

## GENERAL PSYCHOLOGY (PSYC 210)

### Biological Psychology Study Guide

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- I. The brain, biology, and behavior: You are all “wired up”!
  - a. Human brain: >3 lbs; about 100 billion nerve cells (neurons); neurons specialize in carrying and processing information and activating muscles and glands
  - b. Neurons: individual nerve cells (nerve= cluster of neurons)
  - c. Dendrites: receive incoming information
  - d. Soma: main cell body of neuron
  - e. Axon: fiber carrying information away from cell body of a neuron
  - f. Axon terminals: branching fibers at the ends of axons (“terminal boutons”)
  - g. Ion: an electrically charged molecule
  - h. Resting potential: the electrical charge of a neuron at rest
  - i. Threshold: the point at which a nerve impulse is triggered (“action potential” is “all or none”) (How does “action potential” work? How does a nerve “fire”?)
  - j. Neurotransmitter substances (NTSs): specialized chemicals used by neurons to communicate with each other
  - k. Synapse: space between neurons (between axon terminals of one neuron and dendrites of communicating neurons) (n.b. pre-synaptic neurons and post-synaptic neurons); “Hebbian synapses” and long-term potentiation (LTP)
  - l. Energy: ability to do work

## II. The nervous system:

--**Central Nervous System** (CNS: brain and spinal cord)

--**The Spinal Cord:** connects brain to other parts of the body

--31 pairs of spinal nerves

--12 pairs of cranial nerves

--Reflexes controlled at level of spinal cord [“reflex arc” (stimulus evokes an automatic response): sensory neuron (afferent)---→ connector neuron---→ motor neuron (efferent) (muscle fibers= effector cells; n.b. traditionally, “behavior” has been thought of as motor patterns or action patterns; current definition of behavior is broader than this)]

--**The Brain**

--**Cerebrum:** largest brain area the cerebral cortex; cerebral cortex has fissures (sulci, folds, corticalization): What is the function of fissures? How do we study the cerebral cortex? PET scan, FMRI, electrodes

--**Cerebral hemispheres:** connected by *corpus callosum*: left side controls right side, *vice versa*

--Hemispheric specialization:

--Roger Sperry’s Nobel Prize (“split brain” research on *corpus callosum*)

--Why “split brain” operations? (e.g., epilepsy)

--How does a “split brain” person act? [n.b. Both sides of the brain get same information @the same time. If a conflict, one hemisphere is usually dominant. However, if

sensation doesn't go to both sides of brain, one side doesn't know what other side is doing (e.g., cover one eye.)]

--How do hemispheres differ in abilities?

--language a function of left hemisphere; also, math, judging time & rhythm & coordinating movements (thus, analytical, sequential, "linear")

--right hemisphere specialized for recognizing patterns, faces & melodies & expressing emotion and solving spatial problems (holistic, "non-linear"; n.b. Gestalt Psychology)

--However, the entire brain is active at all times: the balance of (neural) activity differs.

--Sex differences? Documented sex difference in brain structure but consequences for brain/behavior/cognitive/emotional function unclear.

--**Lobes of the Cerebral Cortex:** lobes have been "mapped" by electrodes and other methods (n.b. Penfield's studies using local anesthetics)

--The Occipital Lobes (back of brain)

--primary visual area of the cortex (not a TV-like image [i.e., representation not point x point])

--The Parietal Lobes (somatosensory area: touch, temperature, pressure, and other somatic or bodily sensations)

--The Temporal Lobes (auditory information; language center (Broca's Area and Wernicke's Area))

--The Frontal Lobes [motor cortex: damage alters personality, emotionality, intellectual function (pre-frontal cortex), and social impairment (e.g., "impulse control")]

--What do the remaining areas do? Associative areas (process and combine information from various senses; also related to higher mental functions)

--**Brain Injuries**

--Neglect (damage to right hemisphere---→ neglect; damage to left hemisphere is generally more serious because speech and language are so essential)

--Aphasia (impaired ability to use language): Broca's Area [left frontal lobe: speech production (difficulty speaking or writing)]; Wernicke's Area [left temporal lobe: speech comprehension (problems with meaning of words)]

--**The Subcortex:** What do areas below the cortex do?

--Brainstem (or hindbrain)

--Medulla [reflex control of vital life functions (heart rate, breathing, swallowing, etc.)]

--Cerebellum (regulates posture, muscle tone, and muscular coordination and memory storage)

--Reticular Formation (RF: network of fibers: affects messages entering and leaving brain; attention, movement, some reflexes and alertness, maintaining vigilance, wakefulness, breathing, coughing, vomiting)

--Reticular Activating System (RAS: part of the RF [incoming messages from sense organs bombarding cortex with stimulation, keeping it active and alert; sensitive to amphetamines; thus, if drug use, then manipulation of brain])

--Midbrain: link between brain structures above and below it (conducting and switching)

--Forebrain: (including cerebral cortex)

--Thalamus: "switching station" for sensory messages except sense of smell which travels directly to the cortex (What does this imply?)

--Hypothalamus (HT): size of small grape; control center for emotion and many basic motives (sex, hunger, thirst, etc.); connects with cortex and subcortex; HT acts as "final

path” for many kinds of behavior leaving brain; last area of brain where many “decisions” are made

--The Limbic System: HT, parts of thalamus; several structures in cortex [limbic system produces emotion and motivated behavior (rage, fear, sex, etc.)

--Hippocampus: helps in forming lasting memories

--Amygdala: fear

--Hypothalamus [Olds & Milner, 1954: pleasure pathways also activated by drugs (cocaine, heroin, etc.)]

--Aversive or “punishment” areas have also been found in the Limbic System

--**Redundancy**: Brain is an information-processing system. It has dozens of areas to do what one area could do alone. Redundancy in human brains leads to impressive ability to compensate for some brain injuries. n.b. Comparison of brain with computer has limitations.

--Does age at injury make a difference? Plasticity/flexibility: depends upon increased branching of dendrites.

--**Peripheral Nervous System** (PNS: carries nerves to and from CNS)

--**Somatic System** [voluntary system (e.g., writing)]: carries information to and from sense organs and skeletal muscles

--**Autonomic Nervus System** [ANS: involuntary system (e.g., breathing, heart rate)]: carries information to and from internal organs and glands

--Sympathetic system: arouses body (“flight or fight”)

--Parasympathetic system: slows down responses, level of arousal

--**The Endocrine System**: The second communication system made up of glands that dump into bloodstream or lymph system

--Hormones (chemically related to neurotransmitters): activate cells in body via receptor sites

--Pituitary Gland: regulation of growth (regulates functioning of other glands [especially thyroid, adrenals, ovaries, & testes; regulates metabolism, stress (ANS)])

--Pituitary Gland: “the master gland”: controlled by the HT and a major link between the brain and the glandular system

--Pineal Gland: releases melatonin in response to daily variations in light (higher in darkness); helps control body rhythms and sleep cycles

--Thyroid Gland: regulates metabolism (rate of energy production and expenditure)

--Adrenal Glands: arousal (ANS), responds to stress, sex (androgens)

--adrenal medulla (source of adrenaline and noradrenaline)

--adrenal cortex [source of corticoids (cortisol: the stress hormone); antiinflammants (role in immune system)]