

CH. 4- THE BIOLOGICAL MIND: THE PHYSICAL BASIS OF BEHAVIOR

Intro

- There is a genetic mutation that people have that they seem resistant to the HIV virus.
- It's common in northern Europeans, rare in southern Europeans, and absent among Asians, Africans and Native Americans.
- If a person feels socially connected to others, their brains will initiate a cascade of hormonal signals that tell her immune cells to prepare to protect her against viruses and if she's a loner, her brain will generate hormonal signals that will tell her immune system to gear up to protect her against bacteria

What is Biological Psychology?

- Biological psychology- the interdisciplinary field of study that combines the methods and theories of psychology with those of biology, physiology, biochemistry, the neurosciences, and other related fields.
- Biological factors and behavior are viewed as reciprocal
- Raising male testosterone levels makes them more aggressive

Early attempts to understand biological psychology

- Before technology, knowledge resulted from clinical observations of injured or mentally ill through autopsies
- Aristotle believed that the heart was the source of mental activity not the brain
- Phrenology- a historical mistake; proposed that the pattern of bumps on an individual's skull correlated with his or her personality traits and abilities
 - The brain supposedly worked like a muscle, getting larger through use, leading frequently used areas of the brain to grow so much that the skull above these areas would bulge
 - In the 19th century, employers had their employees undergo phrenological exams
 - Their notion that some behavioral functions are localized to certain areas of the brain is one we share today

Contemporary Approaches in biological psychology

- John Hughlings Jackson- neurologist; proposed that the nervous system is organized as a hierarchy, with progressively more complicated behaviors being managed by more recently evolved and complex structures
- Alcohol decreases activity of parts of brain involved with judgment and decision-making.
- 1990's: the decade of the brain
- PET scan- positron emission tomography and fMRI- functional magnetic resonance imaging were invented in the 90's

How do Neurons Communicate?

- Neuron- a cell of the nervous system that is specialized for sending and receiving neural messages
- Human brains have about 100 billion neurons
- Each neuron forms an average of several thousand connections with other neurons so there are hundreds of trillions of connections in the human brain
- Glia- supporting cells
- Neural communication- 1) takes place within a single neuron and involves the generation of an electrical signal 2) takes place between two neurons and involves the release of a chemical messenger from one neuron that impacts the activity of the second.

Neurons and Glia

- Neurons have a large central mass or cell body and within the cell body, a nucleus
- Cell body- the large, central mass of a neuron, containing the nucleus
- Translation of genetic codes into the manufacture of proteins takes place here
- Have an outer membrane which surrounds the neuron and forms a barrier between the fluid outside the cell-the extracellular fluid- and inside the cell-the intracellular fluid
- The neural membrane is composed of fatty materials that do not dissolve in water
 - Only two molecules thick
 - Able to hold the water-based fluids on either side apart
 - Has pores that act as channels that allow chemicals to move into or out of the cell across the membrane
- Neurons have two types of branches
 - Axon- the branch of a neuron that is usually responsible for transmitting information to other neurons
 - Dendrite- a branch from the neural cell body that usually receives input from other neurons
 - Neurons have many dendrites but only one axon
 - Axons can be from a millimeter to a couple feet long
 - At the farthest end from the cell body, the axon bulges and forms a terminal
 - Synaptic vesicles- round hollow spheres inside the axon terminal that contain molecules of chemical messengers
- Gray matter- the chemicals used to preserve the tissue are absorbed by the cell bodies giving them a grey-pink coloring.
- White matter- These chemicals are repelled by the insulating material covering most axons because insulation has a fatty composition that doesn't mix w/ w/ the watery preservatives
 - Areas that look grey have a high density of cell bodies
 - Areas that look white have a high density of axons
- Glia
 - Make it possible for neurons to do their jobs effectively
 - Some provide a structural matrix for neurons, ensuring they stay in place

- Others move to a location where neurons have been damaged to clean up any debris
- Form tight connections with the blood vessels serving the nervous system
- This forms a blood-brain barrier that prevents many toxins circulating in the blood from coming into brain tissue
- Wrap around some axons forming an important layer of insulation called **MYELIN**
- Myelin
 - The insulating material covering some axons
 - Makes neural signaling fast and energy efficient
 - Not all axons are myelinated
 - Sharp quick feelings are from myelinated axons while dull achy long feelings are from unmyelinated axons
- 2 types of Glia
 - 1 is the myelin in the brain and spinal cord
 - the other is the remainder of the nervous system
 - Glia in the brain and spinal cord form scar tissue inhibiting repair to the damaged nerves which causes permanent damage
 - Damage in the nervous system other than the brain and spinal cord doesn't form scar tissue but helps the damaged axons regrow
- Myelin growth in the human nervous system begins before birth, but is not completed until early adulthood, as late as 25
- The last area to be myelinated is the judgement and morality section right behind the eyes

Neural Signaling

- Neural communication is a 2 step process
 - 1- takes place in signaling neuron's axon, the neuron generates an electrical signal known as an **action potential**
 - 2- takes place between two neurons, the arrival of an action potential at the axon terminal of the first neuron signals the release of chemical messengers, which float across the extracellular fluid separating the two neurons.

Electrical Signaling

- Resting potential- the measure of the electrical charge across a neural membrane when the neuron is not processing information
 - This is the difference between the readings from the interior of the axon and the external fluid
 - The interior of the neuron is negatively charged relative to its exterior
- When a resting neuron wants to receive a message, it becomes depolarized or hyperpolarized
 - Depolarized means we have moved closer together
 - The difference between the electrical charges of the extracellular and the intracellular recordings is decreasing