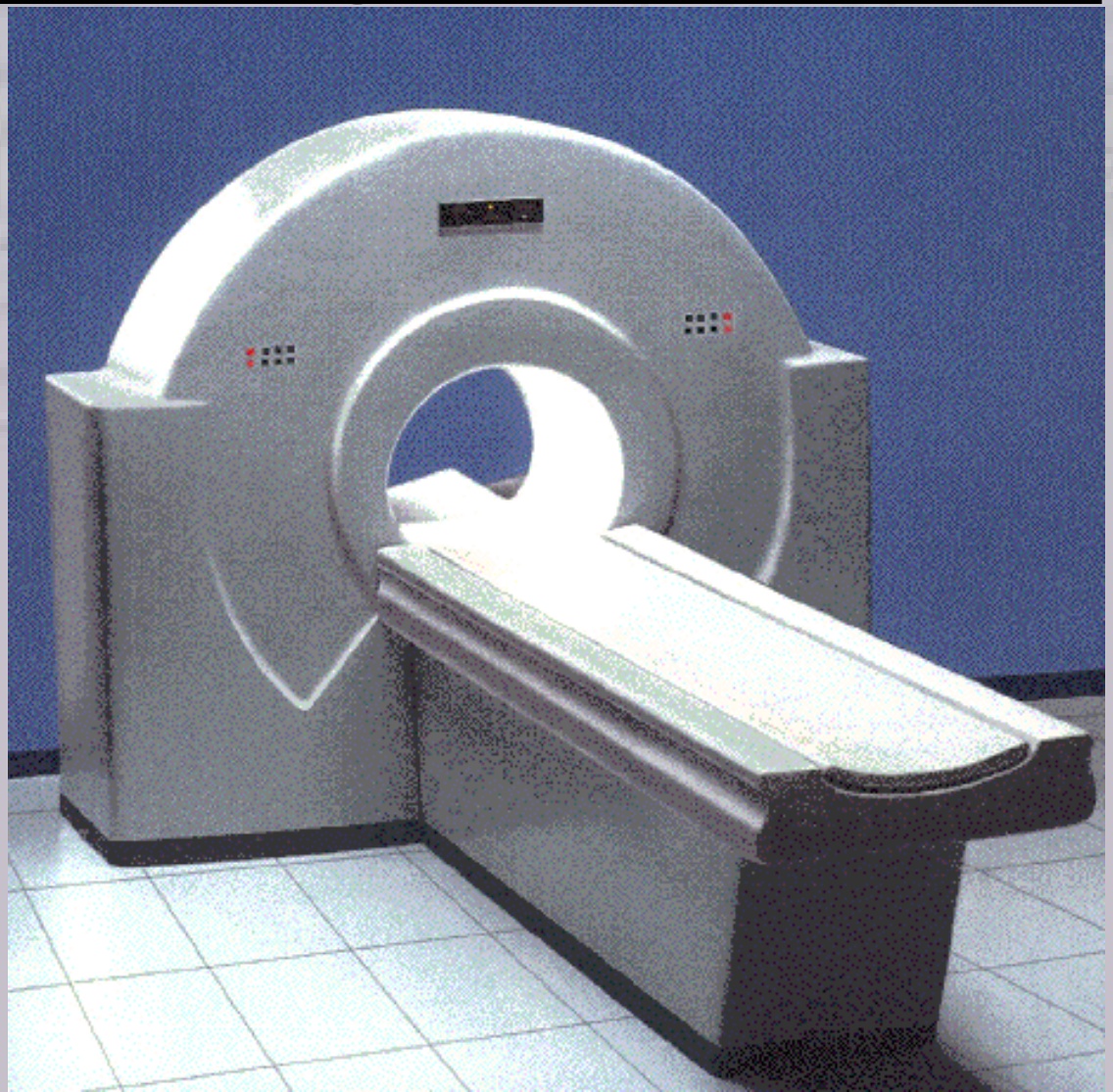
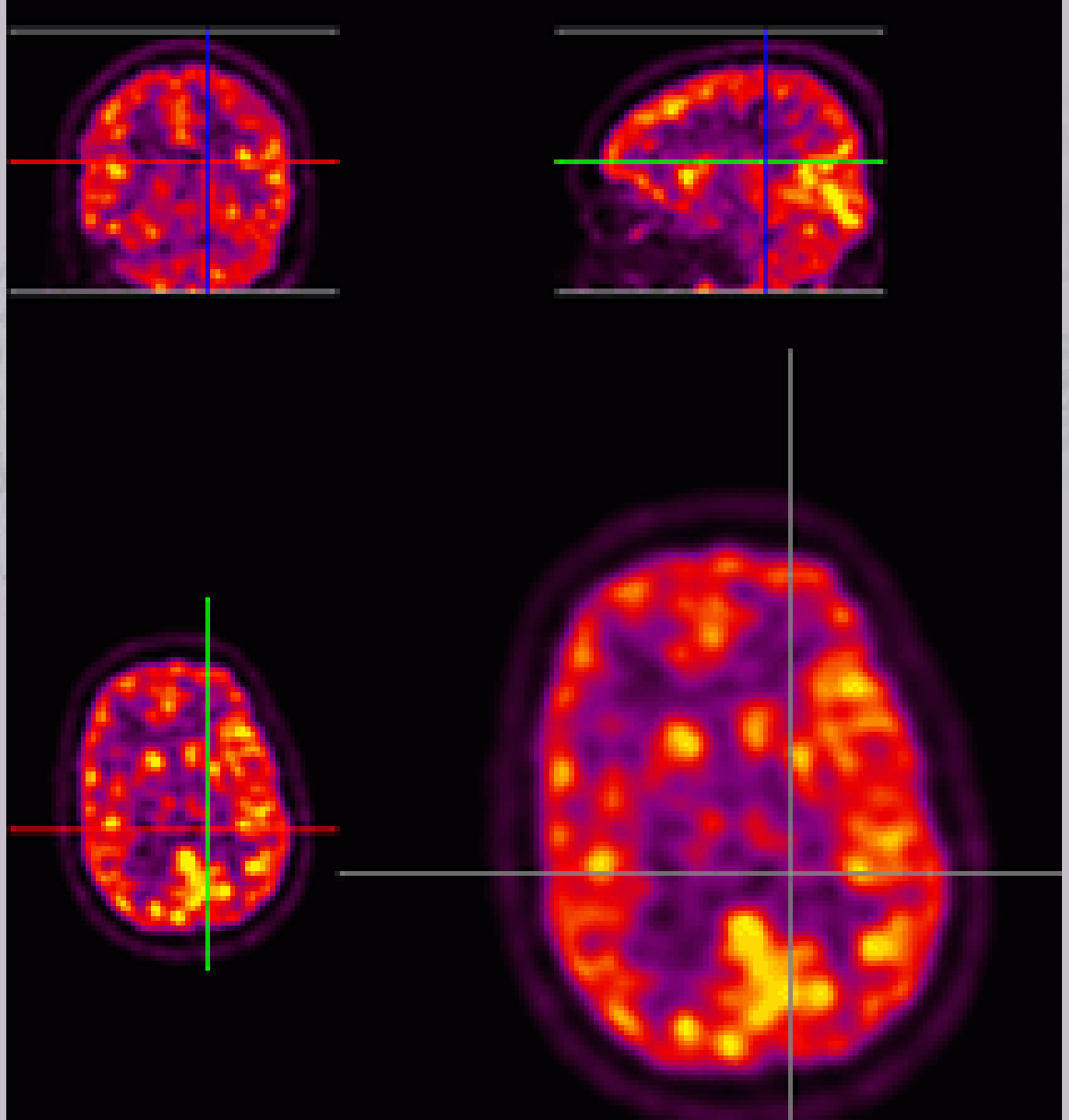
IDE RADIOLOGY GROUP P.C.
GAUDINO, JAC
10 JAN 89
EXTND
SCALE
LEVEL
+40
WINDW
320
R
L
10.0MM
10:17
KVP 120
-120 MAS 614.40

Magnetic Resonance Imaging (MRI)

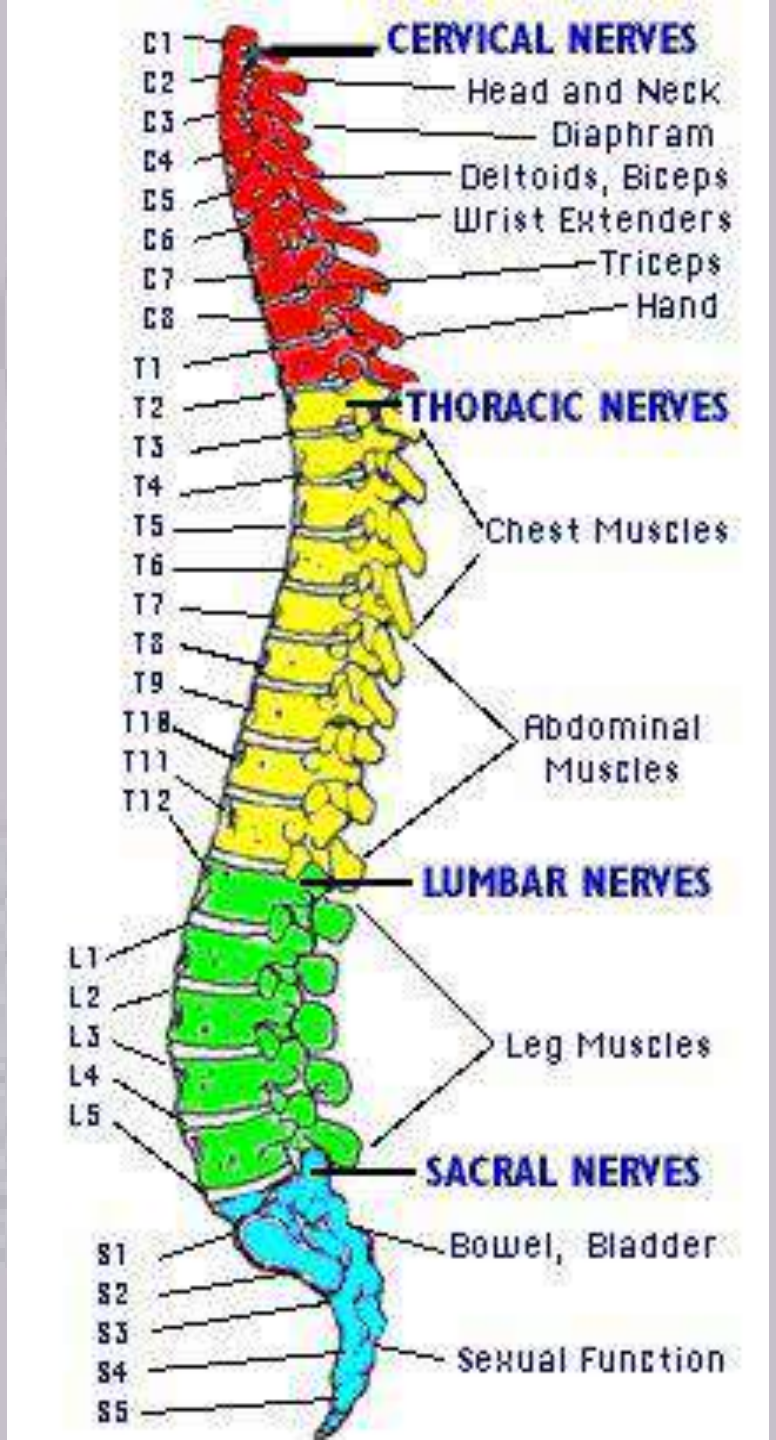
Positron Emission Tomography (PET)



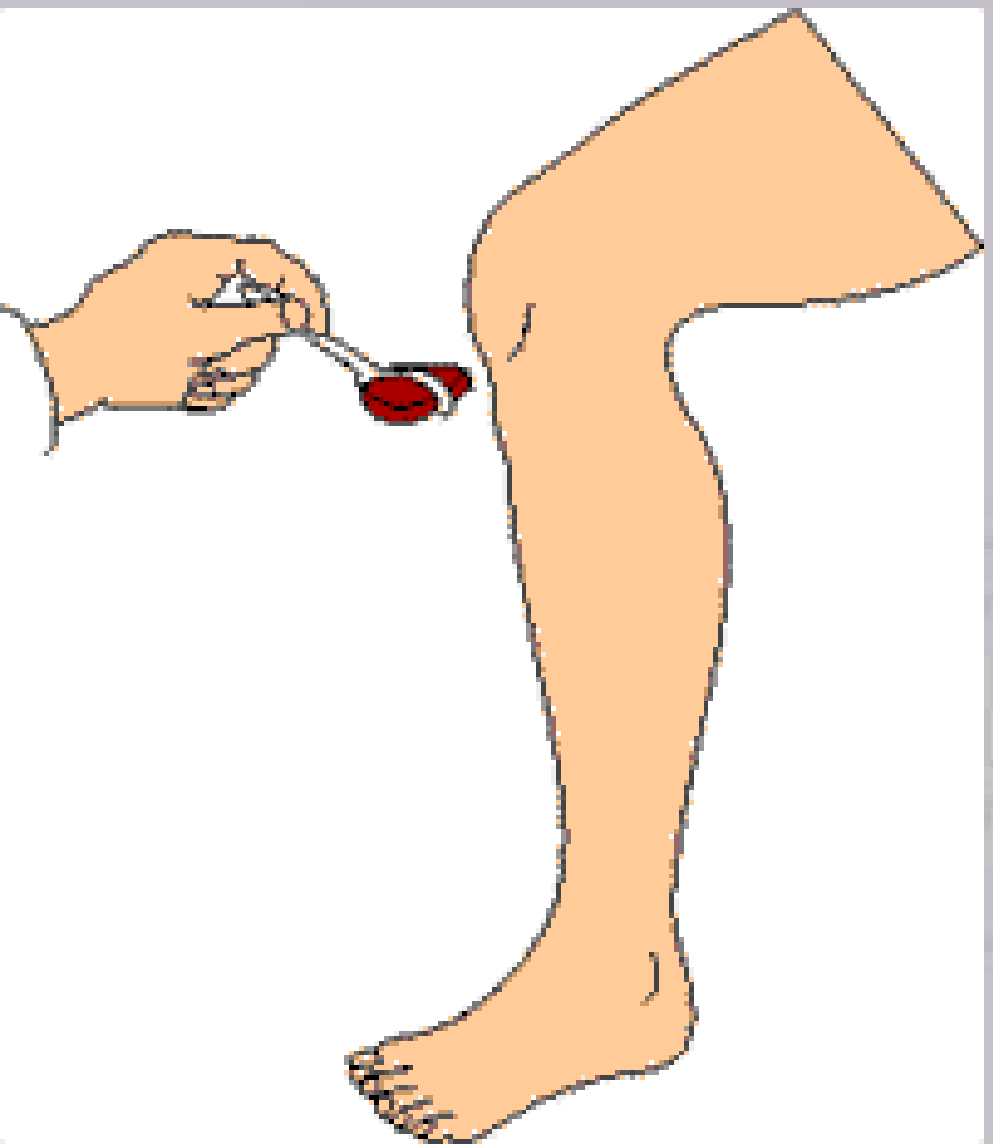


Spinal Cord

- Extends from the brain down the back.
- Protected by the bones of the spine
- Involved in spinal reflexes



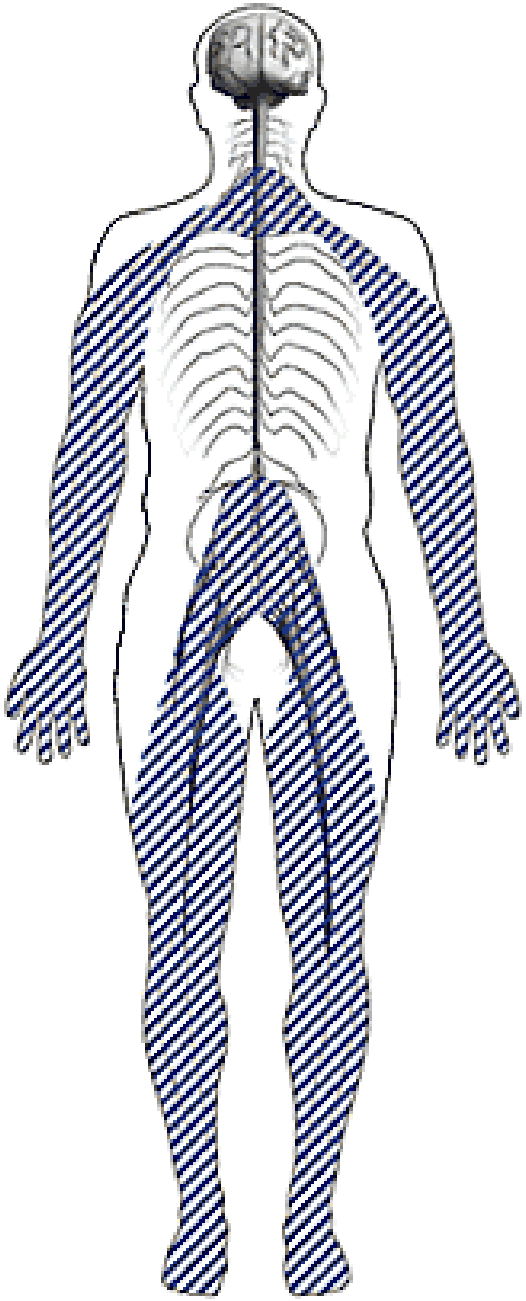
Spinal Reflexes

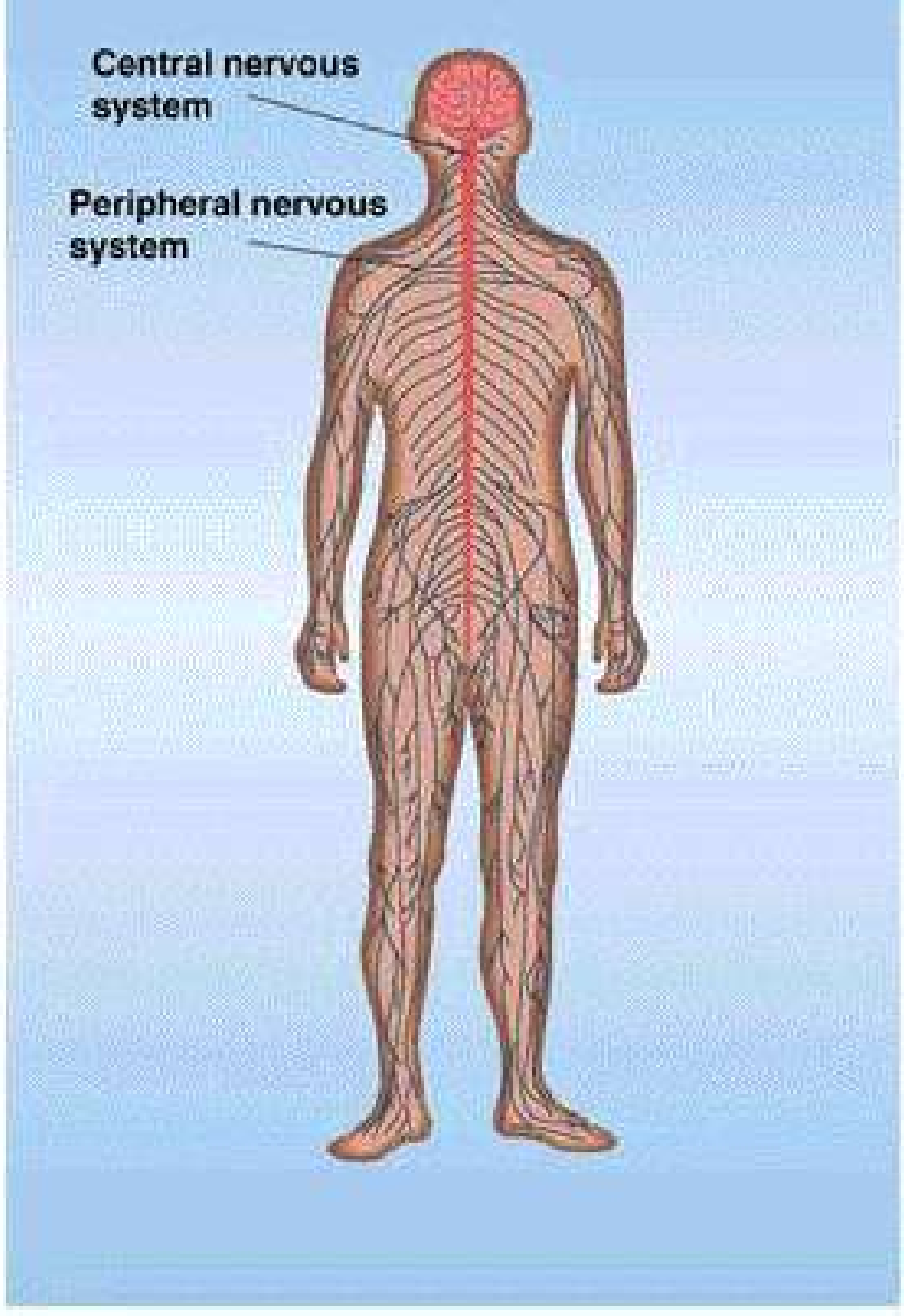


- Automatic response to something (Ex. Knee jerk reflex to doctor's hammer)

The Peripheral Nervous System: Nerve cells that send messages between the CNS and all the parts of the body.

Peripheral Nerves




Central nervous system
Peripheral nervous system

Two main division of the Peripheral nervous system

- Somatic Nervous system
- Autonomic Nervous System

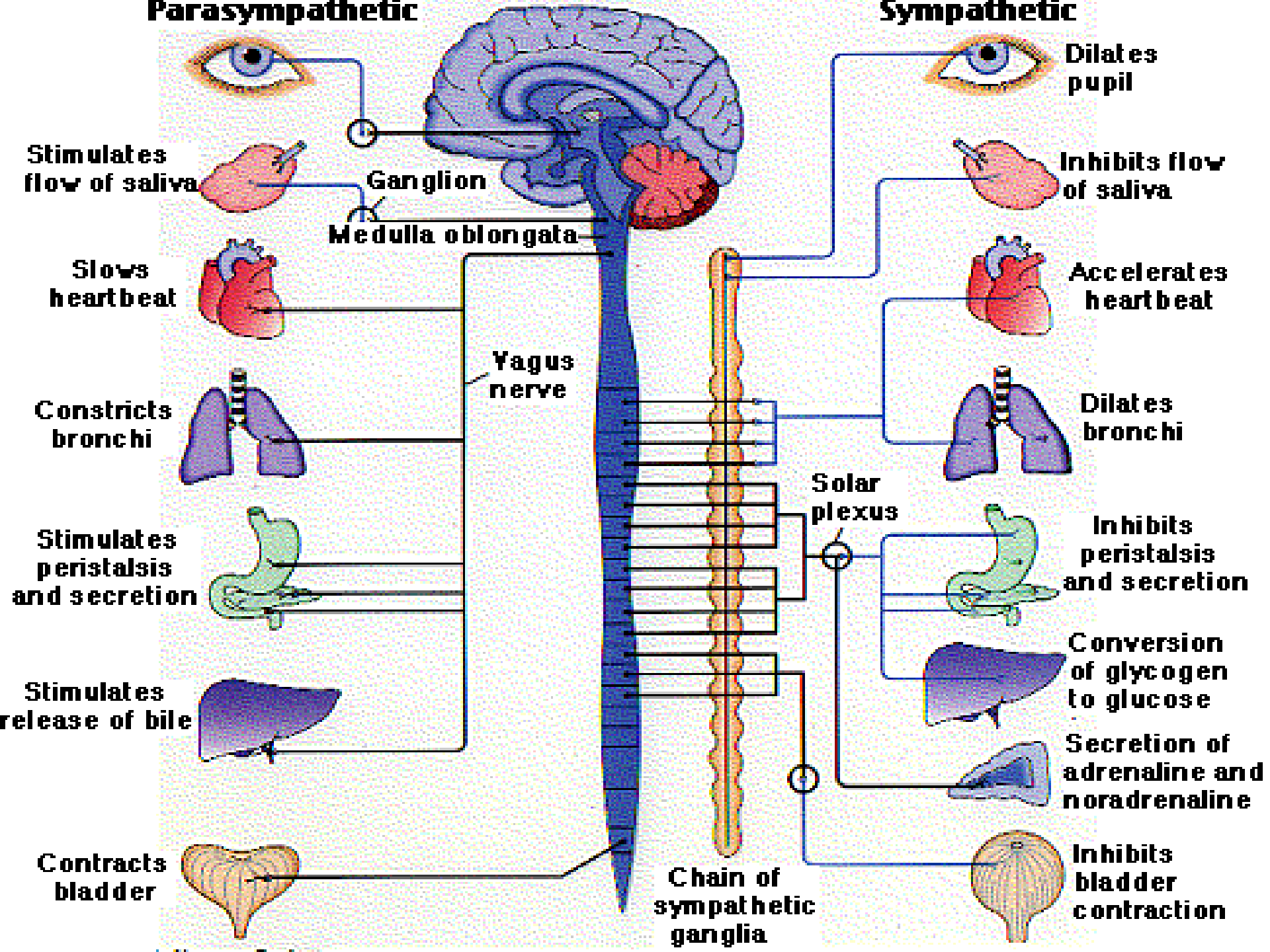
Somatic Nervous system

transmits sensory messages to the Central nervous system.

- **Activated by touch, pain, changes in temperature, and changes in body position.**
- **Voluntary muscles and sense organs**

Autonomic Nervous System regulates the body's vital functions (i.e. Heartbeat)

- Two divisions of Autonomic nervous system:
  - –Sympathetic Nervous system
  - –Parasympathetic Nervous System


Parasympathetic
Sympathetic
Dilates pupil
Stimulates flow of saliva
Ganglion
Medulla oblongata
Inhibits flow of saliva
Slows heartbeat
Accelerates heartbeat
Vagus nerve
Constricts bronchi
Dilates bronchi
Solar plexus
Stimulates peristalsis and secretion
Inhibits peristalsis and secretion
Conversion of glycogen to glucose
Stimulates release of bile
Secretion of adrenaline and noradrenaline
Contracts bladder
Chain of sympathetic ganglia
Inhibits bladder contraction

Sympathetic Nervous system

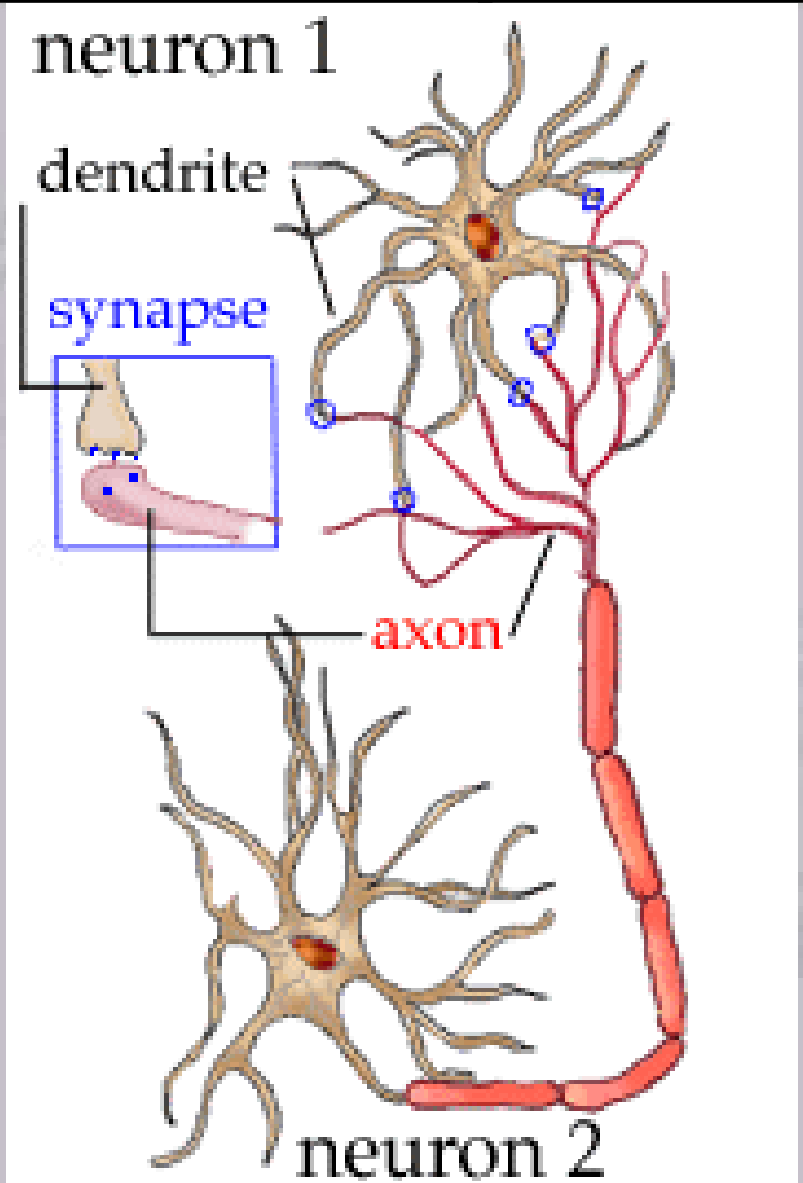
Activated when a person is going into action.

Fight or Flight response

Parasympathetic Nervous System

Calms body after emergencies.

Neurons (nerve cells of the PNS)

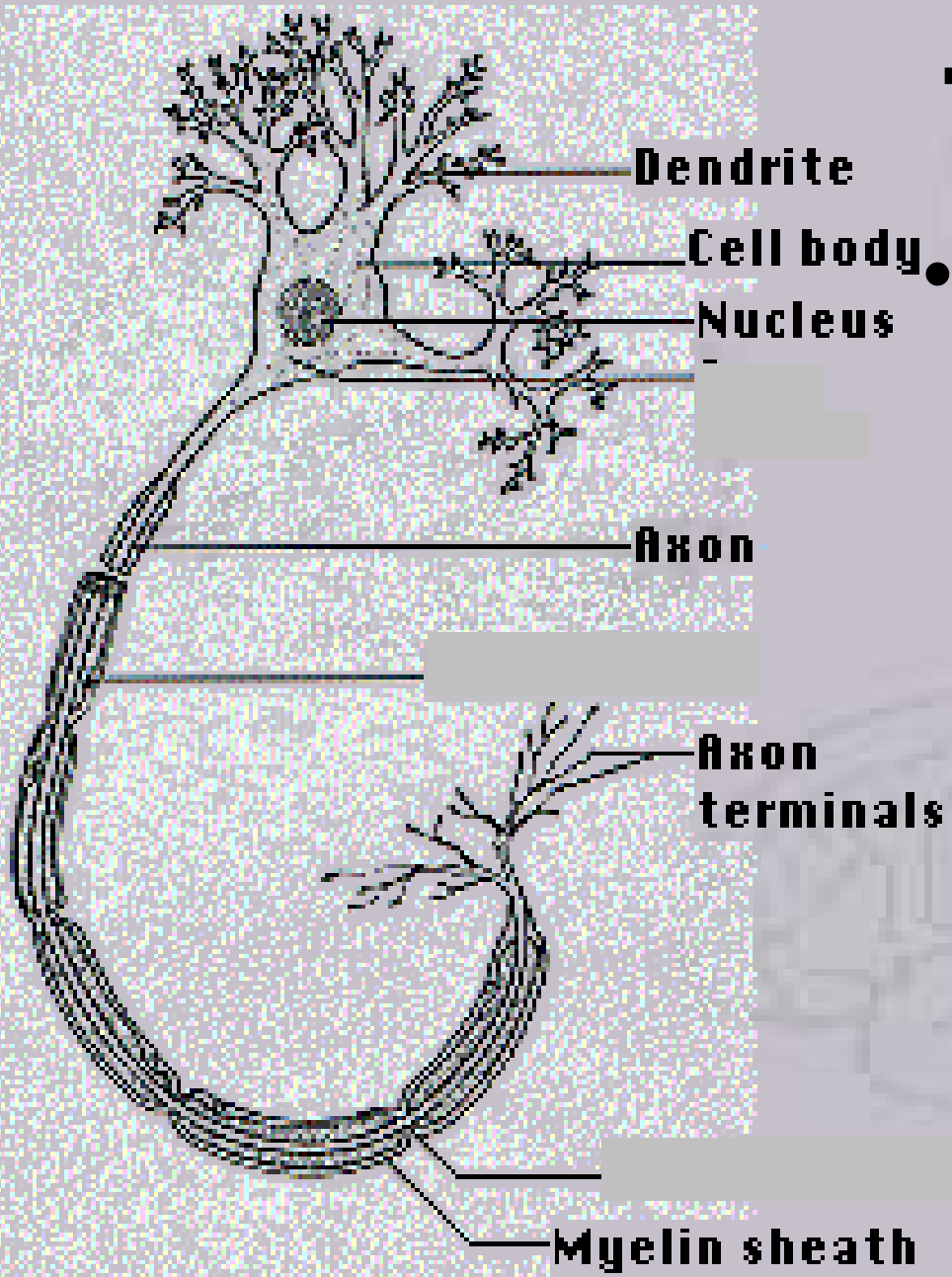


- **Run through the entire body and communicate with each other**
- **More than 100 billion in each person**

The Neurons

- Nerve cells that run through our entire bodies
- Send and receive messages from other structures in the body
  - Muscles
  - Glands

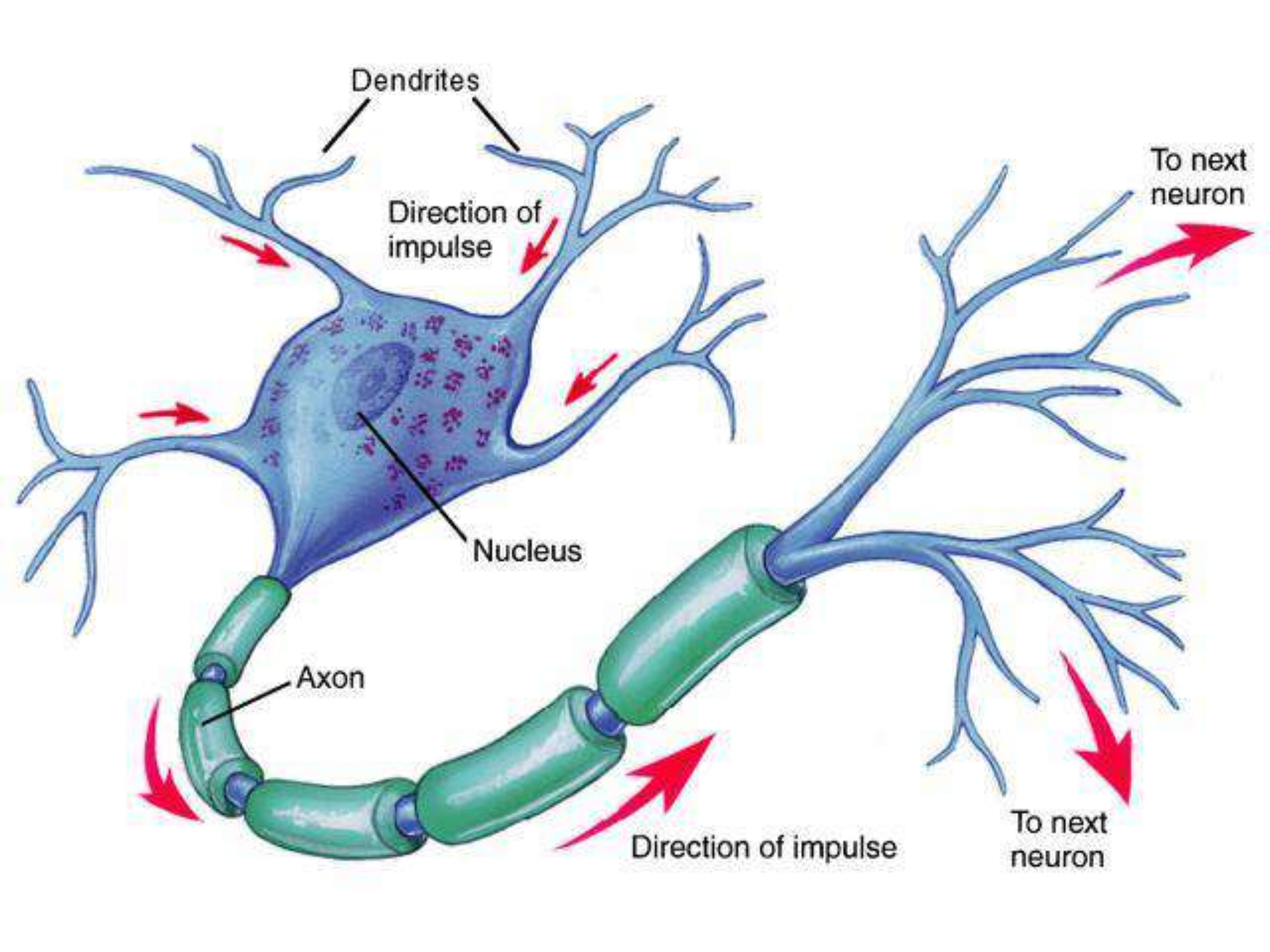
Neurons



- Every Neuron has a :
  - Dendrite
  - Cell body
  - Axon
  - Myelin sheath
  - Axon terminal

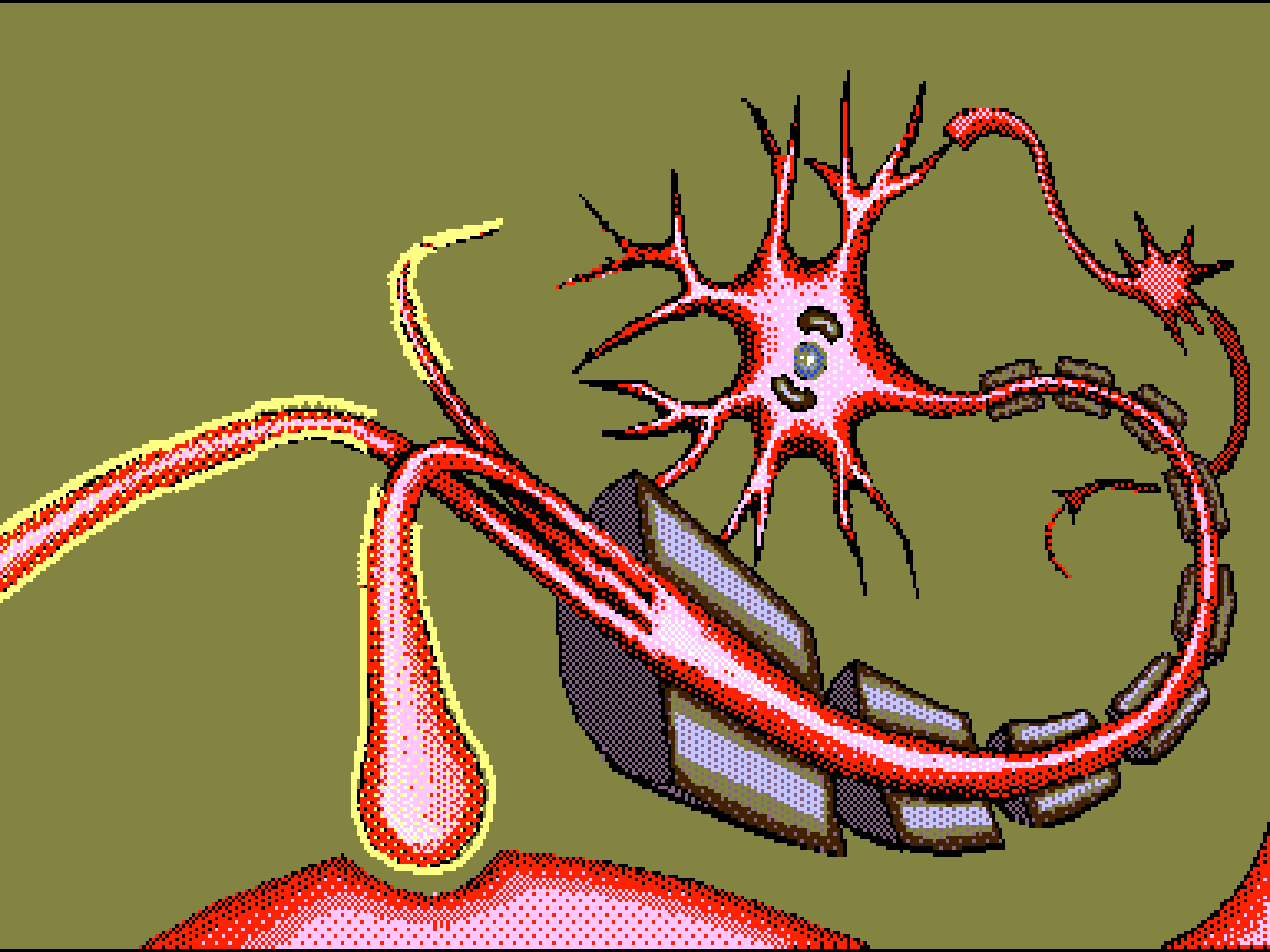
Components of a Neuron

- **Cell body** produces energy that fuels the activity of the cell
- **Dendrites** receive information from other neurons and pass the message through the cell body
- **Axon** carries the messages away
- **Myelin (sheath)** is the white fatty substance that insulates and protects the axon. It helps speed the transmission of the message.
- **Axon terminals** are at the end of the neuron, they pass the message on to the next neuron.


Dendrites
Direction of impulse
To next neuron
Nucleus
Axon
Direction of impulse
To next neuron

The Communication Process

- In order for a message to be sent form one neuron to another neuron, it must cross the synapse.
- Synapse is a junction between the axon terminals of one neuron and the dendrites of another.

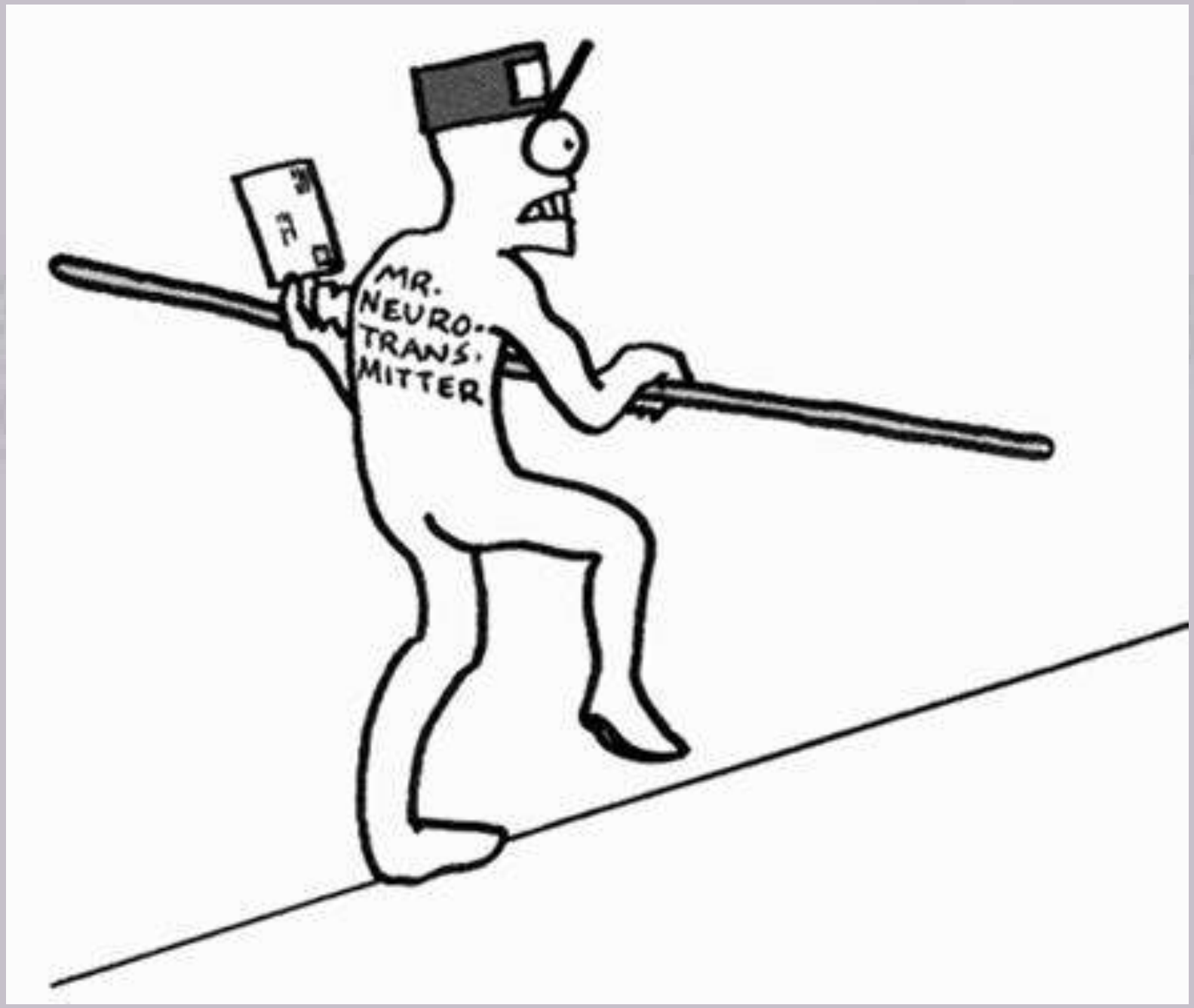


Neurotransmitters

- **Chemicals that are stored in sacs in the axon terminals**
- **The neuron fires, or sends its message, by releasing neurotransmitters, much like droplets of water shooting out of a spray bottle. This can occur hundreds of times every second.**

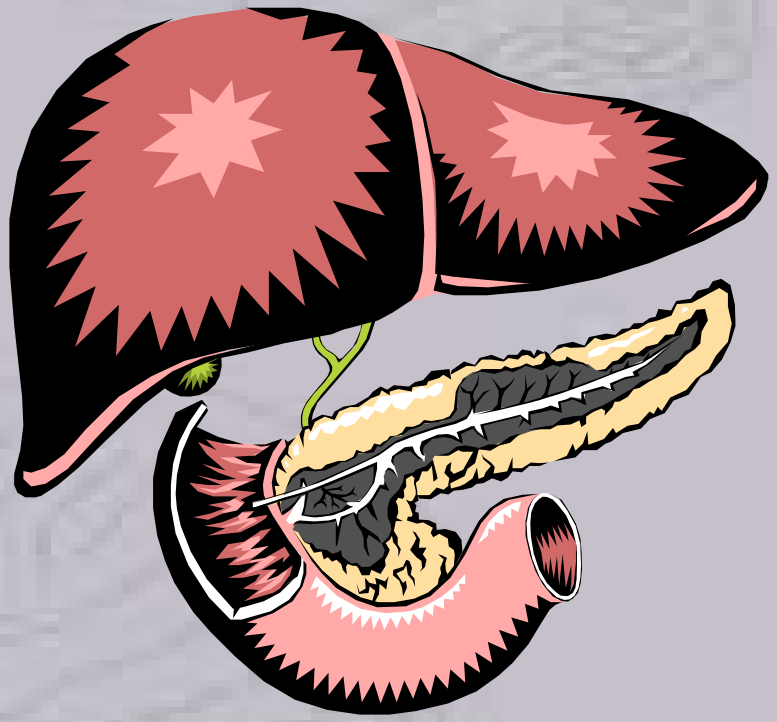
Types of Neurotransmitters

- Specific types of neurotransmitters have their own structure and fit into receptors sites in the next neuron
- Like a key and a lock
- Types of Neurotransmitters:
  - Acetylcholine (control of muscles)
  - Dopamine (involved in motor behavior)
  - Noradrenaline (preparing the body for action)
  - Serotonin (emotional arousal and sleep)


MR.
NEURO-
TRANS-
MITTER

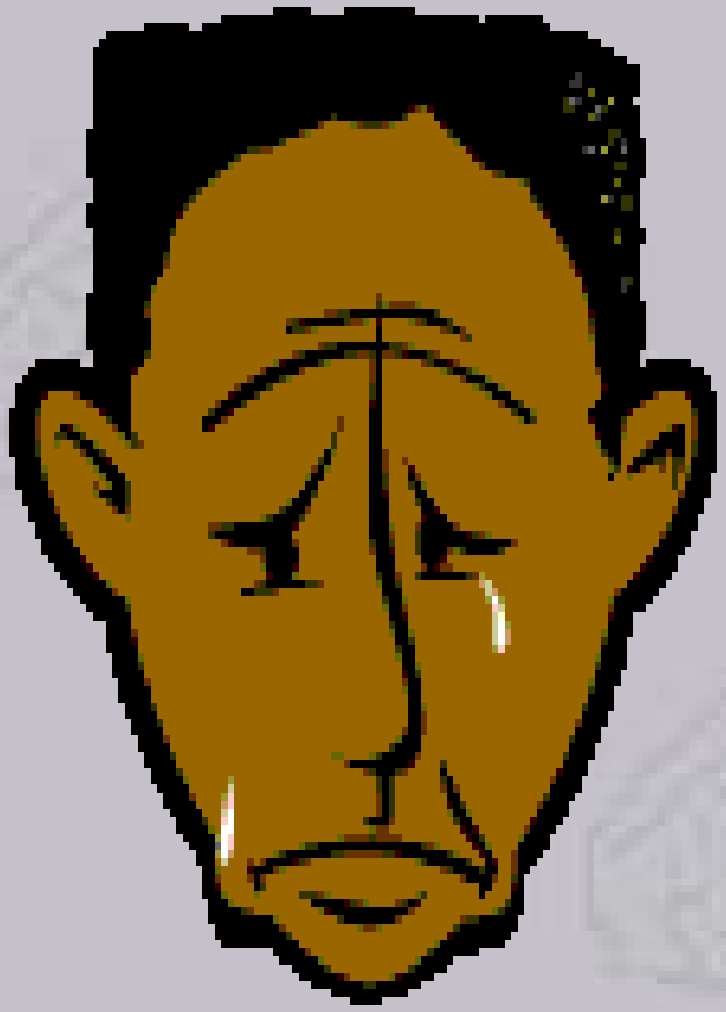
The Endocrine System

Consists of glands that secrete substances called hormones into the blood stream.

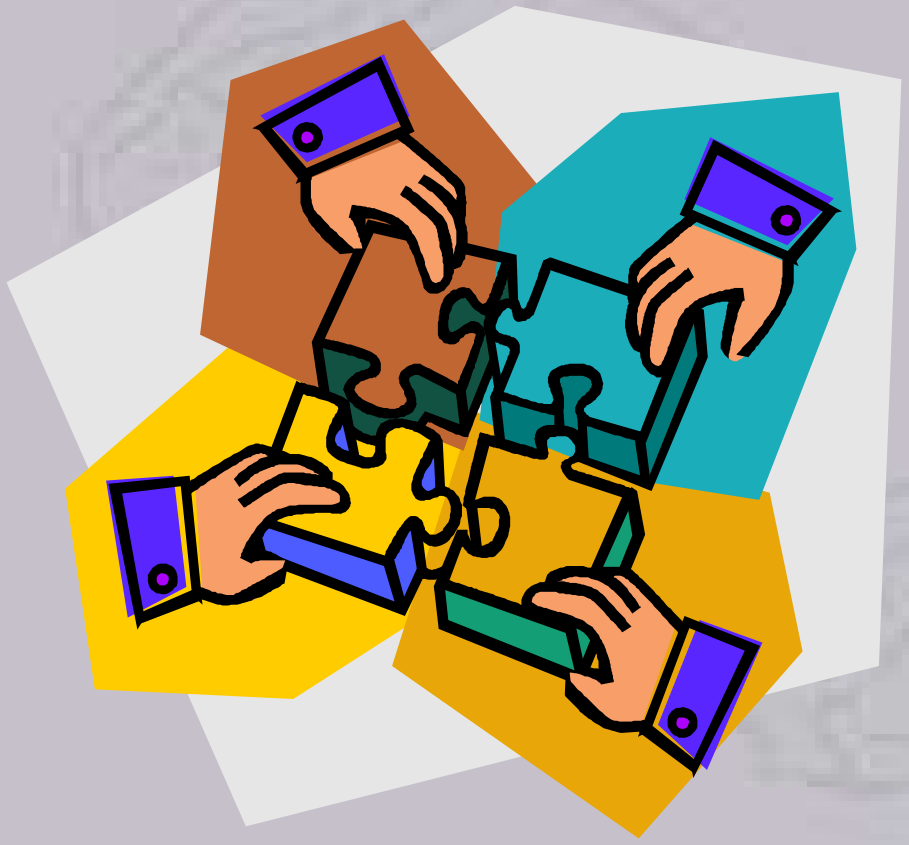


Hormones

Stimulate growth and many kinds of reactions, such as changes in activity levels and moods.



Psychologists studying biology of behavior are interested in the endocrine system



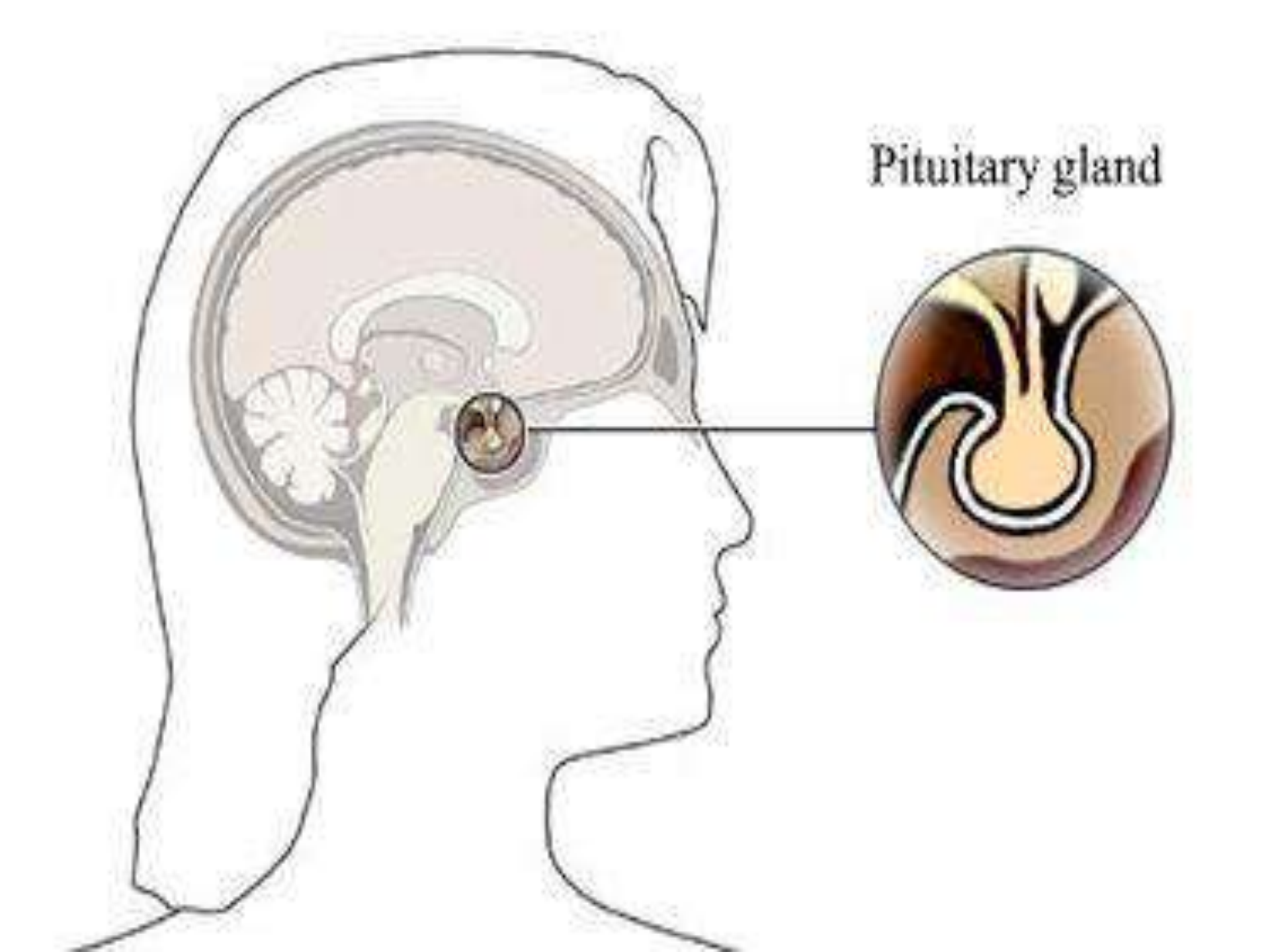
Hormones act only on hormone receptors in certain places

Glands produce hormones

- Some of those glands include:
  - Pituitary gland
  - Thyroid gland
  - Adrenal glands
  - Testes and Ovaries

Pituitary gland

- Located below the hypothalamus
- Nicknamed “the master gland”

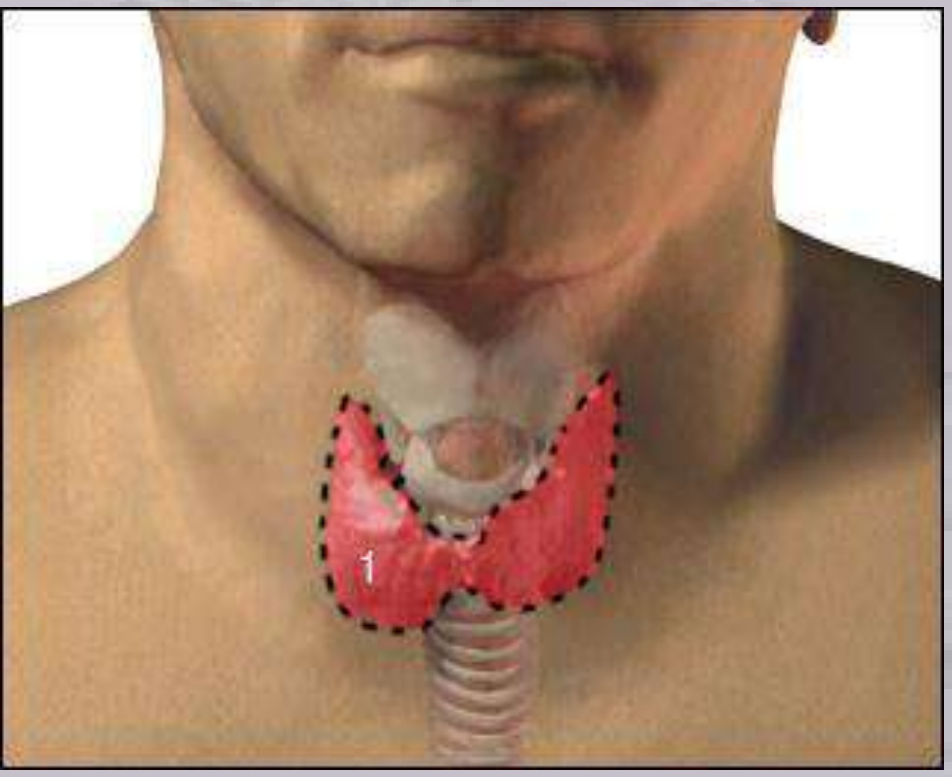

Pituitary gland

Pituitary Gland

Hormones controlled by pituitary gland:

- **Growth Hormones**
- **Pregnancy and mothering**
- **Stimulation of labor in pregnant women (oxytocin)**

Thyroid gland



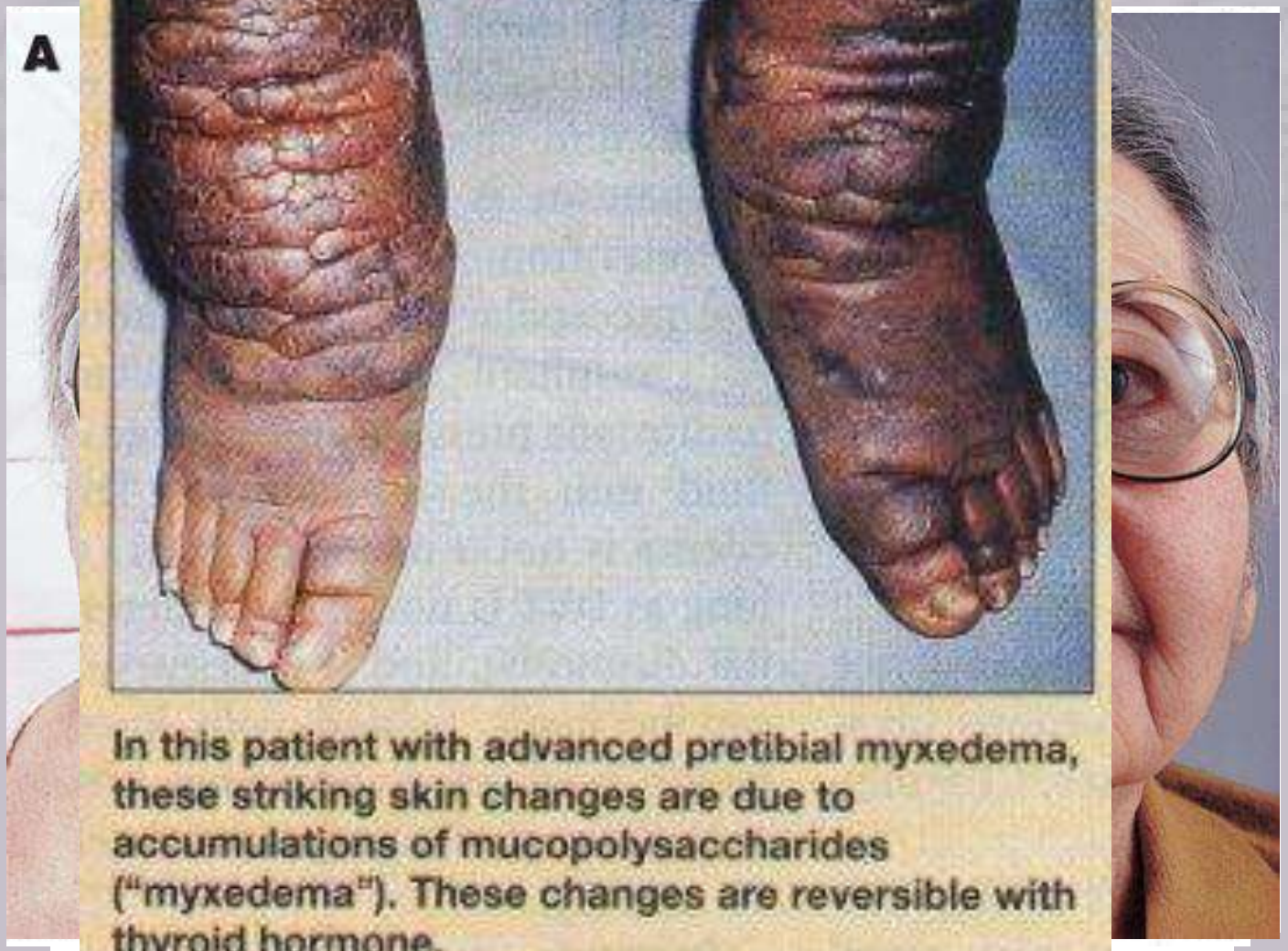
The thyroid gland is located in the middle of the lower neck, below the larynx (voice box) and just above your clavicles (collarbones).

Thyroid gland

Produces Thyroxin

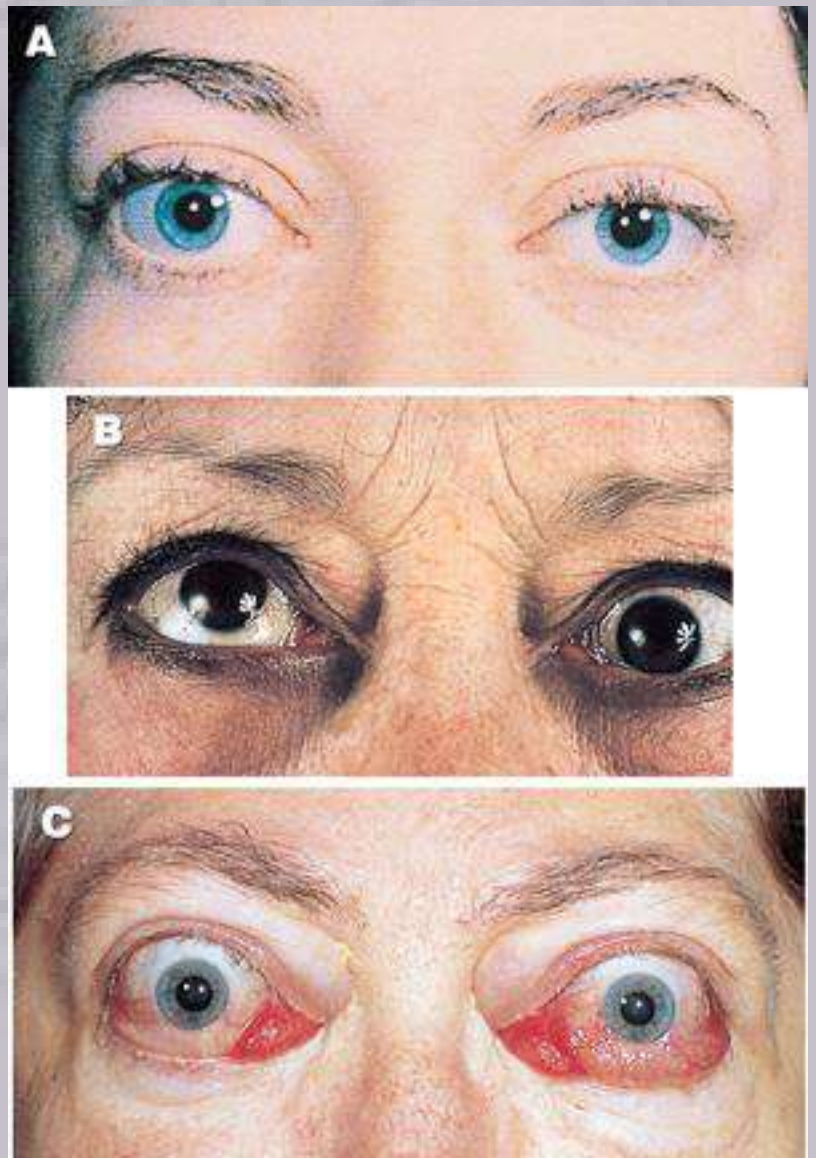
- Effects the body's metabolism
- Too little thyroxin, hypothyroidism (overweight)
- Too little thyroxin in children results in cretinism, stunted growth and mental retardation.
- Too much thyroxin, hyperthyroidism, excitability, inability to sleep, and weight loss.

Hypothyroidism



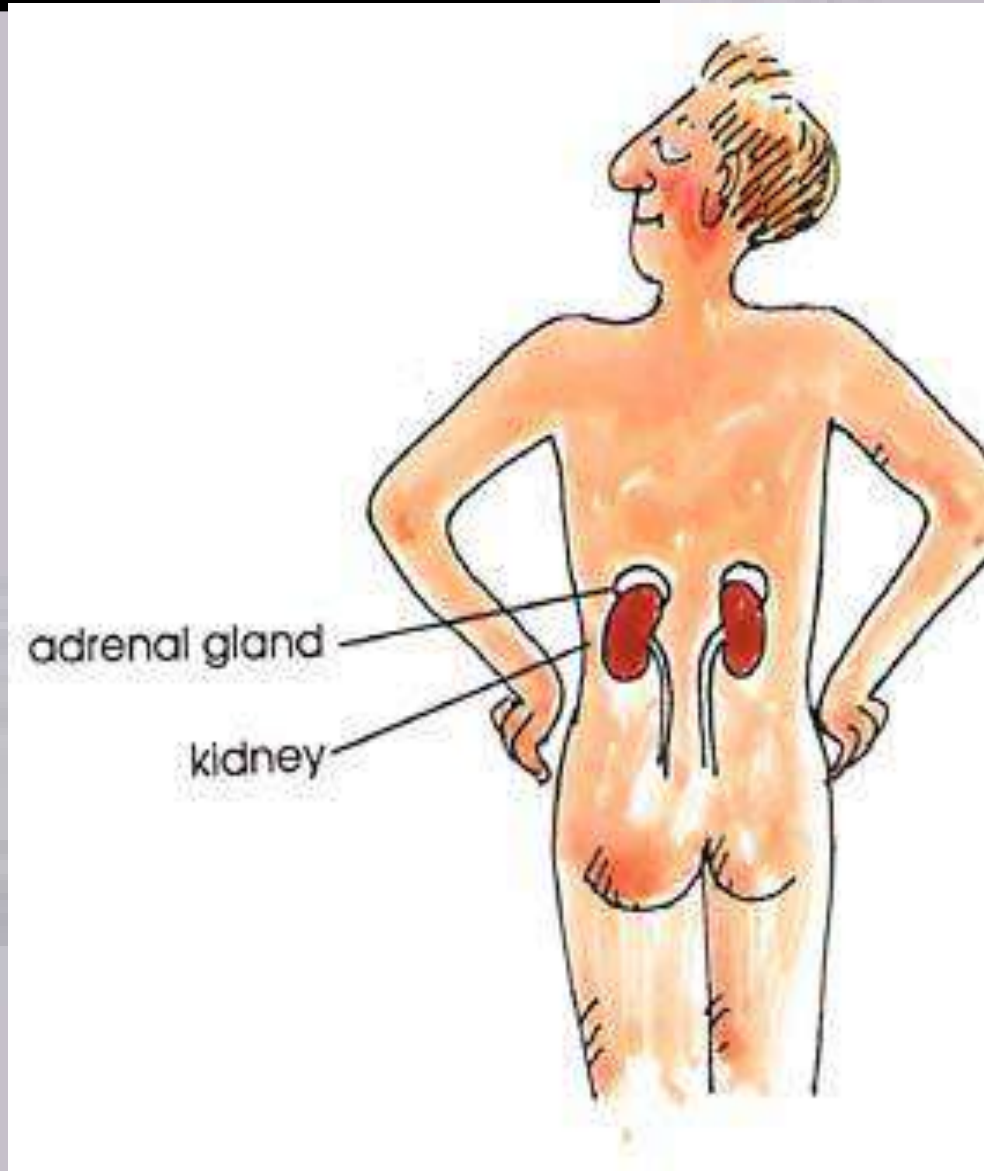
In this patient with advanced pretibial myxedema, these striking skin changes are due to accumulations of mucopolysaccharides ("myxedema"). These changes are reversible with thyroid hormone.

Hyperthyroidism



Adrenal glands

These glands lie above the kidneys, on the back wall of the abdomen



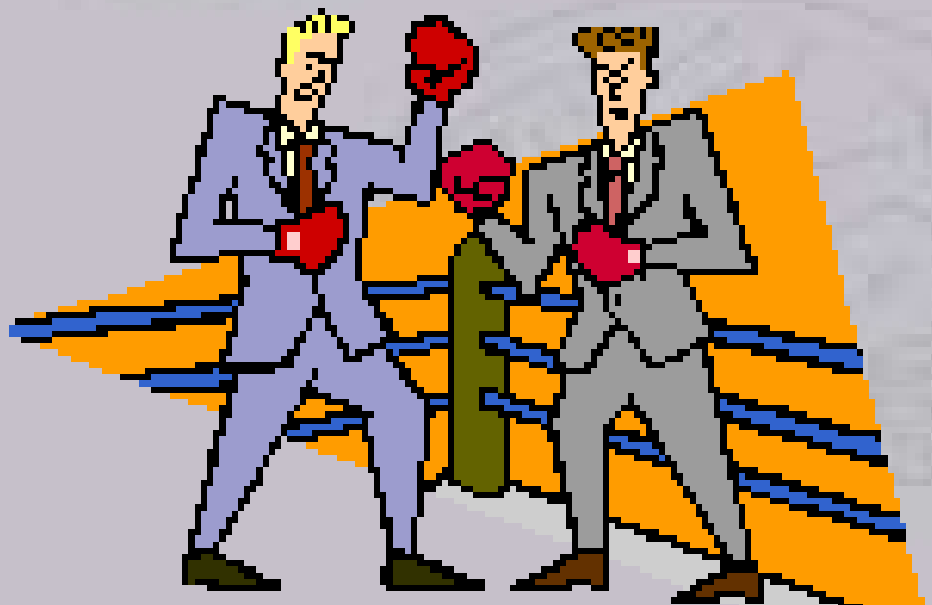
Outer layer of the adrenal glands secrete cortical steroids. This increases resistance to stress and promotes muscle development.

The Adrenal Glands

Adrenaline and Noradrenalin (both hormones) are produced by the adrenal glands

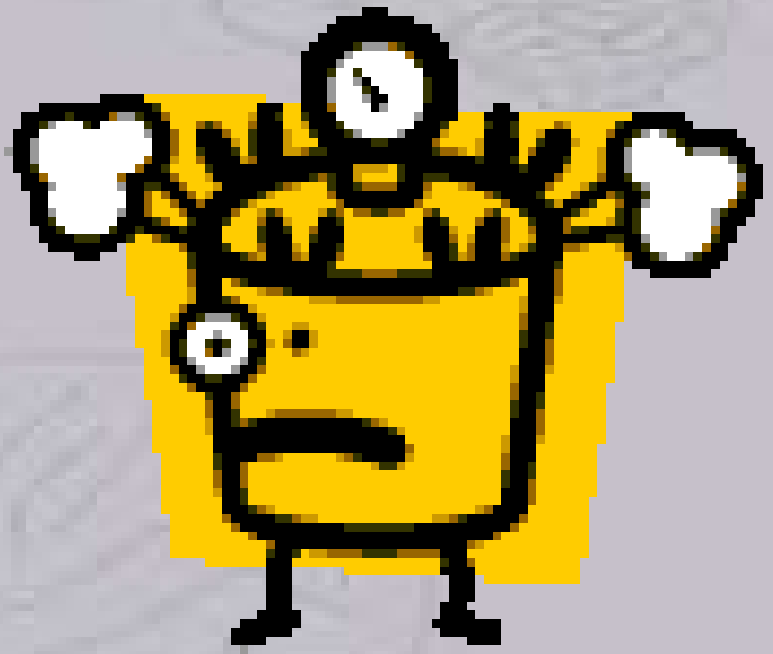
Adrenaline and Noradrenalin

- **Combination of both is secreted when a person faces a stressful situation**
- **These arouse the body and help it cope with the situation.**



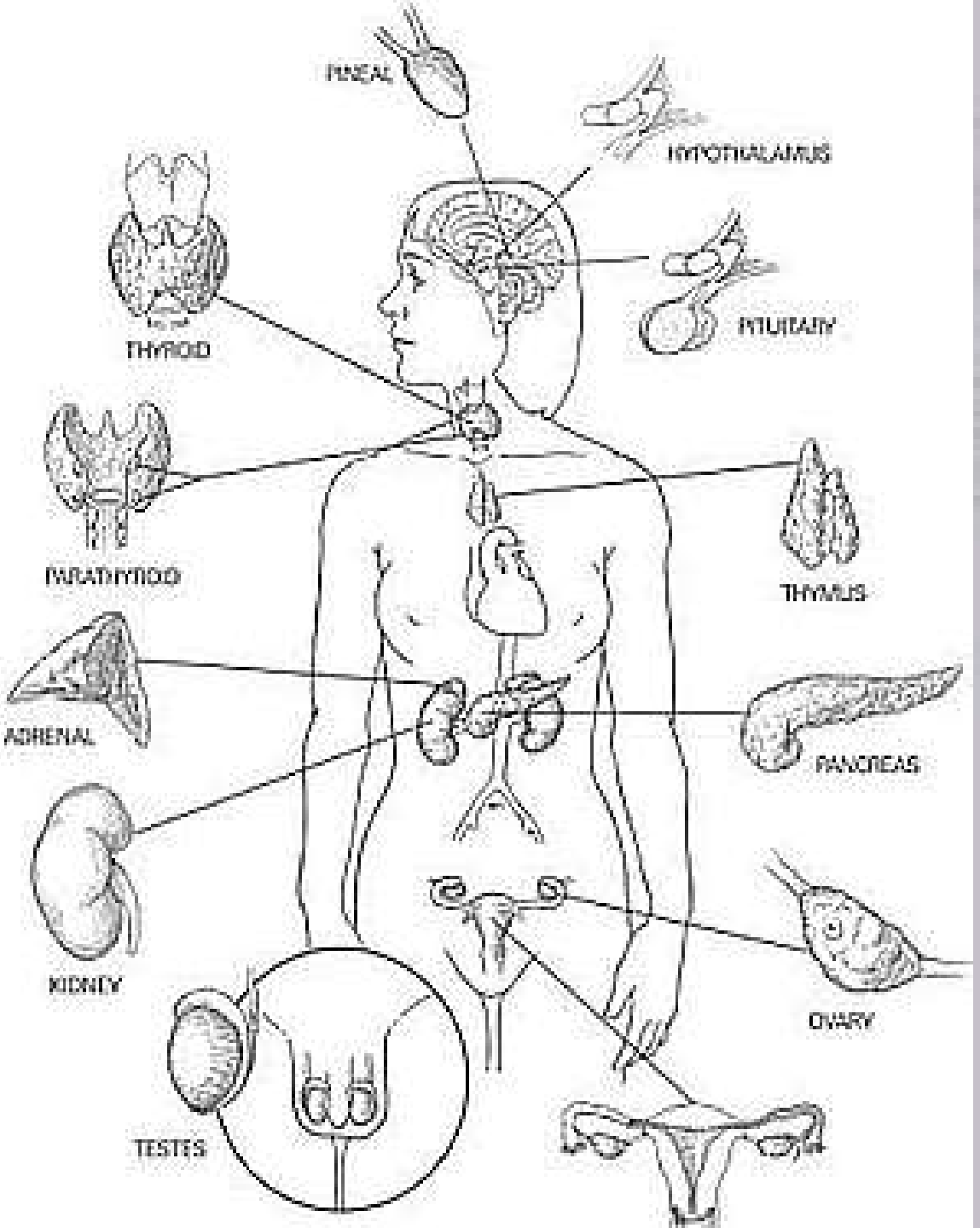
Adrenaline and Noradrenalin

- Adrenaline plays a role in emotions (fear and anxiety)
- Noradrenalin raises the blood pressure and also is used as a neurotransmitter.



Testes and Ovaries

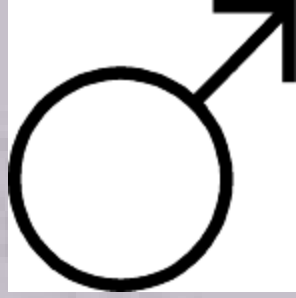
- Testes (found in males)
- Ovaries (found in females)


PINEAL
HYPOTHALAMUS
THYROID
PITUITARY
PARATHYROID
THYMUS
ADRENAL
PANCREAS
KIDNEY
OVARY
TESTES

Testes and Ovaries

- Both produce Testosterone
  - –male sex hormone (females have small amounts of testosterone)
  - –Role in development during prenatal adolescence stages.

Testosterone



- During prenatal stages it projects sex organs.
- Adolescently it helps develop muscle and bone as well as development of primary and secondary sex characteristics.
- A steroid

Sex Characteristics

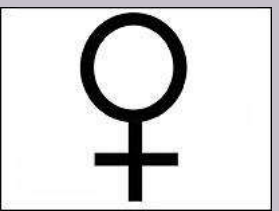
- **Primary sex characteristics have to do with reproduction**
- **Secondary sex characteristics are byproducts of the gender (i.e. beard growth)**

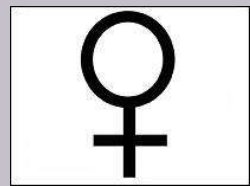
Estrogen and Progesterone

- Both are female sex hormones (males have small amounts of both, also.)
- Ovaries produce both hormones in women.
- Estrogen's purpose is to foster development of primary and secondary sex characteristics (such as breasts)

Estrogen and Progesterone

- Progesterone helps prepare the body for pregnancy
- Both regulate the menstrual cycle
- Changes in estrogen levels are lined to PMS





Heredity

The transmission of characteristic from parent to offspring

Heredity

Key role in the development of traits both in people and in animals

Heredity

Physical Traits

Hair

Hair Texture

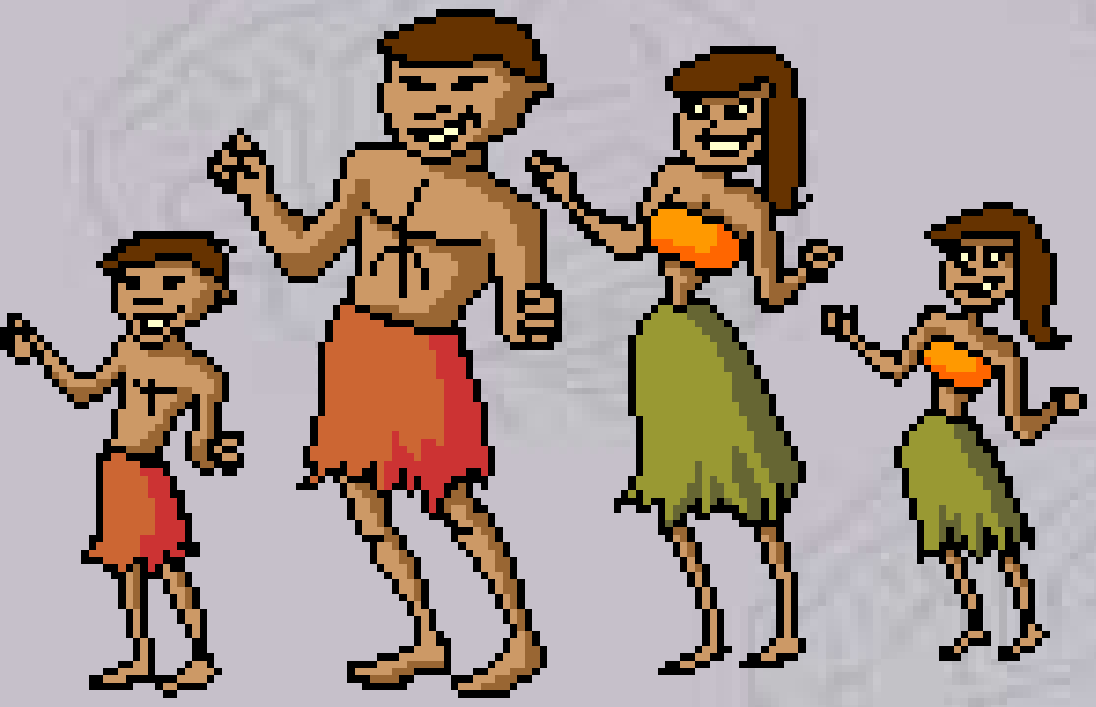
Eye color

Heredity

Related to some psychological Traits:

- Shyness
- Leadership
- Aggressiveness
- Interest in Arts and Crafts

Heredity



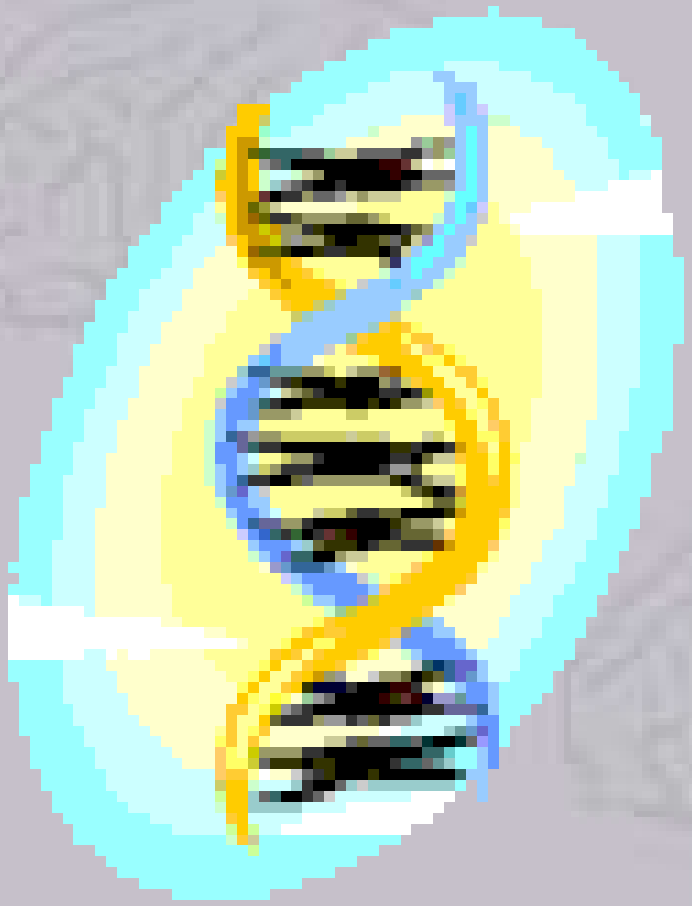
Environment still hold a role in the heredity psychological traits

Heredity

Heredity has been shown to be one factor involved in many psychological disorders:

- **Anxiety and depression**
- **Schizophrenia (distortion in thinking, perception, emotion and behavior)**
- **Bipolar disorder (moods inappropriately alternates between extremes of elation and depression)**
- **Alcoholism**

Heredity



Genes and chromosomes

- Genes are the basic building blocks of heredity
- Grouped in pairs (one from each parent)

Heredity

Chromosomes are where genes are

-Threadlike structures

- **Composed of deoxyribonucleic acid (DNA)**
- **Most human cells contain 46 chromosomes that reorganize into 23 pairs**

Heredity

- The 23rd pair determines the sex of the individual
  - –Males XY
  - –Females XX
  - – Male chromosomes determine the sex of the offspring

Heredity

Children born without 46 chromosomes in

each cell have physical and behavioral disorders

Down syndrome is the result of extra chromosomes.


Clinodactilia
Línea transversal palmar
Depresión entre el 1er y 2° dedo
Pie plano

The Nature vs. Nurture Debate

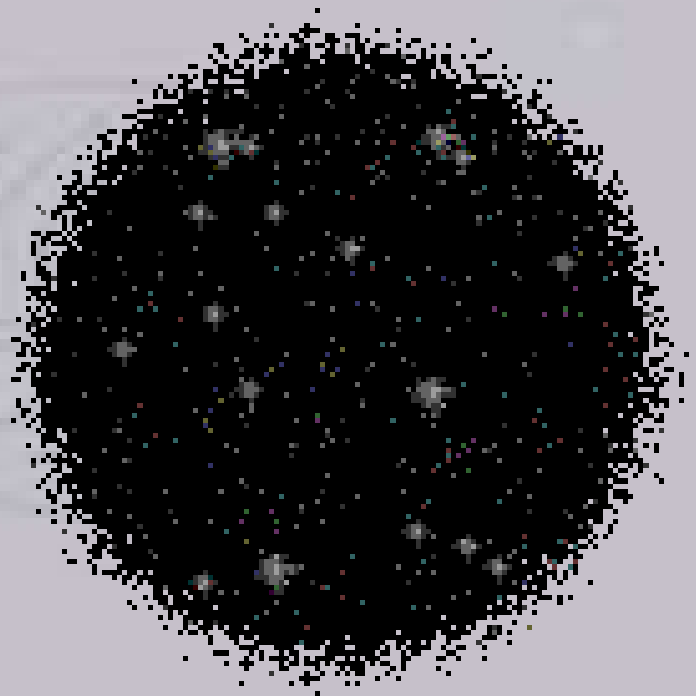
- **Nature** refers to what people inherit-biological groundwork that prepares a person to develop in certain ways
- **Nurture** refers to environmental factors what a person is exposed to in life

Kinship studies

- Refers to the degree to which people are related based on the genes they have in common
- Use these studies to determine the influence of environment and genetics
- Two common types of kinship studies are twin studies are twin studies and adoptee studies.

Twin Studies

- Identical twins- share the same genetic makeup (100%)
- Fraternal twins- share an average of 50% of their genes



Adoptee Studies

Children that shares the same heredity, but have had different environments

Twins reared apart

Children that share the same genetic make up but were raised in different environments are the best ways to test the Nature vs. Nurture debate.