

Biological Bases of Behaviour

Unit 3: Neuroscience, Behaviour & the Endocrine System

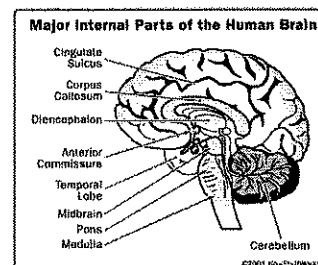
Today's science is riveted on the most amazing parts of the body- our brain, its component neural system, and their genetic blueprints. The brain's ultimate challenge is to understand itself. How does our brain organize and communicate with itself?

Our understanding of how the brain works has come a long way from ancient times with philosophers like Plato. Plato correctly labelled the mind in the spherical head and Aristotle believed the mind was in the heart, which pumps warmth and vitality to the body. The heart remains our symbol of love, but science has long overtaken philosophy on this issue. It's your brain, not your heart that falls in love. ☺

PHRENOLOGY- an ill-fated theory developed by German physician *Franz Gall*, that claimed that bumps on the skull could reveal our mental abilities and our character traits.

Biological Psychology- a branch of psychology concerned with the links between biology and behaviour. Some bio-psychologists call themselves:

- Behavioural Neuroscientists
- Neuropsychologists
- Behaviour Geneticists
- Biopsychologists



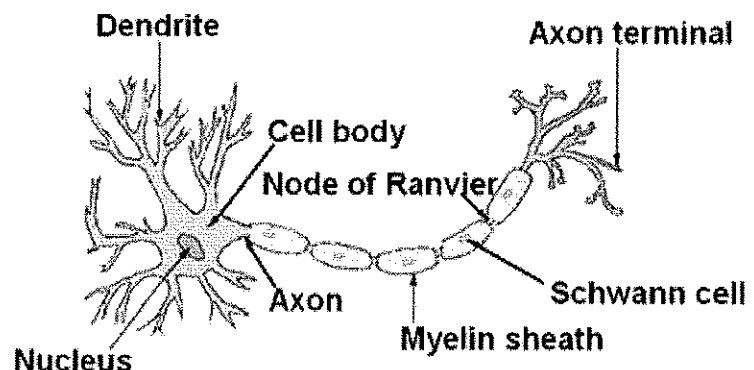
A) NEURAL COMMUNICATION:

Neuroanatomy refers to the study of the parts and functions of the neurons. Neurons are individual nerve cells. These cells make up our entire nervous system from the brain to the neurons that fire when you stub your toe. Every neuron is made up of discrete parts.

Structure of a Typical Neuron

TERMS:

1. Dendrites
2. Cell body
3. Axon
4. Myelin Sheath
5. Axon Terminal (end button)
6. Neurotransmitters
7. Synapse
8. Action Potential



How Neurons Communicate (or 'Fire')

All of the different parts of the neuron work in sequence when a neuron transmits a message. In its resting state, a neuron has an overall slightly negative charge because mostly negative ions are within the cell and mostly positive ions are surrounding it. The cell membrane of the neuron is selectively permeable and prevents these ions from mixing.

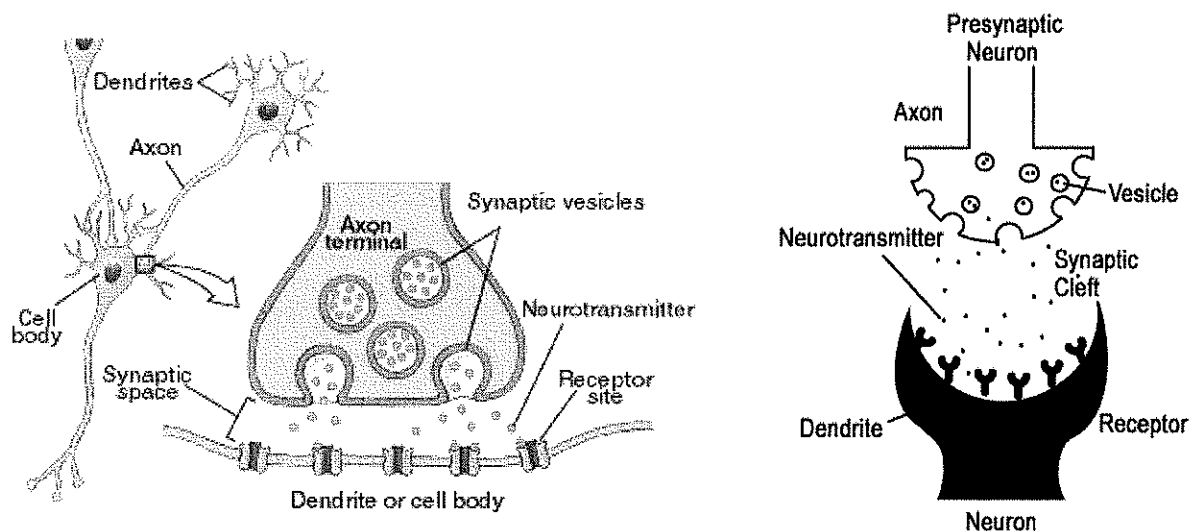
How they work:

1. Visualize a two-neuron chain. The reaction begins when the axon terminals of neuron A are stimulated and release neurotransmitters into the synapse. These neurotransmitters fit into receptor sites on the dendrites of neuron B.
2. If enough neurotransmitters are received, (this level is called a *threshold*), the cell membrane of neuron B becomes permeable and positive ions rush into the cell.
3. The change in charge spreads down the length of neuron B like a bullet from a gun. This electric message firing is called *Action Potential*. It travels quickly- 120 meters per second.
4. When the charge reaches the axon terminal or end buttons of neuron B, the buttons release their neurotransmitters into the synapse. The process may begin again if enough neurotransmitters are received by that next cell to pass the threshold.

Example: Circle Exercise with Students ☺

QUESTION TO ANSWER:

How do neurons communicate with one another?



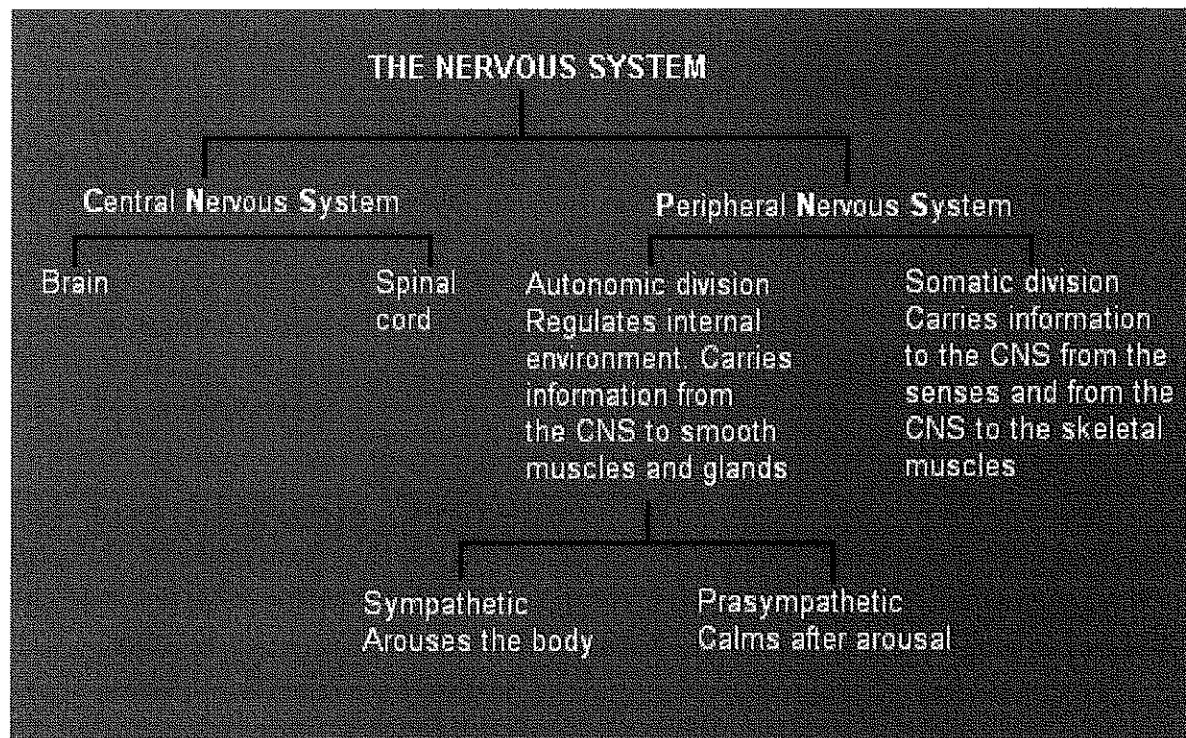
How Neurotransmitters Influence Us

Researchers have discovered dozens of different neurotransmitters each with unique functions. Some drugs (agonists) excite by mimicking particular neurotransmitters or blocking their reuptake; others (antagonists) inhibit by blocking neurotransmitters.

- Acetylcholine
- Endorphins
- Dopamine
- Serotonin
- GABA
- Norepinephrine
- Glutamate

B) The Nervous System:

Neurons communicating with other neurons form our body's primary information system: the Nervous System. The brain and spinal cord form the Central Nervous System (CNS). The Peripheral Nervous System (PNS) links the central nervous system with the body's sense receptors, muscles, and glands.



The sensory and motor axons carrying this PNS information are bundled up into the electrical cables that we know as Nerves.

Information travels in the nervous system through three types of neurons:

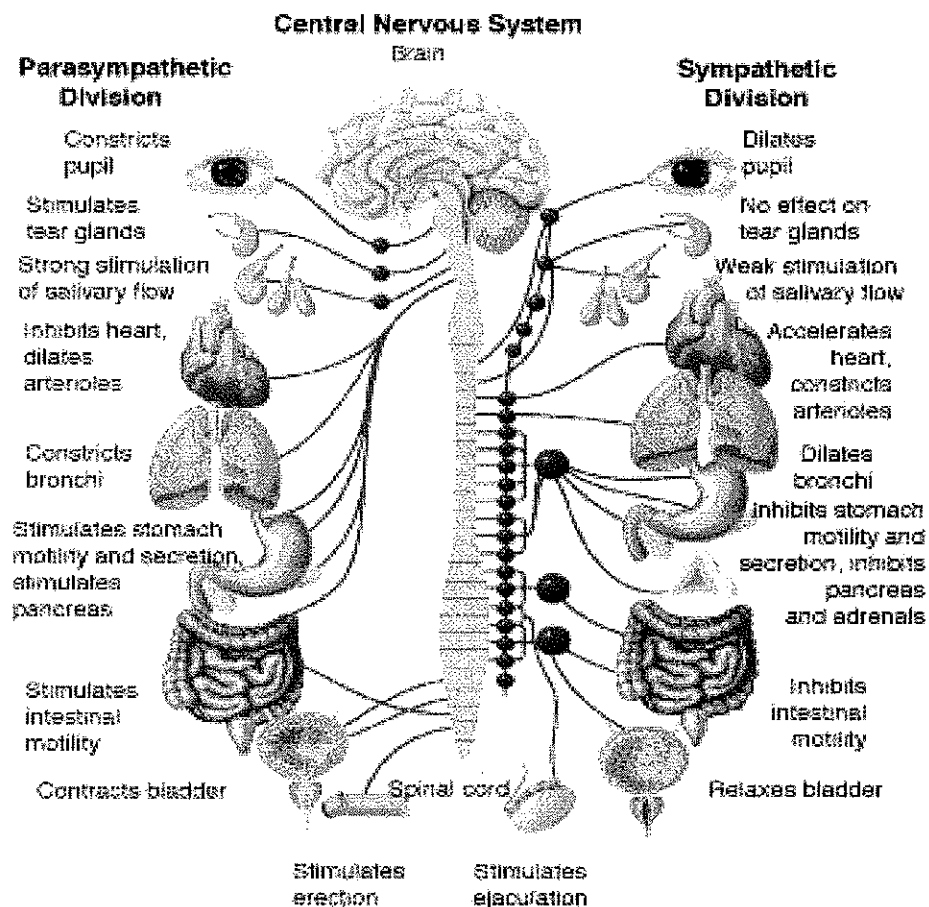
- 1) Sensory Neurons
- 2) Interneurons
- 3) Motor Neurons

THE PERIPHERAL NERVOUS SYSTEM

It has two components

1: Somatic: the division of the PNS that controls the body's skeletal muscles.

2: Autonomic: the part of the PNS that controls the glands and the muscles of the internal organ. Its sympathetic division arouses while the parasympathetic division calms.



THE CENTRAL NERVOUS SYSTEM

The CNS's spinal cord is an information highway connecting the PNS to the brain.

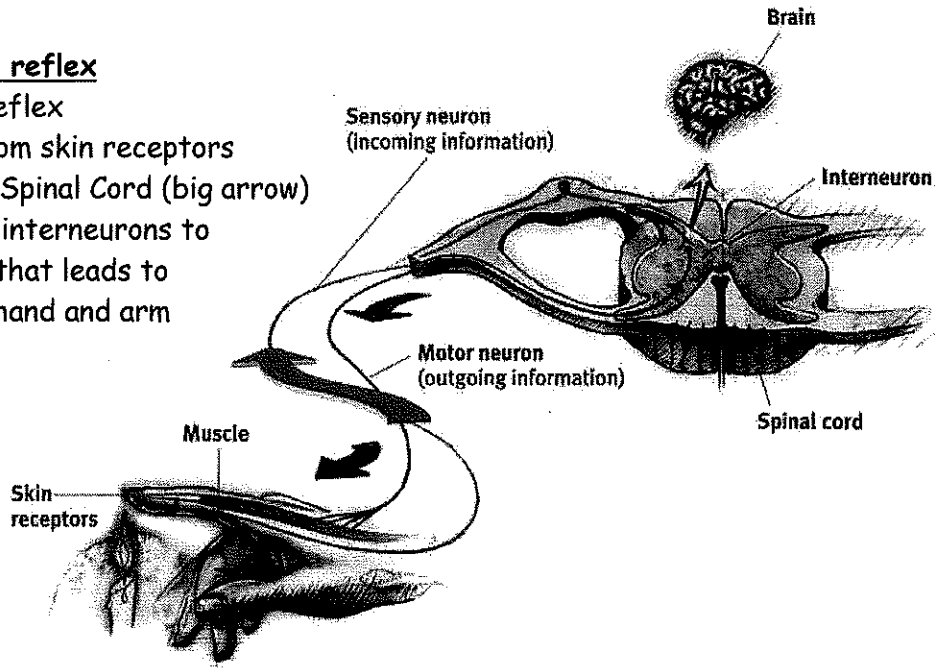
Ascending neural tracts send up sensory information, and descending tracts send back motor-control information.

The neural pathways governing our reflexes, our autonomic responses to stimuli, illustrate the spinal cord's work.

Example: A simple reflex

Hand-withdrawal reflex

1. Info carried from skin receptors
2. Info arrives at Spinal Cord (big arrow)
3. Info passes via interneurons to Motor neurons that leads to Muscles in the hand and arm



Question:

1. How does information flow through your nervous system as you pick up a fork? Can you summarize this process?

The Endocrine System

This chapter so far has dealt with the body's speedy electrochemical information system. There is, however, another communication system. Hormones released by the Endocrine Glands form the body's slower information system.

- **Endocrine System**- interconnected with the nervous system. It is the body's slow chemical communication system. It is a set of glands that secrete hormones into the bloodstream.
- **Hormones**
- **Adrenal Glands**
- **Pituitary Glands**

