

The Brain Functions and Behavior

The brain operates with two systems. The nervous system and the endocrine system.

THE NERVOUS SYSTEM

- The body's electrochemical communication circuitry.
- 4 important characteristics of the brain and nervous system:
 - *complexity*: the average brain consists of about 100 billion neurons
 - *integration*: ability for the brain to combine sensory information and responses
 - *adaptability*: the ability for the brain to adapt (plasticity)
 - *electrochemical transmission*: the processes of memory encoding and retrieval
- The brain's special ability to adapt and change is called plasticity.
- Decision making in the nervous system has a specialized pathways of nerve cells. Which are
 - *sensory input*: the ability for the brain to processes senses such as touch, hearing, seeing, and taste into useable functions
 - *motor output*: the ability to carry impulses from the brain to the body
 - *neural networks*: network programmed to behave in response to external stimulus
- The nervous system is divided into two main parts: central (CNS) and peripheral (PNS).
 - CNS consists of the brain and spinal cord.
 - PNS has two major divisions: somatic and autonomic.
 - The autonomic nervous system consists of two main divisions:
 - sympathetic nervous system drives our body's response to threatening circumstances
 - parasympathetic nervous system is involved in maintaining the body, digesting food, and healing wounds.

NEURONS

- Cells that specialize in processing information
 - the communication network of the nervous system
 - 3 main parts of the neuron are the
 - cell body
 - dendrite (receiving part)
 - axon (sending part).
 - myelin sheath encases and insulates most axons and speeds up transmission of neural impulses.

STRUCTURES OF THE BRAIN AND THEIR FUNCTIONS

- Main techniques used to study the brain are
 - *brain lesioning*: used to treat neurological or psychological disorders

- *electrical recording*: electroencephalograph (EEG) used to record brain waves
- *brain imaging*: X-ray, CT-scan, PET, MRI, fMRI, TMS
- These methods have revealed a great deal about the three major divisions of the brain—the hindbrain, midbrain, and forebrain.
- The cerebral cortex
 - most of the outer layer of the brain
 - higher mental functions such as thinking and planning take place.
 - The wrinkled surface of the cerebral cortex is divided into hemispheres, each with four lobes:
 - *Occipital*: responsible for vision
 - *Temporal*: responsible for hearing, language processing, memory
 - *Frontal*: responsible for intelligence, personality, voluntary muscles
 - *Parietal*: responsible for spatial location, attention, motor control
- The brain has two hemispheres.
 - left hemisphere = specific language functions are Broca's area (speech) and Wernicke's area (language comprehension).
 - The corpus callosum is a large bundle of fibers that connects the two hemispheres.
 - Research suggests that the left brain is more dominant in processing verbal information (such as language)
 - right hemisphere = processing nonverbal information (such as spatial perception, visual recognition, faces, and emotion).

THE ENDOCRINE SYSTEM

- The endocrine glands release hormones directly into the bloodstream for distribution throughout the body.
 - Pituitary gland is the master endocrine gland.
 - The adrenal glands play important roles in moods, energy level, and ability to cope with stress.
 - Other parts of the endocrine system include the pancreas, which produces insulin, and the ovaries and testes, which produce sex hormones.

BRAIN DAMAGE, PLASTICITY, AND REPAIR

- The human brain has considerable plasticity (ability to adapt and change) is greater in young children than later in development.
- 3 ways a damaged brain might repair itself are:
 - collateral sprouting
 - substitution of function
 - neurogenesis.
- Brain grafts are implants of healthy tissue into damaged brains.
 - are more successful when fetal tissue is used.
- Stem cell research is a controversial new area of science that may allow for novel treatments for damaged nervous systems.

GENETICS AND BEHAVIOR

- Chromosomes occur in 23 pairs, with one member of each pair coming from each parent.
 - Chromosomes contain the genetic substance deoxyribonucleic acid (DNA).
 - Genes, the units of hereditary information.
 - The dominant-recessive genes principle = if one gene of a pair is D & R, the D gene overrides the R gene.
- genotype = individual's actual genetic material
- phenotype = observable characteristics of the person.
- 3 methods of studying heredity's influence are:
 - molecular genetics
 - selective breeding
 - behavior genetics.
- 2 methods used by behavior geneticists are: 1) twin studies and 2) adoption studies.

PSYCHOLOGY'S BIOLOGICAL FOUNDATIONS AND HEALTH AND WELLNESS

- Stress is the body's response to changes in the environment.
- Stressors are the agents of those changes—the circumstances and events that threaten the organism.
 - The body's stress response is largely a function of sympathetic nervous system activation that prepares us for action in the face of a threat.
 - The stress response involves slowing down maintenance processes (such as immune function and digestion) in favor of rapid action.
- Acute stress is an adaptive response,
- Chronic stress can have negative consequences for our health.
- Stress may be inevitable, our reaction to a stressful event is largely a function of how we think about it.