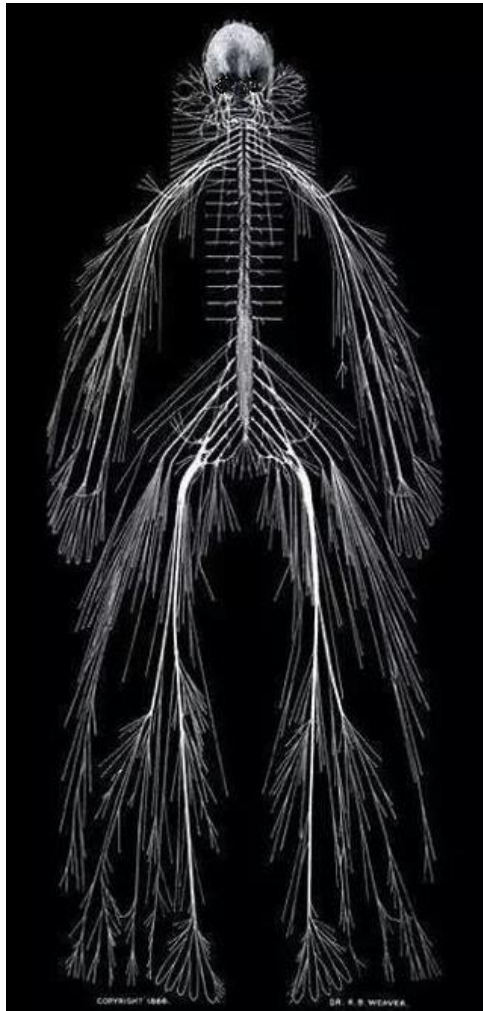


Class Notes  
for the  
**NERVOUS SYSTEM**



Anatomy & Physiology  
2016  
Mr. Johnson

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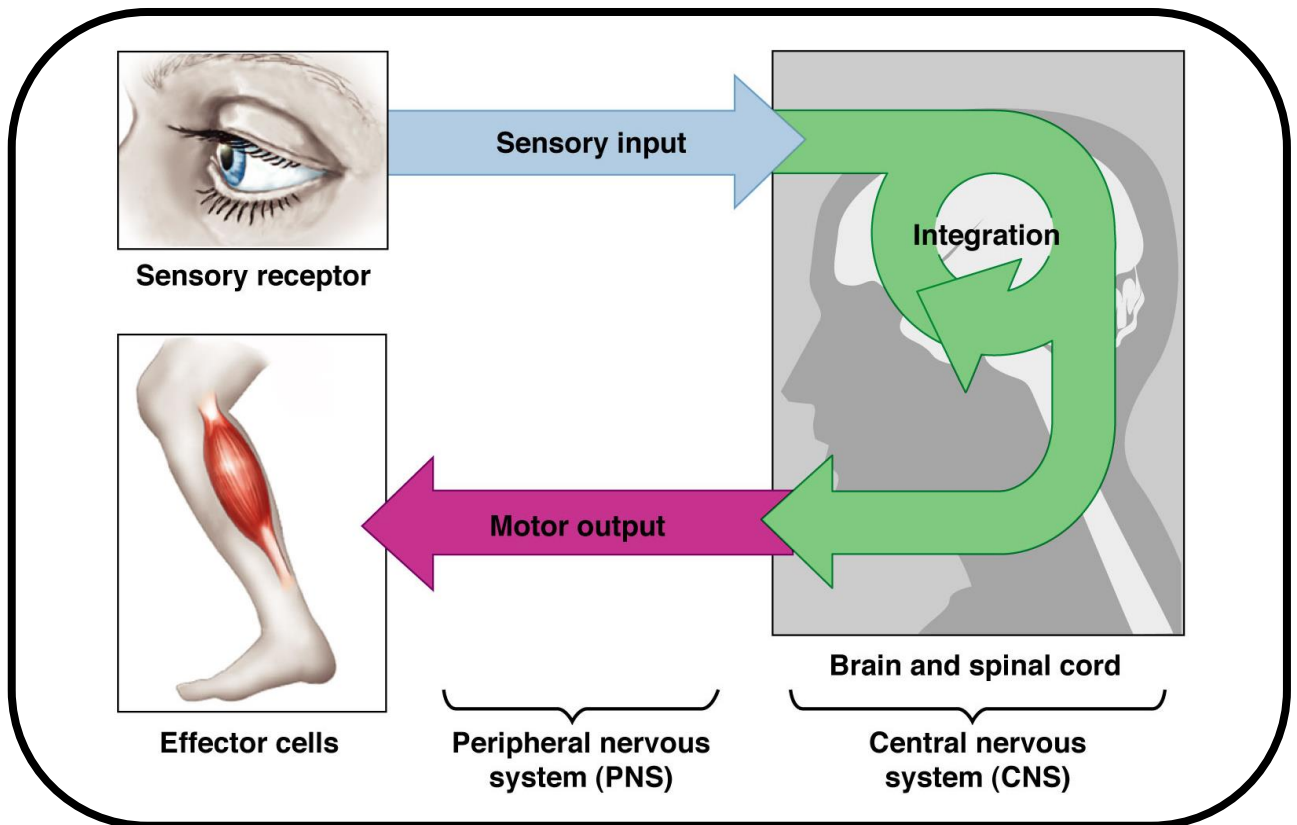
- I. Functions of the Nervous System
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# I. Functions of the Nervous System:

A. The major overall function of the nervous system is to **perceive and respond to events** in our internal and external environment.

B. The major function is done in three overlapping steps:

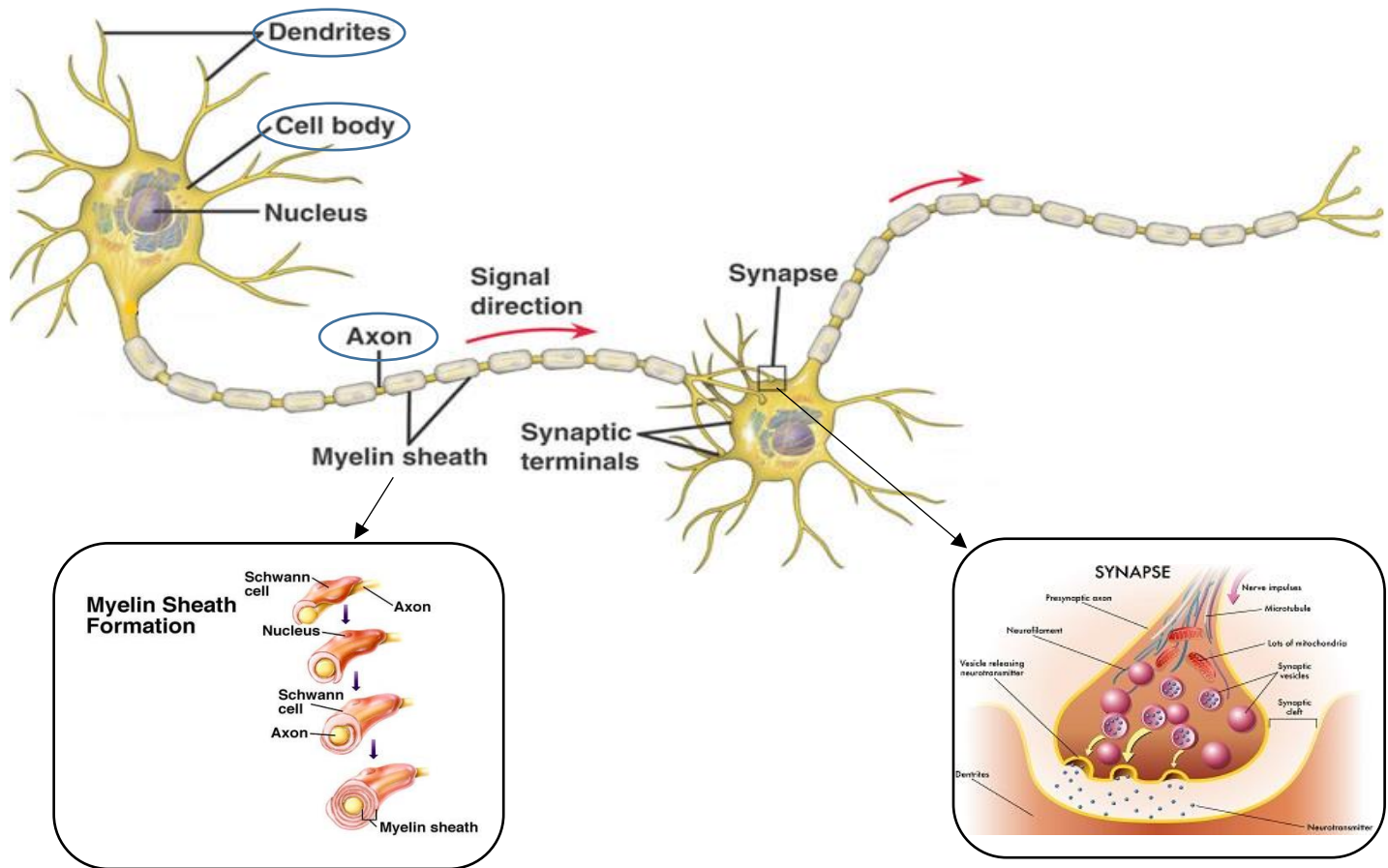
1. **Sensory Input** – sensory receptors gather stimuli.
2. **Integration** – the brain decides what to do about the stimuli.
3. **Motor Output** – muscles or glands respond to the stimuli.



C. Other functions of the nervous system:

- Coordinate all other organ systems
- Memory – storing experiences
- Learning – establishing patterns of response based on past experience

## II. Structure of a Typical Neuron:



## III. How Nerves Work

### A. Electrical Activity ***Along*** Neurons

#### 1. Irritability

- The ability for a nerve to detect a stimulus and turn it into an electrical impulse.
- “All-or-Nothing” threshold response.

#### 2. Conductivity

- The ability of a nerve to carry the electrical signal along the length of its axon.

## B. Chemical Activity ***Between*** Neurons

1. Electrical impulse cannot cross the gap (synaptic cleft) between neurons.
2. Chemicals called “neurotransmitters” are released from the axon terminals to cross the gap and irritate the dendrites of the next nerve, causing an electric impulse to conduct along its length. (takes about 1 millisecond)

C. The complete transmission of a nerve impulse is called an “electrochemical event”.

## D. Interesting Unusual Events of Nerve Physiology

### 1. General Anesthetics, Alcohol, Sedative Drugs

- Decrease the irritability of neurons or disrupt the neurotransmitter process between neurons.

### 2. Body parts “falling asleep”

- Cold or pressure reduces blood supply to neurons.
- Without oxygen and nutrients, the neurons stop working.
- Returning blood supply causes neurons to start transmitting again, which feels prickly.

## IV. Organization of the Nervous System:

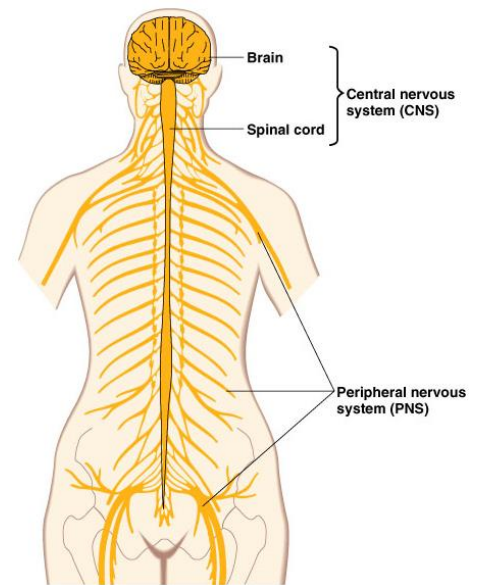
### A. Two major regions:

#### 1. Central Nervous System

- Structures contained in the skull and spinal cord.

#### 2. Peripheral Nervous System

- All other neurons outside of the skull and spinal cord.
- Sensory (afferent) nerves carry information to the CNS.
- Motor (efferent) nerves carry information back out to the body.



### B. The Peripheral Nervous System can be further divided into the Somatic and Autonomic Systems:

1. Somatic System – controls voluntary muscles

2. Autonomic System – controls involuntary organs  
(digestive system, heart, glands, etc.)

### C. The Autonomic System can be split into two systems:

1. Sympathetic – activates organs & glands

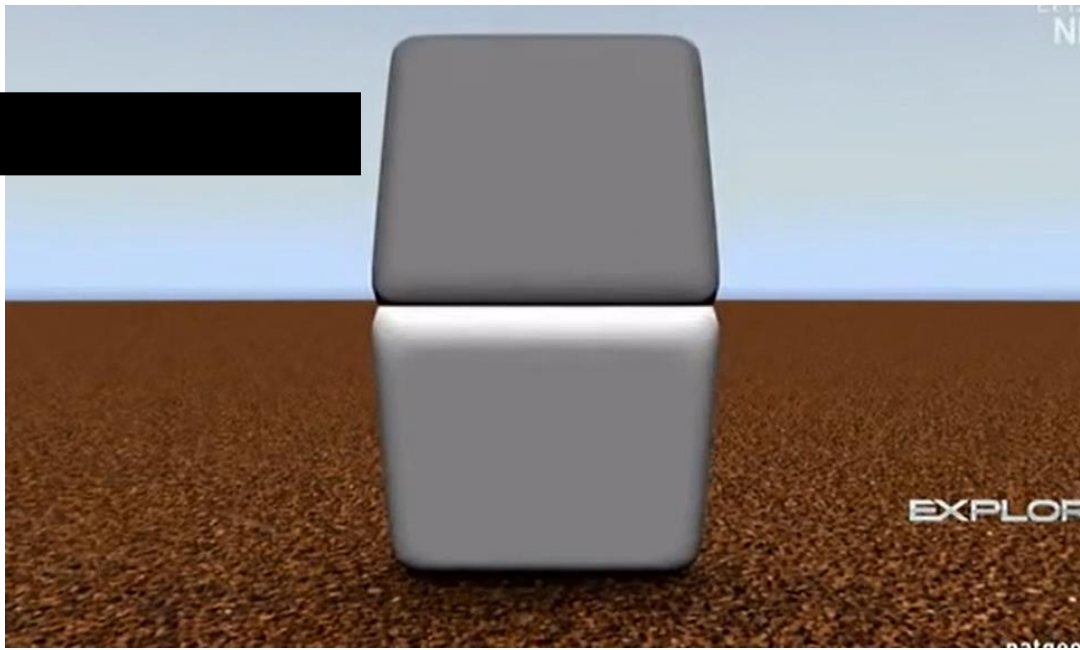
\*Fight-or-Flight

2. Parasympathetic – calms organs & glands

\*Resting & Digesting

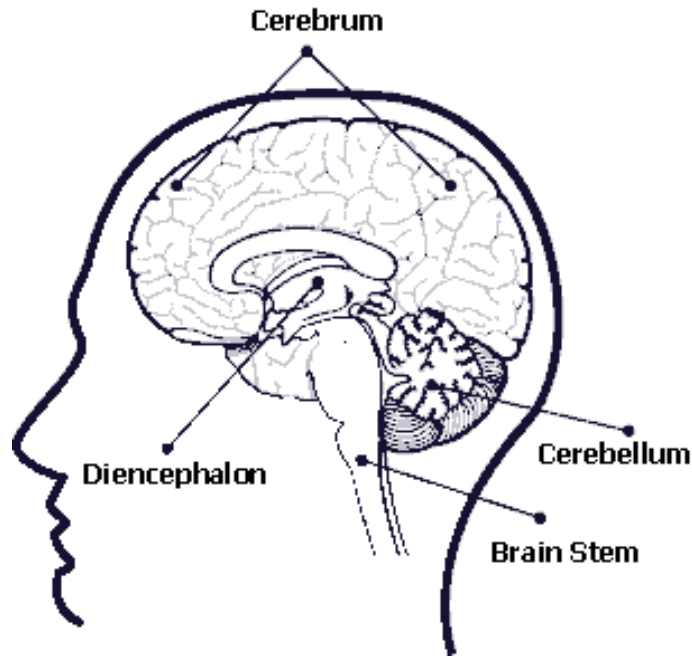
Wow. That was a lot of stuff. Let's take a minute to somehow diagram that Organization of the Nervous System below:

# HUMPING TO CONCLUSIONS





## V. The Brain ~ Four Major Regions



Major Region	Function(s)	Subdivisions
<b><u>Cerebrum</u></b>	<ul style="list-style-type: none"> <li>*Thinking &amp; Memory</li> <li>*Sensory information</li> <li>*Complex movement</li> </ul>	Parietal Lobe Occipital Lobe Temporal Lobe Frontal Lobe
<b><u>Cerebellum</u></b>	<ul style="list-style-type: none"> <li>*Balance &amp; Equilibrium</li> <li>*Coordinates body movement</li> </ul>	
<b><u>Diencephalon</u></b>	<ul style="list-style-type: none"> <li>*Controls autonomic organ systems and hormones to help maintain homeostasis</li> </ul>	Thalamus Hypothalamus Pituitary Gland
<b><u>Brain Stem</u></b>	<ul style="list-style-type: none"> <li>*Heartbeat and breathing</li> <li>*Consciousness</li> </ul>	Midbrain Pons Medulla Oblongata

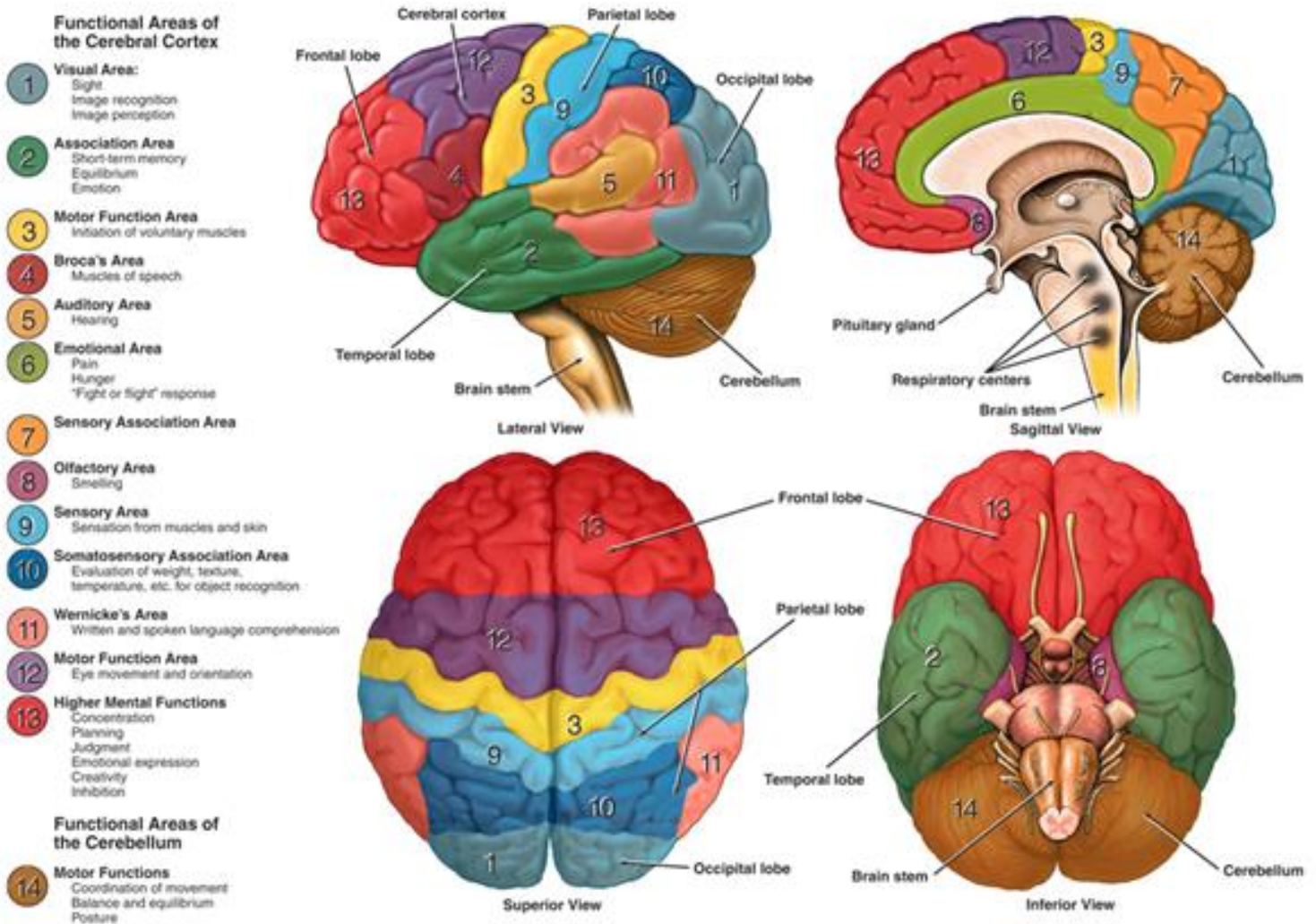
Let's dissect something!!!

## VI. The Brain ~ A Closer Look at Each Subdivision

### A. Cerebrum

1. Two **hemispheres** connected by a dense network of nerves called the "**corpus callosum**".

2. Many lobes do specialized higher functions:

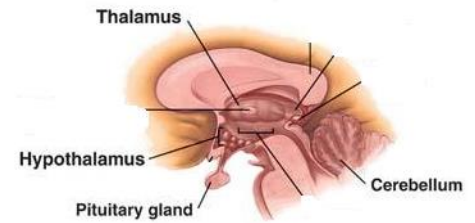


B. Cerebellum – no subdivisions that we are going to worry about.

## C. Diencephalon – three major subdivisions

### 1. Thalamus

- First check of sensory input to determine if pleasant or unpleasant.



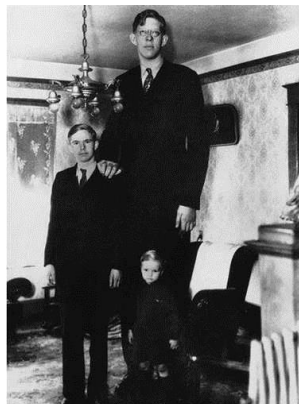
### 2. Hypothalamus

- Body temperature
- Water balance
- Metabolism
- Limbic System: emotions & addictive behaviors



### 3. Pituitary Gland

- Secretion of growth hormones
- Pituitary Dwarfism, Gigantism, Acromegaly



## D. Brain Stem

1. Midbrain – vision & hearing

2. Pons - breathing

3. Medulla Oblongata – heartrate, breathing, swallowing

## Brain Games demonstrations for fooling the brain:

- Effect of shadows on color perception ~ 3:30
- Phantom images ~ 13:53
- Fooling your ears with your eyes ~ 23:53
- Visual “pain” ~ 19:06

## VII. Stimulus & Response for Homeostasis

### A. Reflexes - rapid, predictable, and involuntary responses to stimuli.

#### 1. Automatic adjustments to:

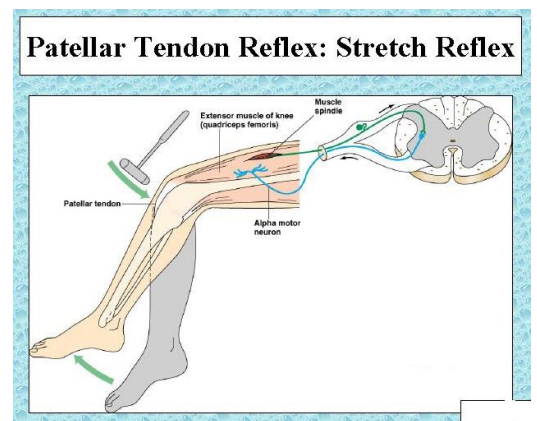
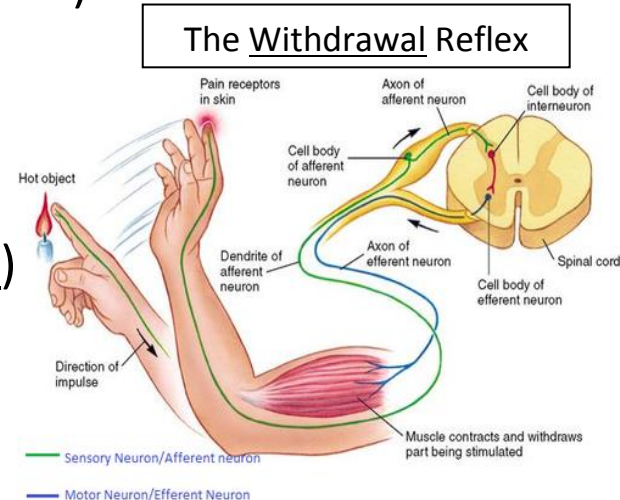
- Heart & breathing rates
- Glandular activity
- Eye pupil dilation
- Body position (skeletal muscles)

#### 2. Reflex Arc

a. Stimulus signal sent through afferent (sensory) nerve to spinal cord.

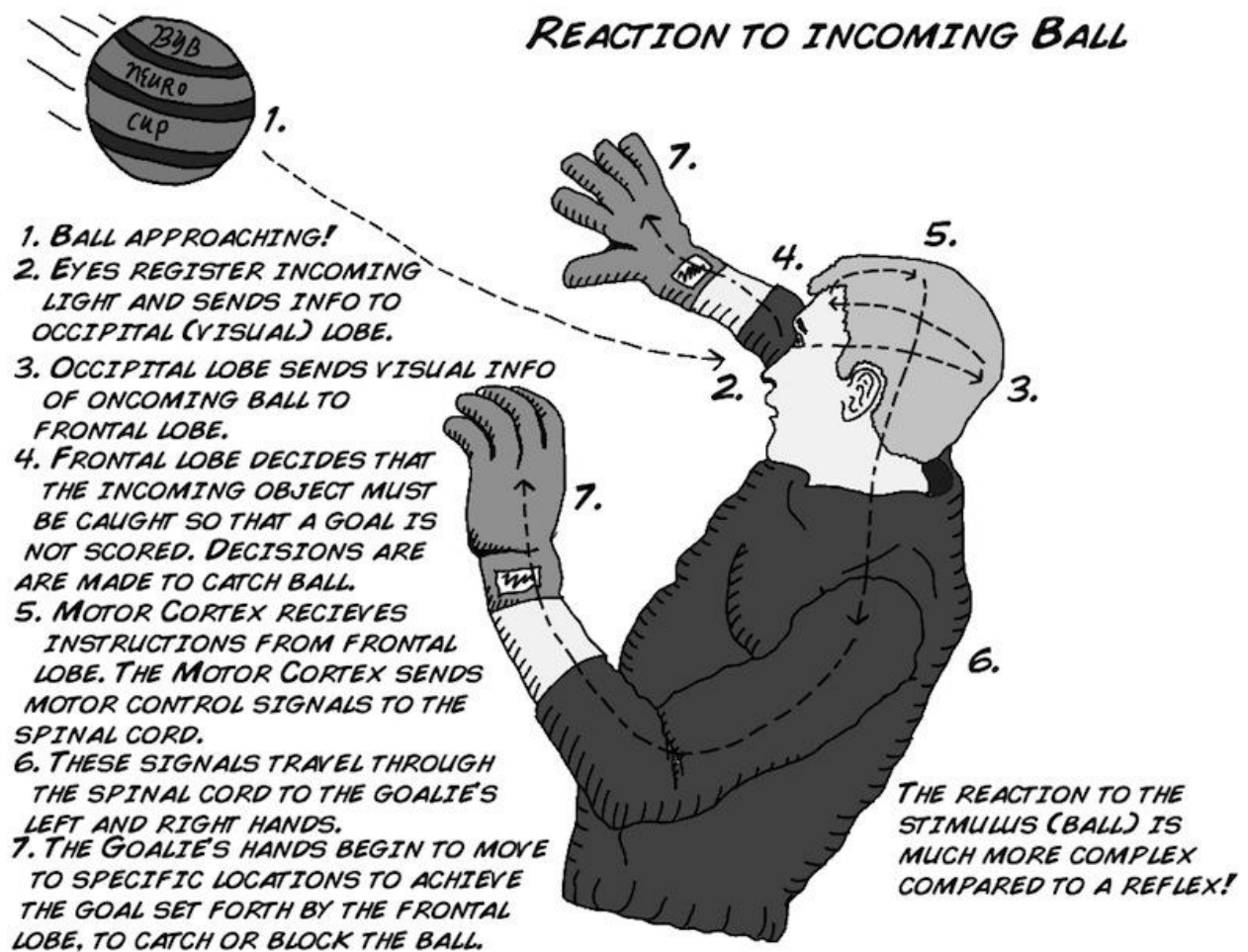
b. Spinal cord interprets signal and responds by:

- Sends one message back to the muscles through efferent (motor) nerves telling it to flex quickly.
- Sends another message to the brain as an “FYI”.



#### 3. Useful in evaluating the condition of nervous system.

B. Reaction Time – the time between a stimulus and the beginning of a voluntary response.



1. Much more complex than a reflex because the brain is involved in the response.

2. Human reaction times:

0.25 seconds for visual stimuli

0.17 seconds for auditory stimulus

0.15 seconds for a touch stimulus

## VIII. Our Five “Special Senses”

- Sight
- Hearing
- Equilibrium
- Smell
- Taste