

The Biology of Psychology

Biological Psychology

Theme:

Our complex psychological experience is mirrored in our biological complexity

Many different biological systems with our bodies must cooperate to create psychological experience and behavior

Brain:

Weighs 3 pounds

Contains 100 billion neurons

Contains thousands of types of neurons

Nervous System:

Uses an electrochemical process to perform three tasks:

Receive information

Integrate information

Transmit information

Basic cells that makeup the nervous system:

Glia

Neurons

Neurons have three basic parts:

Dendrites

- Branchlike fibers extending from the cell body

- Receive information from other neurons

- Carry information into the cell body

Cell Body (Soma)

- Contains cell nucleus

- Houses cell's genetic material

- Produces energy for the cell

Axon

- Carries information away from the cell body to other neurons

Neural Transmission

- Average neurons connect with 1,000 other neurons

- Some neurons connect with 200,000 others

Information travels electrochemically

- Electrically within a neuron

- Chemically between neurons

Electrical Transmission

Electrical transmission depends on polarity:

Positive Ions: Sodium, Potassium

Negative Ions: Chloride

Neural polarity is determined by ion movement and summative charge:

Polarized at rest (negatively charged)

Depolarized leads to firing

Sodium Ion Gates

Allow for flow of ions in and out of the neuron

Action Potential

Firing is called the *Action Potential*

Firing follows the *All or None Law*

Firing can not occur during the *Absolute Refractory Period*

The Synapse

Synapses:

Enable chemical communication between neurons and their target cells

Brain has up to a quadrillion synapses

Synapses consist of:

Presynaptic axon terminal on the sending neuron

Fluid-filled synaptic cleft

Postsynaptic receptor site in the receiving neuron

Neurotransmitters are molecules:

Synthesized by neurons

Stored in the axon terminals

Released by action potential

Keys that open postsynaptic receptors

Neurotransmitters

Carry two kinds of messages:

Excitatory (EPSP) - Increases the chance of firing

Inhibitory (IPSP) - Decreases the chance of firing

Brain Chemicals

Chemicals in the brain can be:

Agonist

Antagonist

Nervous System

Main Divisions: Central & Peripheral

Central Nervous System Includes: Brain and Spinal Cord

Encased in protective material

Bone

Meninges

Surrounded by cerebrospinal fluid

Protective role

Nourishment role

Peripheral Nervous System has two parts:

Somatic Nervous System

Senses

Muscles

Autonomic Nervous System

Glands

Organs

Two sets of Nerves:

Afferent: Bring information to CNS

Efferent: Deliver information from CNS to Body

Autonomic Nervous System has two divisions:

Sympathetic: Activates body systems

Parasympathetic: Slows body systems; Conserves bodily resources

Research Methods

Imaging Techniques:

Structure: CT, MRI

Function: PET, CT Scan

The Brain

Brains are *built* and *changed* all life long through the interaction of genes with environment and experience

Three Major Divisions:

Hindbrain

Medulla: Heart, breathing, reflexes

Pons ; Sleep, arousal

Cerebellum: Posture, balance, coordination of movement

Midbrain

Serves as information relay station

Integrates sensory processes

Influences voluntary movement

Forebrain

Thalamus:

- Filters sensory information

- Organizes sensory information

- Routes sensory information

Hypothalamus: Controls basic biological drives and needs

Fighting & Fleeing

Hunger and thirst

Mating

ANS control through endocrine control

Endocrine System

Includes all glands

Allows communication between brain and body

Hormones travel through the bloodstream to control body functions

Pituitary: Controlled by hypothalamus; Controls all other glands

Limbic System

Emotional center of the brain

Memory center of the brain

Influences motivation and learning

Contains dopamine releasing pleasure centers

Cerebral Cortex

Convolutated outer layer of cerebrum

Made of folds and fissures

Center of all higher mental processes (conscious thought)

Cerebral Cortex Lobes Include:

Occipital Lobe:

- Primary visual cortex

- Processes visual information

Parietal Lobe

- Integrates visual input

- Processes information from: Movement; Location of body parts; Skin senses

- Somatosensory strip

Temporal Lobe

- Contains primary auditory complex

- Processes: Sound; Language

- Complex visual information (facial recognition)

Frontal Lobe:

- Two divisions: Motor cortex; Prefrontal cortex

 - Motor Cortex controls voluntary muscle movement

 - Prefrontal Cortex monitors, organizes & directs thought processes including:

 - Working memory

 - Planning

 - Social behavior

 - Regulating mood

Brain Operation

Brain is made up of two halves:

Right hemisphere

Left hemisphere

Lateralization

Contralateral Arrangement: Each side of the brain controls different sides of the body

Right cerebral cortex is connected to the left side of the body

Left cerebral cortex is connected to the right side of the body

Hemispheric Specialization: Each hemisphere has its own specialized functions

Left Hemisphere responsible for:

- Language comprehension

- Speech production

- Reading & writing

- Language Comprehension: Wernicke's Area

- Speech Production: Broca's Area

Right Hemisphere responsible for:

Recognition of:

- Spatial information & Shapes

Musical information

Visual information: Colors & Faces

Hemispheric Cooperation

Corpus Callosum - Bundle of nerve fibers connecting the right and left hemispheres

Permits information to transfer between hemispheres

Split brain: corpus callosum is cut

Genetics

DNA is the Key:

Genes are segments of DNA

Chromosomes are strands of DNA

46 chromosomes form 23 pairs in every human cell

Genes occur in pairs

Homozygous condition: when both genes in a pair match

Heterozygous condition: the genes in a pair are different

Dominant – gene is expressed

Recessive – gene that is masked

Behavioral Genetics

Genotype vs. Phenotype

Genotype is the genetic code that is inherited

Phenotype is the result of how the genes develop within the environment and manifest themselves

Genetic Disorders:

Monogenic Inheritance - Huntington's Disease

Polygenic Inheritance – Schizophrenia & Autism

Chromosomal Abnormalities - Down Syndrome

Genetic Mapping

Human Genome Project - Determines location and chemical sequence of specific genes

Conclusion: Genes provide a vulnerability which interacts with environmental experiences to determine how the trait will manifest itself