2

BASES OF HUMAN BEHAVIOUR

While ironing her clothes, Zoya accidentally touches the hot iron surface and instantly pulls her hand back. Aman closes his eyes the moment his sister flashes a torch on his face. Both these responses (withdrawal of hand and shutting of eyes) occur in less than a second's time. These fast reactions indicate a special kind of functioning of the body, known as autonomic responses, carried out by the brain. Our behavior and actions are controlled by different parts of the brain.

The previous chapter talks about the basics of Psychology, the study of behavior. The behavior a person exhibits requires flow of information in the body which is carried out by neurons. In this chapter, we will elaborate on 'neurons 'and other biological bases of behavior facilitated by the nervous and endocrine systems. We will also look into how socio-cultural and ecological factors affect the development of an individual.

LEARNING OUTCOMES

After studying this lesson, learner :

- describes the structure and function of neuron and nervous system;
- explains the role of heredity and environment on human behavior; and
- elaborates the socio-cultural and ecological factors underlying human behavior.

2.1 STRUCTURE AND FUNCTION OF NEURON

Neuron is the most basic unit of the brain. The human brain is estimated to contain at least 150 billion **neurons**, also known as nerve cells. Each of these neurons is connected

to many other neurons, making uncountable connections. These connections between neurons are called **synapses**. A neuron is a specialized cell in the nervous system that receives and sends messages within the system. Neurons act as messengers of the body and possess a very special structure.

Neurons come in many shapes and sizes, yet there are certain common features. The part of neuron that receives messages from other cells is called **dendrites** (branches). The dendrites are attached to **soma** (cell body) that contains the nucleus and keeps the entire cell alive and functional. As we move further, follows **axon**, a fiber like structure attached to the soma whose job is to carry messages to the other cells (to other neurons, muscles or glands).

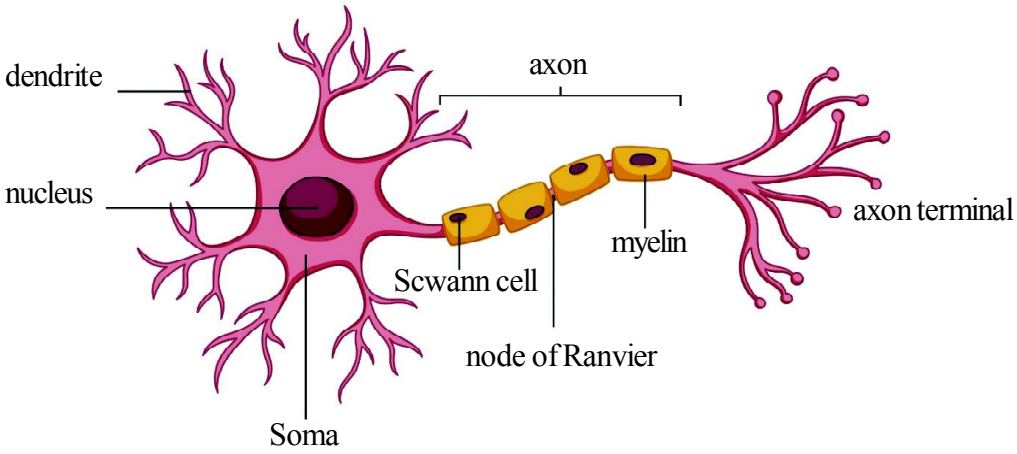


Figure 2.1: Neuron Anatomy

Neurons make up only 10% of the cells in the brain. The other 90% of the brain is composed of glial cells. **Glial cells** serve as a sort of structure on which the neurons develop and work, and also work as nutrients and oxygen supplier to the neurons. They hold the neurons in place. A special type of glial cells called **Schwann Cells** produce **myelin** to coat axons and clean up waste products and dead neurons. The axons may or may not have myelin sheath. Even when it is there, it is interrupted at the Nodes of Ranvier. A neuron which has the myelin sheath conducts the message faster than the neuron which is not covered by myelin sheath. Bundles of myelin-coated axons travel together in cable like structures called neurons. Axons of neurons found in the body are also coated with a thin membrane called **Schwann's Membrane**. They serve as a tunnel through which damaged nerve fibers can repair themselves. Unfortunately, axons of the neurons in brain and spinal cord do not usually have this coating and are therefore more likely to be damaged on a permanent basis.

2.1.1 Types of Neurons

Based upon the number of processes that extend directly from the cell body, neurons are divided into three categories-

- Nerves conducting excitation from the sense organs of the skin to the brain and spinal cord, i.e., sensory nerves are comprised of **Unipolar Neurons**.
- The **Bipolar** (two processes) **Neuron** has a single axon and a single dendrite. It is believed to be the primitive type.
- A **Multipolar** (many processes) **Neuron** has several short dendrites and a single axon and is therefore connected to many neurons.

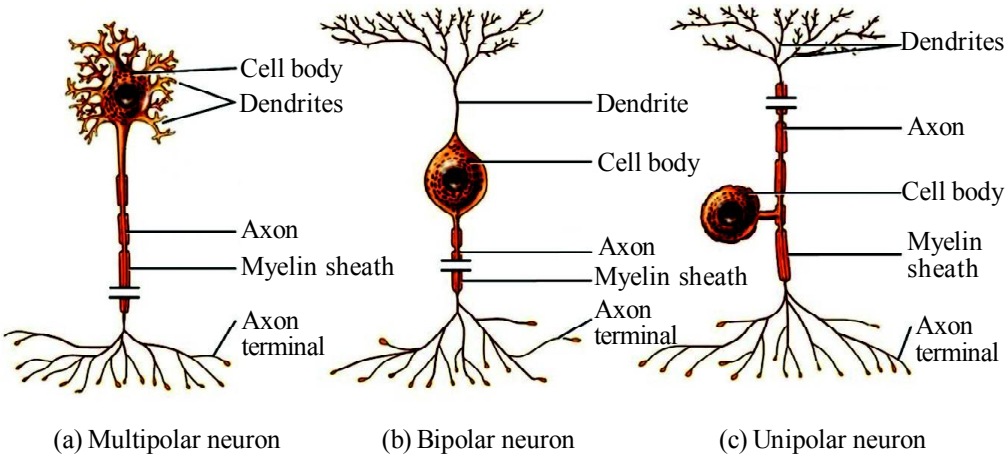


Figure 2.2: Types of Neurons

2.1.2 Functions of the Neurons

Neurons function on the basis of "**All or None**" law. Depending upon the stimulus intensity, i.e., if it reaches a critical value it will fire with total strength, if below, then there will be no excitation. So, nerve impulses are electrical events of very short duration that move along the axon. During this transaction, when the neuron is not conducting any impulse i.e. resting, the inside of the membrane has a negative electrical charge. When the cell membrane is excited by the stimulus, the cell becomes little less negative from the inside. As the stimulus reaches a threshold level, the membrane changes its characteristics- certain channels open to allow sodium from outside to enter the cell.

Since sodium ions are positively charged, the inside of the cell becomes momentarily positive (for a millisecond). This results in nerve impulse.

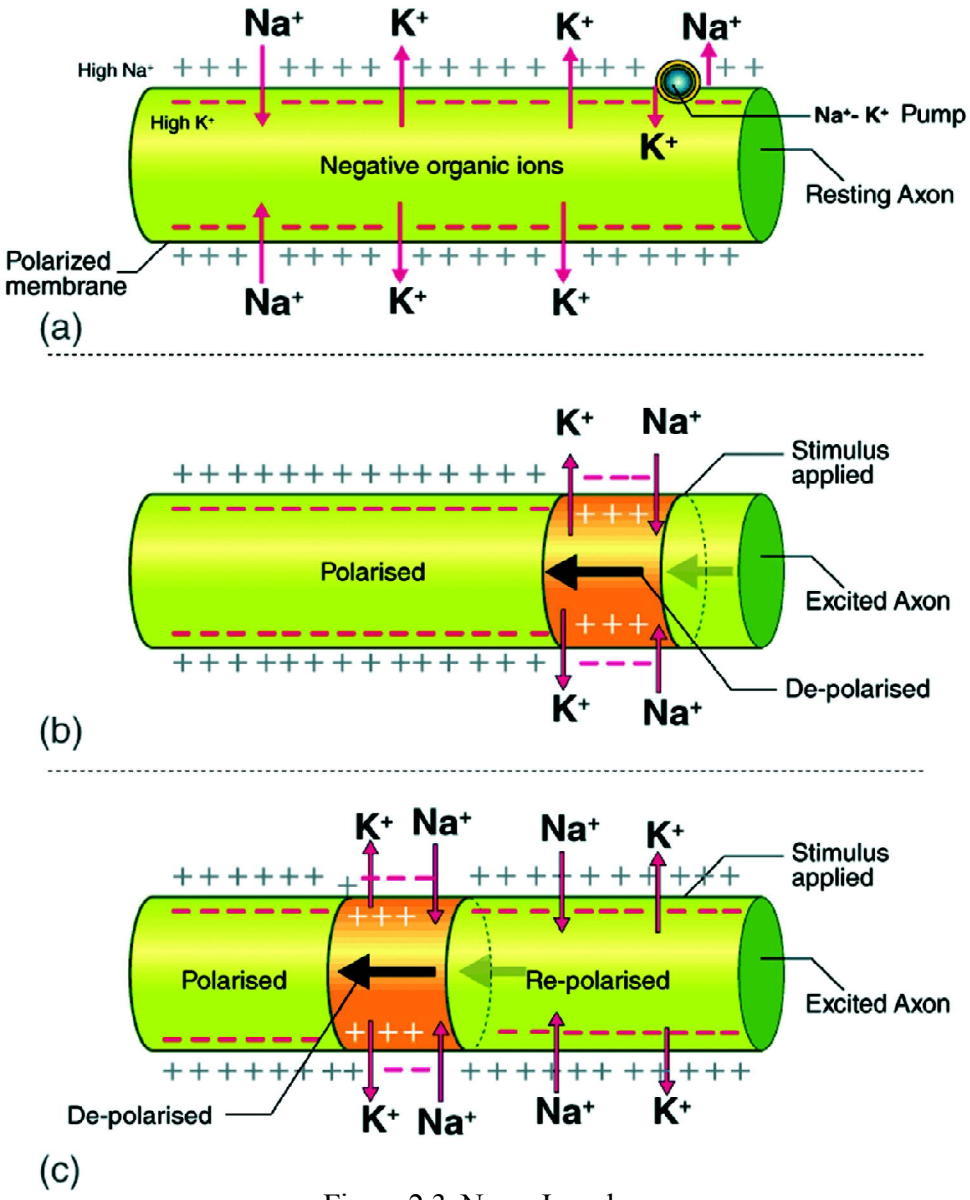


Figure 2.3: Nerve Impulse

After a millisecond, to restore the potential, potassium ions move out to neutralize charges (sodium-potassium pump). In an axon, the active portion triggers a spike (nerve impulse) in the next region and so on down the axon. Once the potential has been restored at the point of initial activity, it becomes ready to carry another impulse from a subsequent stimulation. The tip of the axon makes a functional connection (though never connected physically) with the dendrites/cell bodies of the following neurons, called Synapse. The gap between the axon terminal and dendrite is known as

the **Synaptic Cleft**. There are small packets (vesicles) at the terminal position of the axon that contain neurotransmitters. Neurotransmitters can either excite or inhibit transmission of impulse in the receiving cell.

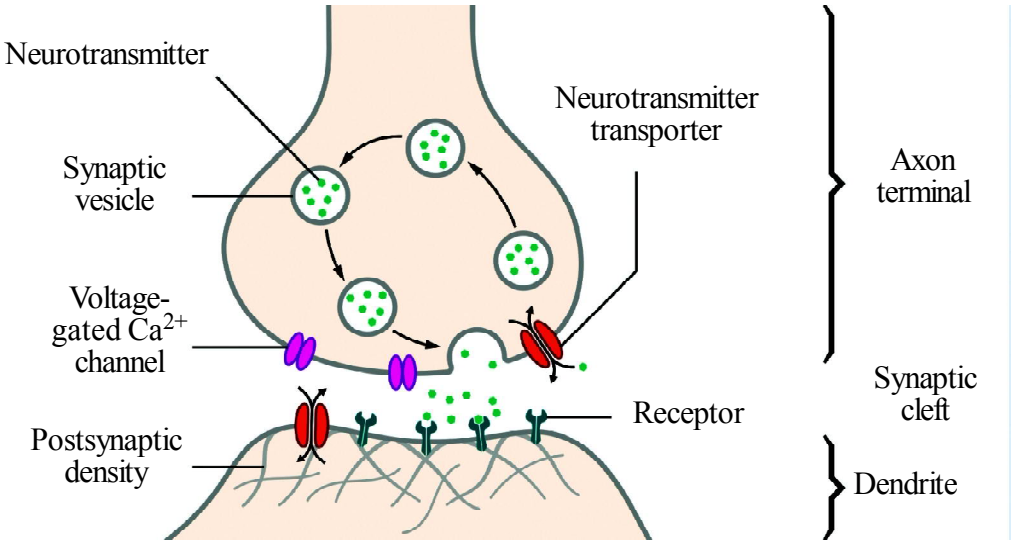


Figure 2.4: Nerve Impulse at Synapse

INTEXT QUESTIONS 2.1

Match the following.

1.	Smallest unit of nervous system	A.	Dendrite
2.	Receives messages from other neurons	B.	Myelin Sheath
3.	Structure on which neurons develop & works	C.	Bipolar
4.	Helps in conduction of message	D.	Neuron
5.	A type of neuron	E.	Glial Cells

2.2 ROLE OF NERVOUS SYSTEM AND ENDOCRINE SYSTEM IN HUMAN BEHAVIOUR

Signals from the nervous system and hormonal release from the endocrine system are the internal sources for the behaviour, undertaken as action or reaction. Before moving on to endocrine system, let us understand the categorization of nervous system and its functions. Nervous system can be understood in a simple manner by categorizing it on the basis of its location and function. On the basis of location, the nervous system can be branched into:-

a. **Central Nervous System (CNS)**

Central Nervous System (CNS) comprises of brain and spinal cord which lie within the bony cases of skull and spine, and

b. **Peripheral Nervous System (PNS).**

PNS is parts of the nervous system outside the skull and spine- comprising of autonomic and somatic nervous system.

a. **Central Nervous System:** It is comprised of brain that continues as the spinal cord in the form of long stalk. Brain integrates the inputs from the sensory organs, analyzes it (cognitive appraisal) and carries out the motor activities as per the requirement. However, brain would be useless without the functioning of the spinal cord.

2.2.1 The Spinal Cord:

A bony case known as the spinal column encases the spinal cord. There are 31 segments of the spinal cord. The nerves that follow the dorsal pathway contain the sensory fibers, and the ones that follow the ventral pathway contain the motor fibers.

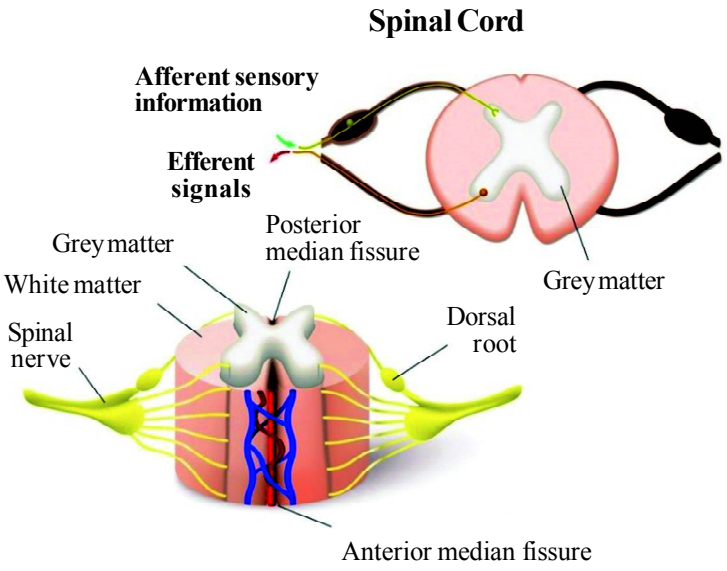


Figure 2.5: Cross-Section of Spinal Cord and its Functions

The cross-sectional image of the spinal cord appears like a butterfly. The central part,

which is majorly comprised of neuron's cell bodies appears grey, and hence popularly known as the grey matter. The outer part, mainly composed of axons and nerves, looks white. The outer section is responsible for carrying to and fro information from the brain to various parts of the body (message pipeline). The other major function taken care by the spinal cord is the **reflex action** (example knee jerk, reaction on touching hot and eye blinking). The three types of neurons involved in the process are sensory (afferent- carry messages from senses to the spinal cord) neurons, motor neurons (efferent- from spinal cord to muscles and glands) and interneurons that link the sensory and motor neurons and form the inside of the spinal cord and the brain itself.

2.2.2 The Brain:

The spinal cord progresses in the upward direction into brain stem, near the junction of the skull that encapsulates the brain. For a better understanding, brain can be categorized on the basis of the major functions it carries out, i.e.,

(i) Survival

(ii) Motivation and emotion, and

(iii) Higher mental processing.

Anatomy of the Brain

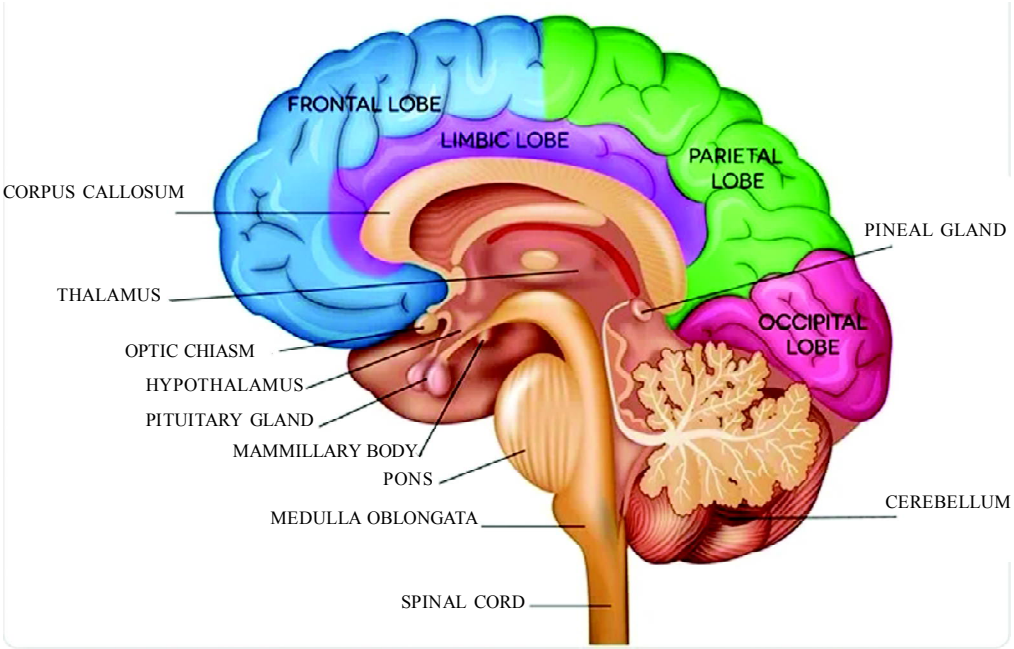


Figure 2.6: Brain

(i) **Survival Function**: It is carried out by the brain stem. Brain stem covers medulla, pons, cerebellum, and reticular activating system (popularly known as Midbrain). Medulla and pons are placed above the spinal cord. **Medulla** is found to be responsible for heartrate and breathing. **Pons** facilitates the passing of sensory and motor information and they are responsible for sleep-arousal, muscle tone and cardiac reflexes. The **cerebellum** lies at the back of the brain stem. It transmits the information to the higher parts of the brain and controls the movements. **Reticular Activating System** activates/arouses central cortex and is involved in sleep-arousal, regulation of muscle tone and cardiac reflexes.

(ii) **Motivation & Emotion**: Motivational behaviours like eating and aggression are controlled by a small structure that lies in the deep layers of the brain i.e., Hypothalamus. **Hypothalamus** also plays role in controlling autonomic nervous system. Quite near the hypothalamus, around the center of the brain also lies thalamus. **Thalamus** receives sensory inputs from various parts of the nervous system and transmits the information to the cerebral hemispheres and other parts of the brain. Emotional reactions and behaviours are regulated by the **limbic system** that comprises of a set of small structures found in deep layers of brain. Largest among these structures is **Hippocampus** which is responsible for making memories. **Amygdala**, which is near hippocampus, is responsible to people's reactions to dangerous situations. It controls fear responses and memory of fear.

(iii) **Higher Mental Processes**: Abilities like reasoning, planning, remembering, and imagining are taken care by **cerebral cortex**. It covers the entire surface of the brain. Although, the structure of the two hemispheres that comprise cortex seem identical, but functionally the two are responsible for different functions. The left hemisphere is predominantly responsible for language aspects, and right hemisphere takes edge in image formation, spatial relationships and pattern recognition. The two hemispheres are interconnected with myelinated fibers, Corpus Callosum, for transmitting and receiving information. On the basis of functionality, cerebral cortex is divided into four lobes- Frontal, Parietal, Temporal, and Occipital. As the name suggests, **frontal lobe** lies in front of the central fissure, and is responsible for cognitive functioning, like attention, thinking, memory, learning and reasoning, and is also responsible for inhibitory effects on autonomic and emotional responses. **Parietal lobe** is placed behind the central fissure. It is responsible for processing information from skin and internal body receptors for touch, temperature and body positioning. The **temporal lobe** is placed behind the temples. The main function this lobe is responsible for is

hearing. It is also responsible for memory of symbolic sounds, understanding of speech and written language. **Occipital lobe** is placed at the base of the cortex, towards the back of brain. It is responsible for the visual information from eyes, in the form of visual impulses, and memory for visual stimuli.

The functional division that is explained above gives us an understanding of brain and its functions. Nothing works in isolation to each other; it is just that an area predominates over others in carrying out the routine functioning in everyday life. Example when we say that we are going to watch a movie, the visual system gets activated which is a predominant role of occipital lobe, the dialogues and music, are interpreted through temporal lobe, the comfort level of the seats are experienced through parietal lobe, and the relation we are able to make between various scenes is through frontal lobe. The emotions we experience while watching the move are controlled by the hypothalamus, thalamus and limbic system. The point is to emphasize that nothing happens in isolation; all the functions in the brain are interlinked and well-coordinated, with its subsystem performing their key roles.

(b) **Peripheral Nervous System (PNS):** PNS consists of the nerve fibers or axons which:

1) carry nerve inputs from the sensory receptors to the body, inward to the CNS;

2) carry nerve impulses for the movement of muscles and the excitation of certain glands outward from the CNS. It comprises of Somatic Nervous System (SNS) and Autonomic Nervous System (ANS). SNS takes charge of activating the striped muscles (example arms and legs) through motor fibers and carry information from the sensing organs (ear, nose, touch receptors of the skin) through sensory fibers. All the involuntary muscles, organs and glands are controlled by Autonomic Nervous System (ANS). Here, motor fibers activate smooth muscles (bodily organs) as the stomach, activate secretion from certain glands like the salivary glands and regulate activities in certain type of muscles of heart. Sensory fibers under ANS carry information from the internal organs that is perceived as pain, warmth, cold or pressure.

(c) **Autonomic Nervous System (ANS)**: It is further categorized as **Sympathetic** and **Parasympathetic Nervous System**. Let's look into an example, Prateek, while going for interview, notices certain changes in his body- his heartbeat increases, his breathing becomes fast, he starts sweating and his mouth becomes

dry. After the interview gets over, no matter how good or bad it was, his breathing becomes normal, heartbeat lowers, the dryness in his mouth goes away and he stops sweating. Now, what Prateek experiences is something we all have experienced at some point of time or the other. These changes are controlled by the sympathetic and parasympathetic part of ANS and are involuntary in nature. The sympathetic division of the ANS is primarily located on the middle of the spinal column. Commonly, it is known as the **"fight or freezing" system**, as it helps people to deal with the stressful events in their lives. During its activation, pupils' dilate, heart rate increases, and digestion of food and excretion of waste tends to be inhibited. The parasympathetic division (PSD) is known as the **"eat-drink- & rest" system.** The neurons responsible for its activation are placed at the top and the bottom of the spinal column, on the other side of the sympathetic division neurons. PSD helps the body to restore the normal functioning after a stressful situation ends. It slows the heart rate and breathing, constricts the pupils, and reactivates digestion and excretory functions of the body.

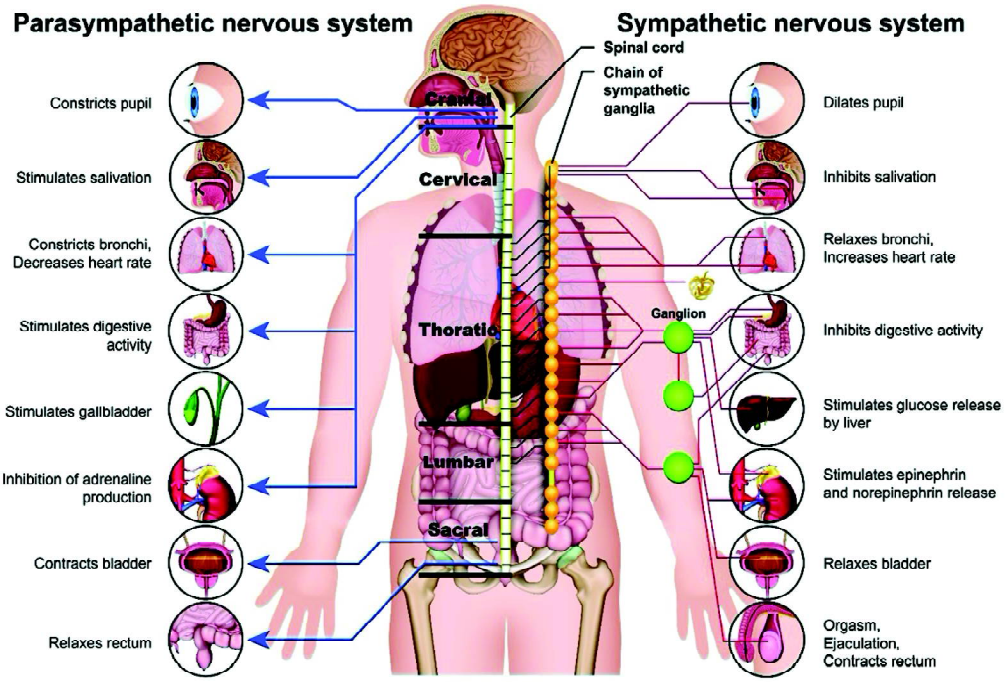


Figure 2.7: Sympathetic & Parasympathetic NS

INTEXT QUESTIONS 2.2

One Word Answers

1. Name the part of the neuron that receives messages from adjacent cells.
2. The neurons of the motor pathway control _____.
3. Name the cell which is responsible for the reproduction of other cells of the body.
4. Damage to which brain part may lead to difficulty in heart rate and breathing.
5. Damage of which part of brain may lead to difficulty in forming new memories.

2.3 THE ENDOCRINE GLANDS

The nervous system also controls the endocrine glands and their secretion of hormones into the bloodstream. The functioning of nervous system and endocrine system (endocrine glands) is together known as Neuro-endocrine System.

Endocrine glands are different from other glands (sweat or salivary glands) as they are ductless glands. Unlike other glands, they do not secrete directly into the tissues, rather they secrete into the bloodstream to have their impact on the desired organ. The secretion that is released from the endocrine glands is known as Hormones. These hormones, when correctly fit in the receptor organs, help in bringing out the desired behaviour. These hormones have been found to be responsible for the functioning of the heart, pancreas, and sex organs. They are also found to influence our emotional reactions and excitatory or inhibitory effects of brain activity. There are different types of endocrine glands which are as follows-

Pituitary: It is located in the brain and is also known as the 'master gland' because it influences other hormones secreting glands. It releases hormones responsible for human growth.

Pineal: It is placed near the base of cerebrum and regulates sleep-wake cycle through the release of melatonin hormone.

Thyroid: It is found in the neck region and releases thyroxine that regulates the metabolism rate of the body.

Pancreas: It is found in the abdomen region and releases insulin that controls the level of blood sugar in the body.

Gonads: They are also known as sex glands, ovaries in females and testes in males. They control sexual behavior and reproduction.

Adrenal: The adrenal glands are placed just above each kidney. They are divided in two sections- adrenal medulla and adrenal cortex. Adrenal medulla controls the secretion of epinephrine and norepinephrine that in turn regulates sympathetic arousal (helps people during stress). The adrenal cortex releases 30 different types of hormones, called corticoids. These hormones control physical stress (of illness, surgery, temperature), psychological stress (emotional aspects), salt intake and functioning of nervous system.

For the overall functioning of the body, regulated release of various hormones is important. They are responsible for the optimal functioning of various parts of the body, including the nervous system. They also control our reactions to external environment.

INTEXT QUESTIONS 2.3

Fill with suitable answers

1. Endocrine glands release _____ in blood stream.
2. Pineal gland is placed near the base of _____.
3. _____ are male gonads.
4. Insulin is secreted in blood stream by _____.
5. Metabolism is controlled by _____.

2.4 THE ROLE OF HEREDITY AND ENVIRONMENT IN HUMAN BEHAVIOUR

When a child is born in the family, you must have observed that the family members say that the child's nose is exactly like her father's, her eyes look like her mother's, and so on. Every child inherits equal number of chromosomes from both mother and father. The combination is so unique that apart from identical twins, all children born to same set of parents have their unique genetic makeup. In this backdrop, one can understand genetics as the study of inheritance of physical and psychological makeup among offspring from their parents (ancestors in the larger domain). For example, hair color of the child is usually genetically determined; and certain psychological factors like emotional expression are also influenced by parental behavior.

The genes are found in the chromosomes, which are present in the nucleus of the zygote, the beginning stage of the new life. Zygote has 23 pairs of chromosomes, 23 contributed by mother and father equally. The 23rd pair of chromosome determines the sex of the child.

Genes: Chromosomes contain tiny little structures called genes. They are the codes or commands that are responsible for the physical and psychological development of the offspring. These genes are the carriers, responsible for the similarity among parents, their ancestors and the offspring, i.e. the basic unit of heredity. The genes do not work within their own system. They take information from the environment, adapt according to the changes required for the betterment of the individual (Darwin's theory of survival of the fittest).

Nature Vs. Nurture

Is a child's development and behavior governed by his/her unique genetic makeup or the environment s/he lives in? Well, the answer to this question is an ongoing debate with no certain conclusions. For example, Sharon displays aggressive behavior. So, does she exhibit this behavior because her mother is aggressive and so she has inherited aggression from her mother (nature), or she learned that kind of behavior from her mother through observation and interaction (nurture). Like it is mentioned earlier, it is difficult to answer this question.

It would be better to say that nature and nurture both play an important role in a child's development. We inherit some features, while others are what we develop over time as a result of interacting with our environment.

In short, heredity and environment interplay determine our physical and psychological makeup. Psychologists usually undertake studies on twins (identical and fraternal twins) to understand the role of heredity and environment.

2.5 THE SOCIO-CULTURAL AND ECOLOGICAL FACTORS UNDERLYING HUMAN BEHAVIOR.

The behavior of an individual does not occur in isolation; it is determined by both genetics and environment. The term environment is encompassing of physical, psychological, and socio-cultural environment. Example the food intake behavior of humans is to satisfy the biological need of hunger. But unless and until we are hungry, are we ready to eat when food is provided to us? The answer for most of us is 'No'. We have our individual food preferences, based on our taste, choice, mood, and availability in time and situation, i.e. it is guided by our psychological, socio-cultural

upbringing and the ecological environment that we are part of. The important role environment plays in a child's development process can be understood by the **Ecological Systems Theory** given by **Urie Bronfenbrenner**, and so popularly known as **Bronfenbrenner's Bioecological Model**.

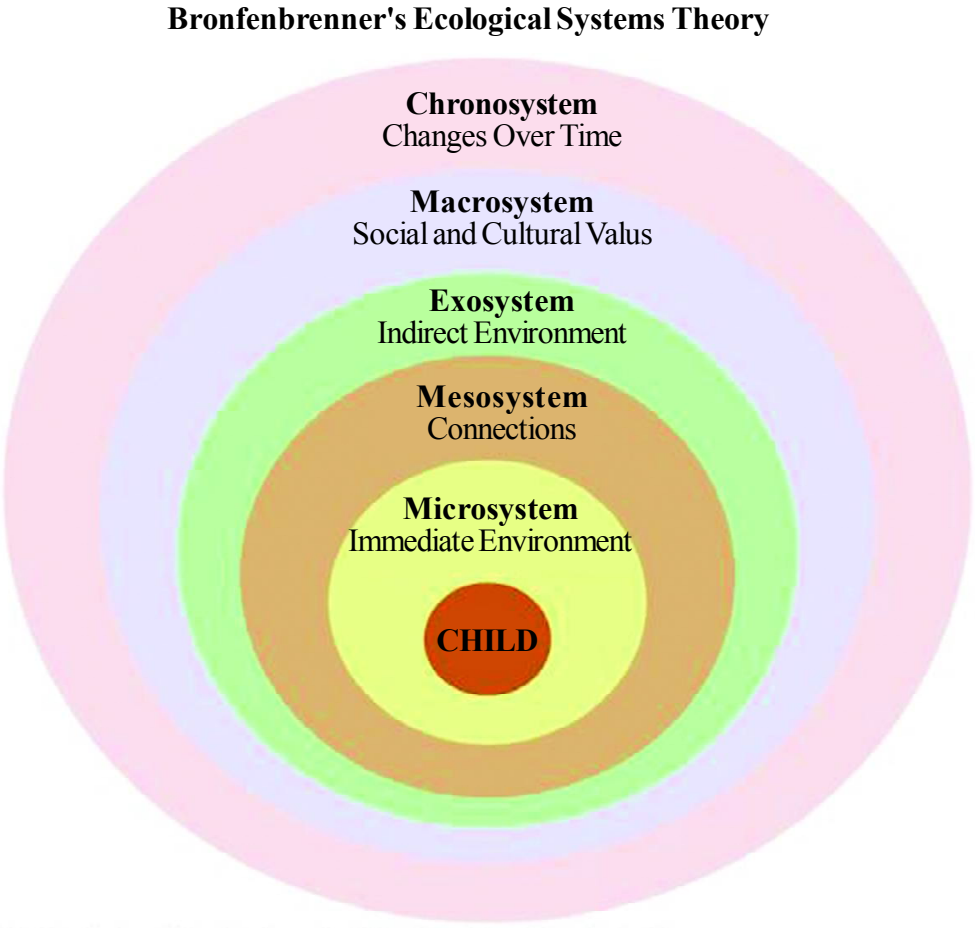


Figure 2.8: Bronfenbrenner's Model

The Bronfenbrenner's model focuses on interconnection between the individual and the environment at various levels. The model has five systems or levels at which this interconnection can be understood.

i. **Microsystem**- The environment that a child comes in immediate contact with and lives in is the microsystem, like the family, school and peers. It also encompasses the various ways in which the parents, siblings, teachers, friends etc. interact with the child. The more supportive these interactive patterns are the better is the development of the child.

ii. **Mesosystem**- This level talks about the relationship between the various components of the microsystem, i.e. how do the parents interact with the teachers, what connection is there between the parents and peers of the individual, etc. Such experiences affect the kind of relationship the individual has with others. For example, during parent-teacher meetings, if parents use supportive and positive words for the child instead of complaining about him/her, the child's confidence boosts up and s/he learns to talk positively about others in a social setting.

iii. **Exosystem**- The environmental factors that have an indirect effect on the development of individual, like workplace of parents. The child may not be interacting with these factors, but they do impact the developmental process of the child. For example, if the father doesn't get his idea approved in the office meeting, he might show his anger at home, which will in turn affect the child in a negative way.

iv. **Macrosystem**- It comprises of the culture in which an individual is brought up. The values, ideas and beliefs, all come under this system. Culture is the phenomenon which differs from society to society. For example, children brought up in Western culture will be more individualistic than the children from the collectivistic Eastern cultures of the world.

v. **Chronosystem**- It includes the changes in the environment of an individual that occur over time. It includes instances like transfer of either of the parent to a new place which might result in shifting among new people. Another example could be birth of a sibling. When a younger sibling is born, the entire pattern of interaction that the child had earlier, changes. If in such situations, the child is neglected due to change in the circumstances, the child might develop behaviours such as inferiority complex which are not good for his/her development.

2.6 MAJOR SOCIAL AGENTS THAT GUIDE HUMAN BEHAVIOR

As discussed in the Bronfenbrenner's Model, the role of various contributors that help in the socialization of the child cannot be denied. The way we perceive, attend, analyze and reciprocate to the external environment is affected by social agents like parents, siblings, peers, school, and media that are discussed below.

i. **Parents**: Parents are the first social contact that a child experience. Child's behavior is shaped by the regular parental interactions like talking, eating, guiding, rewarding certain behaviors and punishing other behaviors, level of control

exerted, etc. The way parents behave with each other, their interaction with the rest of the family members; various social groups etc. also affect the behavior of the child.

ii. **Siblings**: The influence that siblings have on each other cannot be overlooked. They are the ones that spend a lot of time together. Living with a brother or sister teaches a child various things like adjustment, sharing, respecting the other person's space, and dealing with conflicts. If a child shares a good relationship with his or her sibling, it helps in better growth of the child.

iii. **School**: Next social system a child comes in contact with is school. This is a child's first exposure to structured social system. It helps children learn rules and regulations, gives them platform to develop self-initiative and help in developing relations beyond parents in the form of teachers, peers, friends, etc. So, children start socializing with others who are different from family members.

iv. **Peers**: Within the school system and beyond, as the child grows, peers become a major influencing group. Being of same age, peers become most relatable social agents. They help a child in inculcating the habits of sharing, caring, mutual understanding, trust, etc. Children also learn to assert their viewpoint along their interaction with peers.

v. **Media**: As discussed earlier, culture is influenced by changing times. Media, which is a scientific development of the virtual world, has been identified as a significant contributing agent of socializing. The exposure to harmonious, violent, and funny content on television influences a growing child through imitation. The media (virtual world) has enabled children to grab information with the touch of a button. The information hence sought should be guided and monitored to prevent children from developing undesirable behaviour through this social agent.

In summary, human behavior is very complex which is largely determined by several factors such as heredity, environmental, social and cultural values.

INTEXT QUESTIONS 2.4

Fill in the blanks with suitable answers

1. At the beginning stage of the new life. Zygote has _____ pairs of chromosomes.

2. _____ and _____ interplay determines our physical and

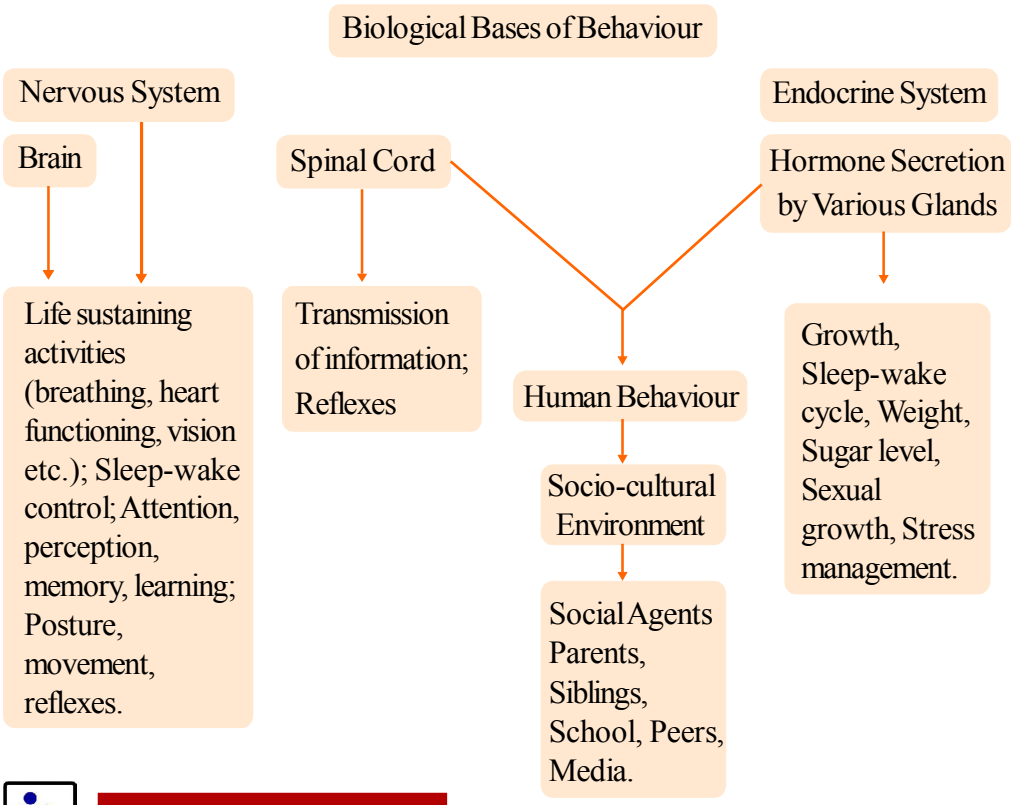
psychological makeup.

3. The Bronfenbrenner's model focuses on interconnection between the _____ and the environment at various levels.

State whether these statements are True or False

1. The Bronfenbrenner's model has been divided into three levels.
2. The exposure to harmonious, violent, and funny content on television influences a growing child through imitation.
3. Genes are the codes or commands that are responsible for the physical and psychological development of the offspring.

WHAT YOU HAVE LEARNT



TERMINAL EXERCISE

1. Discuss the function of neurons and their structural composition.
2. Describe the process involved in information transmission between neurons.

3. Why are psychologists concerned with the role of heredity and environment while studying human behavior?

4. Discuss the functioning of human behavior.

5. Elaborate the role of endocrine system in human behavior.

6. What are the major social agents that guide human behavior?

7. Explain different levels of Bronfenbrenner's model that focuses on interconnection between the individual and the environment.

8. Differentiate between CNS, PNS and ANS.

9. Describe major functions of brain.

10. Cerebral Cortex covers the entire surface of the brain. How its different lobes function in transmitting and receiving information?

ANSWERS TO INTEXT QUESTIONS

2.1

(1-D), (2-A), (3-E), (4-B), (5-C)

2.2

1. Dendrite, 2. Voluntary muscles, 3. Stem cells,

4. Medulla, 5. Hippocampus

2.3

1. Hormones, 2. Cerebrum, 3.Testes,

4. Pancreas, 5. Thyroxin

2.4

1. 23, 2. Heredity and environment, 3. Individual

1. False, 2. True, 3. True