Emergence of ANN

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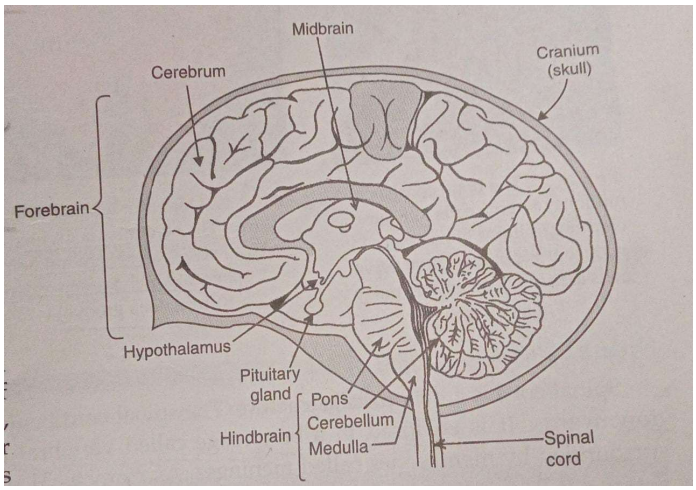
HUMAN BRAIN

1. Highest coordinating centre in the body.
2. Located inside skull of body.
3. Protected by bony box in skull(cranium).
4. Surrounded by three membranes (meninges) to protect it.
5. Space between membranes filled with cerebro spinal fluid to protect from mechanical shocks.
6. Contains about 10^6 neurons. Each neuron is connected to 10^4 neurons.
7. Weighs about 1.5 Kg
8. Average neuron has a weight 1.5 x 10^{-9} gms.
9. PARTS OF HUMAN BRAIN

FOREBRAIN	MIDBRAIN	HINDBRAIN
1.Cerebrum:main thinking part. memory learning reasoning intelligence perform voluntary actions	Control reflex movements of head , neck and trunk, eye muscles, changes in pupil size, shape of eye lens	1. Pons: regulating respiration
		2. Cerebellum: coordinates smooth body movements like walking, dancing, etc.
		3. Medulla: control involuntary actions like heart beat, breathing, blood pressure



BIOLOGICAL NEURAL NETWORK

A structure that consists of Synapse, dendrites, cell body, and axon.

Some advantages of BNN :

1. The synapses are the input processing element.
2. It is able to process highly complex parallel inputs.

Some disadvantages of BNN :

1. There is no controlling mechanism.
2. Speed of processing is slow being it complex.

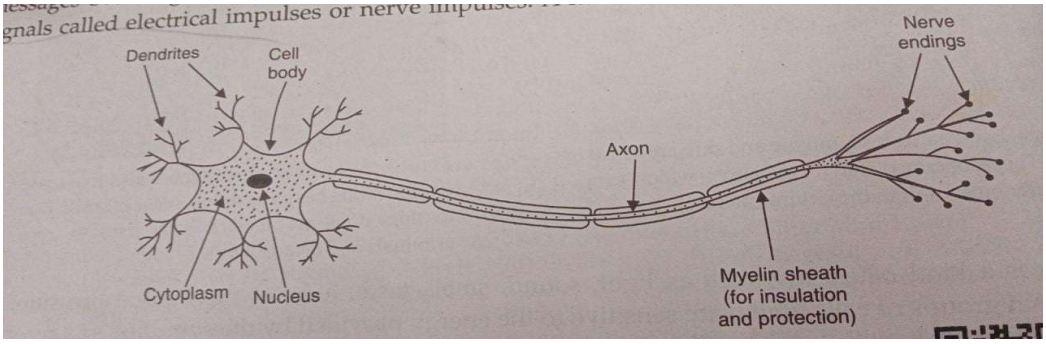
Parts of BNN:

Dendrites: They are tree-like branches, responsible for receiving the information from other neurons it is connected to. In other sense, we can say that they are like the ears of neuron.

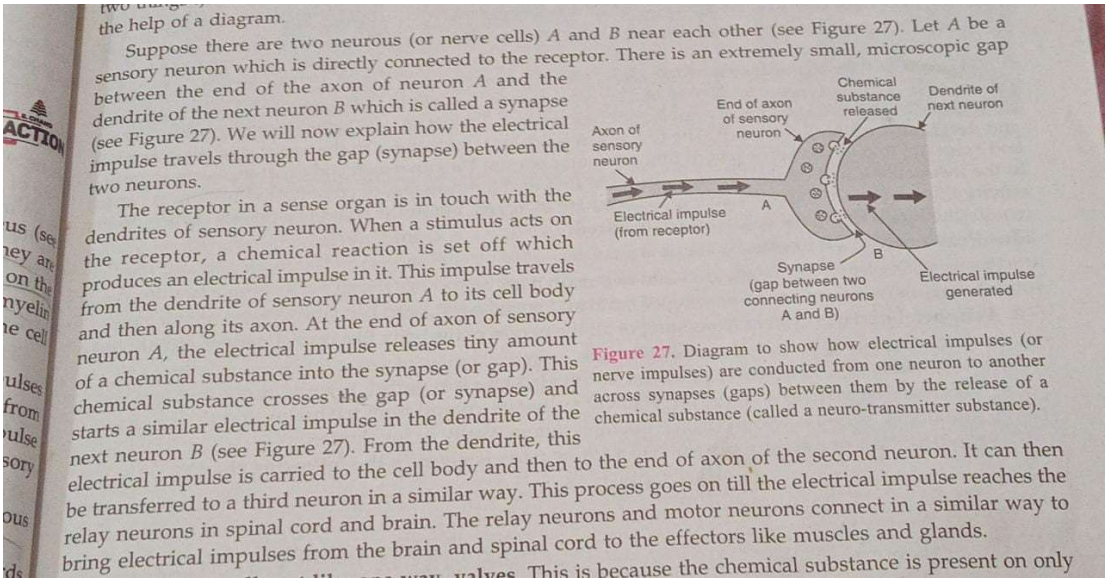
Soma – It is the cell body of the neuron and is responsible for processing of information, they have received from dendrites.

Axon -Axon is a tube-like(cables) structure through which neurons send the information. Axon has an insulating and protective sheath of myelin(made up of fat and protein).

Synapse: It is the connection between the axon and other neuron dendrites.(A microscopic gap),connect two neurons, ensure that nerve impulses travel only in one direction.



Working of BNN:



the help of a diagram.

Suppose there are two neurous (or nerve cells) *A* and *B* near each other (see Figure 27). Let *A* be a sensory neuron which is directly connected to the receptor. There is an extremely small, microscopic gap between the end of the axon of neuron *A* and the dendrite of the next neuron *B* which is called a synapse (see Figure 27). We will now explain how the electrical impulse travels through the gap (synapse) between the two neurons.

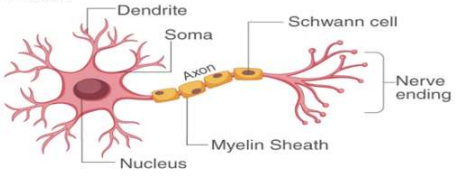
The receptor in a sense organ is in touch with the dendrites of sensory neuron. When a stimulus acts on the receptor, a chemical reaction is set off which produces an electrical impulse in it. This impulse travels from the dendrite of sensory neuron *A* to its cell body and then along its axon. At the end of axon of sensory neuron *A*, the electrical impulse releases tiny amount of a chemical substance into the synapse (or gap). This chemical substance crosses the gap (or synapse) and starts a similar electrical impulse in the dendrite of the next neuron *B* (see Figure 27). From the dendrite, this electrical impulse is carried to the cell body and then to the end of axon of the second neuron. It can then be transferred to a third neuron in a similar way. This process goes on till the electrical impulse reaches the relay neurons in spinal cord and brain. The relay neurons and motor neurons connect in a similar way to bring electrical impulses from the brain and spinal cord to the effectors like muscles and glands.

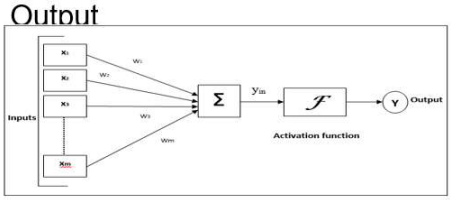
Figure 27. Diagram to show how electrical impulses (or nerve impulses) are conducted from one neuron to another across synapses (gaps) between them by the release of a chemical substance (called a neuro-transmitter substance).

valves. This is because the chemical substance is present on only

SIMILARITY BETWEEN BNN AND ANN

Biological Neural Network	Artificial Neural Network
Soma	Node
Dendrites	Input
Synapse	Weights or Interconnections
Axon	Output





DIFFERENCE BETWEEN BNN AND ANN

Characteristics	Artificial Neural Network	Biological(Real) Neural Network
Speed	Faster in processing information. Response time is in nanoseconds.	Slower in processing information. The response time is in milliseconds.
Processing	Serial processing.	Massively parallel processing.
Size & Complexity	Less size & complexity. It does not perform complex pattern recognition tasks.	Highly complex and dense network of interconnected neurons containing neurons of the order of 1011 with 1015 of interconnections.<strong
Storage	Information storage is replaceable means new data can be added by deleting an old one.	Highly complex and dense network of interconnected neurons containing neurons of the order of 1011 with 1015 of interconnections.
Fault tolerance	Fault intolerant. Information once corrupted cannot be retrieved in case of failure of the system.	Information storage is adaptable means new information is added by adjusting the interconnection strengths without destroying old information
Control Mechanism	There is a control unit for controlling computing activities	No specific control mechanism external to the computing task.