

Advanced Placement Psychology

Chapter 2: Neuroscience, Genetics, and Behaviors

(<http://www.ApPsychology.net>)

- Franz Gall developed the *false* theory called **Phrenology** – where bumps on the head dictate personality and intelligence. But the theory did direct our attention to *brain region* and *function*.
- Psychologists that study these connections between biology and behavior are called **Biological Psychologists**.

Neural Communication

- Our Neural System is basically made up of nerve cells or **neurons**. Each neuron is composed of **Dendrites** ~ message receiving fibers and **Axons** ~ message sending fibers which are insulated by the **Myelin Sheath** ~ fatty cells that help [speed up impulses](#).
- Impulses or **Action Potential** is a brief electrical charge that travels down the axon as it becomes *Depolarized* due to the movement of positively charged ions entering the axon. After the transmission, the axon becomes *Polarized* as positive ions are pumped out during the *Refractory Period*.
- The intensity of a stimulus is called the **Threshold**. A stimulus must exceed the threshold in order for a transmission to occur. *The neuron will either fire or it won't*. [Much like a gun, the neuron either fires or it doesn't, there are no half-fires](#). This is called the *all-or-none-response*; if a stimulus is really strong, only the *number* of neurons firing will increase, not their speed.
- The axon terminal of the sending neuron is separated from the receiving neuron by a tiny gap called the **Synapse** (or **Synaptic Cleft**). Once the action potential reaches the synapse, **neurotransmitters**, or *chemical messengers*, are released into the gap where it will bind onto specific receptor sites on the receiving neuron.
- The most well know neurotransmitter is **Acetylcholine** (ACh), it causes muscles to contract in movement.
- **Endorphins** are natural opiates produced in the body to control pain and induce pleasure. (*"Morphine within"*)
- *Agonists* are molecules which *mimics* the shape of natural neurotransmitters (Morphine)
- *Antagonists* are molecules which *block* neurotransmitters from binding on receptor sites
- The brain has a *Blood-brain barrier* which filters out unwanted chemicals in blood stream.

Neural and Hormonal Systems

- The Nervous System is composed of the **Central Nervous System** (CNS) – brain and spinal cord, and **Peripheral Nervous System** (PNS) – links CNS to body's muscles and glands by means of **nerves** which are bundles of **sensory** and **Motor Neurons** (they carry incoming and outgoing information respectively).
- The **Autonomic Nervous System** (under PNS) has **Sympathetic Nervous System** – [arouses](#) the body for defense (increase heartbeat, dilating pupils, inhibit digestion etc.) and **Parasympathetic Nervous System** – [calms](#) the body after stress.
- A simple **Reflex** is an automatic response to stimuli (like knee-jerk) involving messages from Sensory to **Interneuron** (Spinal Cord) to Motor Neuron.
- The **Endocrine System** (slow hormone secreting system) communicates by releasing **Hormones** (chemical messengers) into the bloodstream.
- In times of stress the ANS will signal **Adrenal Glands** (above kidney) to release *epinephrine* and *norepinephrine* hormones (also called *adrenaline* and *noradrenaline*.)
- **Pituitary gland** is the most powerful endocrine gland, and under the influence of hypothalamus in brain, pituitary releases hormones that regulate glands and growth.

The Brain

- **Lesions** – [remove brain tissue](#)
- **Electroencephalogram (EEG)** – [measures brain electric activity](#)
- **Computed Tomograph (CT or CAT Scan)** – [taking x-ray photographs of brain](#)
- **Positron emission tomograph (PET Scan)** – [detects radioactive glucose consumption in brain](#)
- **Magnetic Resonance imaging (MRI)** – [generates brain images from magnetic activity](#)

- The **brainstem** – oldest portion in brain forms into the **Medulla Oblongata** – regulates **involuntary** processes like heartbeat and breathing.
- Within the brainstem lies the **reticular formation** (looks like a finger-shaped net) which controls **arousal, when you wake or sleep**.
- The **Thalamus** lies above brainstem and is shaped like two eggs. Its function is to act as a *sensory switchboard* relaying incoming signals to appropriate brain regions. **But does not relay sensory signals dealing with smell.**
- The **Cerebellum** stores partial *memory* and *learning capacities*. But it mainly controls *balance*.
- **Limbic System** includes **Amygdala** – influence **emotions** (fear, anger), and the **Hippocampus** – process **memory**. Removal of amygdala results in emotionless organisms upon arousal.
- The **Hypothalamus** maintains body homeostasis (temperature, hunger, growth) and governs pituitary.
- **Glial cells** guide and support nerve cells in the brain.
- The brain is divided into **4** regions.
- **Frontal Lobe** – **behind forehead** – has **Motor Cortex** (located at the back of frontal lobe, the cortex controls **voluntary movement**)
- **Parietal Lobe** – **top to back of head** – has **Sensory Cortex** (located in the beginning of parietal lobe, the cortex processes **bodily senses**)
- **Occipital Lobe** – **back of head** – **regulates vision**.
- **Temporal Lobe** – **above ears** – **regulates hearing**
- $\frac{3}{4}$ of the brain is uncommitted to motor or sensory functions. These brain regions are called **Association Areas** – areas involved in thinking, remembering, and speaking. *The larger the association area, the more intelligent the species for they are able to anticipate future events.*
- The case with Phineas Gage showed researchers that damages in the frontal lobe could result in personality alterations because their normal "restraints" or inhibitions are erased. This was due to a tamping rod that shot from his left cheek and out his head, separating his internal motives and external judgement.
- Stages of Language :
 1. **Visual Cortex** – **occipital lobe (back of head)** – sees the visual stimulation (words)
 2. **Angular Gyrus** – **mid-side of parietal lobe** – converts words into auditory code
 3. **Wernicke's Area** – **between temporal and parietal lobe (side of head)** - derives meaning from auditory code
 4. **Broca's Area** – **mid-bottom of frontal lobe** – controls motor cortex
 5. **Motor Cortex** – **back of frontal lobe** – activates speech muscles to pronounce word
- Damage to (1) cannot see, (2) cannot read, (3) cannot understand, (4) and (5) cannot speak.
- **Corpus Callosum** joins the two hemispheres and is separated to cure epileptic seizures.
- People with separated corpus callosums are referred to as **Spilt-brain** patients. They are unable to say what they see in their left visual field because speech is in left hemisphere and the hemispheres regulate opposite sides of body.
- When split-brainers are asked to say what they **saw**, the **left hemisphere** will say what is seen in **right visual field**; when asked to **point, get, or write** what they saw, the **right hemisphere** will dictate what is seen in the **left visual field**.
- Sign language is nevertheless language and is control by left hemisphere, if deaf people get a stroke in left hemisphere, signing will be disrupted.
- **Left Hemisphere** : Mathematics, language, logical, reasoning. meaning
- **Right Hemisphere** : Perceptual tasks, musical, artistic, emotion, face recognition, copying information.

Genetics and Behavior

- **Chromosomes** contain **Genes** which are made up of **DNA**. There are 23 chromosomes in human egg and sperm; they are combined (fertilized) to make a 46 chromosome cell.
- **Evolutionary Psychologists** study the effects of evolution of behavior of organisms.
- **Behavior Geneticists** study genetic and environmental effects on behavior. – using **Linkage Analysis**.
- Psychologists study **Identical Twins** (two babies within one egg) and **Fraternal Twins** (two babies in 2 separate eggs) to contrast adoption studies.
- Identical twins have more similarities than fraternal twins.
- **Heritability** tell us what percentage of traits are because of **genetic factors**. Traits (height, intelligence, eye color etc.) are either due to genetic or environment *there are no half-halves*. If heritability of intelligence is 70%, that means 70% of the people will have inherited intelligence.

Bibliography

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