Introduction to Biology of Behaviour

GCE 106

University of Ibadan Distance Learning Centre
Open and Distance Learning Course Series Development

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Vice-Chancellor's Message

The Distance Learning Centre is building on a solid tradition of over two decades of service in the provision of External Studies Programme and now Distance Learning Education in Nigeria and beyond. The Distance Learning mode to which we are committed is providing access to many deserving Nigerians in having access to higher education especially those who by the nature of their engagement do not have the luxury of full time education. Recently, it is contributing in no small measure to providing places for teeming Nigerian youths who for one reason or the other could not get admission into the conventional universities.

These course materials have been written by writers specially trained in ODL course delivery. The writers have made great efforts to provide up to date information, knowledge and skills in the different disciplines and ensure that the materials are user-friendly.

In addition to provision of course materials in print and e-format, a lot of Information Technology input has also gone into the deployment of course materials. Most of them can be downloaded from the DLC website and are available in audio format which you can also download into your mobile phones, IPod, MP3 among other devices to allow you listen to the audio study sessions. Some of the study session materials have been scripted and are being broadcast on the university's Diamond Radio FM 101.1, while others have been delivered and captured in audio-visual format in a classroom environment for use by our students. Detailed information on availability and access is available on the website. We will continue in our efforts to provide and review course materials for our courses.

However, for you to take advantage of these formats, you will need to improve on your I.T. skills and develop requisite distance learning Culture. It is well known that, for efficient and effective provision of Distance learning education, availability of appropriate and relevant course materials is a *sine qua non*. So also, is the availability of multiple plat form for the convenience of our students. It is in fulfilment of this, that series of course materials are being written to enable our students study at their own pace and convenience.

It is our hope that you will put these course materials to the best use.

Prof. Abel Idowu Olayinka
Vice-Chancellor

Foreword

As part of its vision of providing education for "Liberty and Development" for Nigerians and the International Community, the University of Ibadan, Distance Learning Centre has recently embarked on a vigorous repositioning agenda which aimed at embracing a holistic and all encompassing approach to the delivery of its Open Distance Learning (ODL) programmes. Thus we are committed to global best practices in distance learning provision. Apart from providing an efficient administrative and academic support for our students, we are committed to providing educational resource materials for the use of our students. We are convinced that, without an up-to-date, learner-friendly and distance learning compliant course materials, there cannot be any basis to lay claim to being a provider of distance learning education. Indeed, availability of appropriate course materials in multiple formats is the hub of any distance learning provision worldwide.

In view of the above, we are vigorously pursuing as a matter of priority, the provision of credible, learner-friendly and interactive course materials for all our courses. We commissioned the authoring of, and review of course materials to teams of experts and their outputs were subjected to rigorous peer review to ensure standard. The approach not only emphasizes cognitive knowledge, but also skills and humane values which are at the core of education, even in an ICT age.

The development of the materials which is on-going also had input from experienced editors and illustrators who have ensured that they are accurate, current and learner-friendly. They are specially written with distance learners in mind. This is very important because, distance learning involves non-residential students who can often feel isolated from the community of learners.

It is important to note that, for a distance learner to excel there is the need to source and read relevant materials apart from this course material. Therefore, adequate supplementary reading materials as well as other information sources are suggested in the course materials.

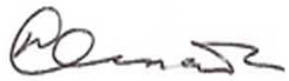
Apart from the responsibility for you to read this course material with others, you are also advised to seek assistance from your course facilitators especially academic advisors during your study even before the interactive session which is by design for revision. Your academic advisors will assist you using convenient technology including Google Hang Out, You Tube, Talk Fusion, etc. but you have to take advantage of these. It is also going to be of immense advantage if you complete assignments as at when due so as to have necessary feedbacks as a guide.

The implication of the above is that, a distance learner has a responsibility to develop requisite distance learning culture which includes diligent and disciplined self-study, seeking available administrative and academic support and acquisition of basic information technology skills. This is why you are encouraged to develop your computer skills by availing yourself the opportunity of training that the Centre's provide and put these into use.

In conclusion, it is envisaged that the course materials would also be useful for the regular students of tertiary institutions in Nigeria who are faced with a dearth of high quality textbooks. We are therefore, delighted to present these titles to both our distance learning students and the university's regular students. We are confident that the materials will be an invaluable resource to all.

We would like to thank all our authors, reviewers and production staff for the high quality of work.

Best wishes.



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Study Session 1: The Science of biology

Expected duration: 1 week or 2 contact hour

Introduction

Have you ever wondered how scholars and others get to know the functioning of the body, how the mind works and how living things interact with one another?
Biology is a science that deals with the living world. Its methods are similar to those employed in all natural sciences. It is a very interesting study that ranges from microscopic cellular molecules to the multicellular macro forms of life, encompassing the earth's surface and its living organisms.

To this extent, this study session is to provide you with the definition of biology and what it's all about.

Learning Outcomes for Study Session 1

At the end of this study session, you should be able to:
1.1 Explain the term Biology
1.2 Discuss the four basic principles of modern Biology

1.1. Meaning of Biology

The word 'biology' is from the Greek word 'bios' which means life, while 'logos' mean science. It can therefore be simply put as the science of life.

As a separate science, biology was developed in the 19th century, when scientists discovered that organisms shared fundamental characteristics. It is now a standard subject of instruction at schools and universities.

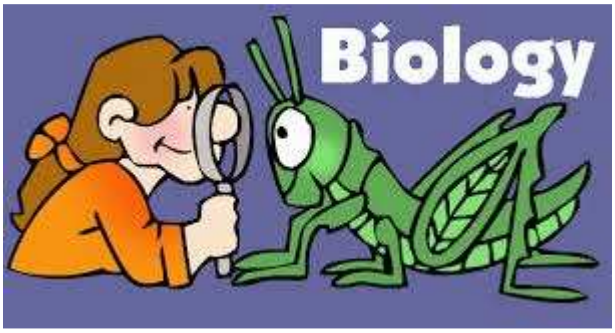


Figure 1.1: *Biology Depicted*
Source: *http://www.cranford.hounslow.sch.uk/images/369.gif*

Biology is a branch of natural science, and it is the study of living organisms and how they interact with their environment. It deals with every aspect of a living organism.

It examines the structure, functions, growth, origin, evolution and distribution of living things.

It classifies and describes organisms, their functions, and how species come into existence and the interactions they have with each other with the natural environment. Aspects of biological science range from the study of molecular mechanisms in cells, to the classification and behaviour of organisms, how species evolve and interaction between ecosystems.
The study of biology can be divided into different disciplines such as:

a) Ethology
b) Evolutionary Biology
c) Physiology
d) Genetics
e) Molecular Biology
f) Morphology
g) Systematics
h) Ecology

Biology often overlaps with other sciences; for example, biochemistry and toxicology with biology, chemistry, and medicine; biophysics with biology and physics; stratigraphy with biology and geography; astrobiology with biology and astronomy.

In text question

Biology is the study of _____

In test answer

- Life

Social sciences such as geography, philosophy, psychology and sociology can also interact with biology, for example, in administration of biological resources, developmental biology, biogeography, evolutionary psychology and ethics.

Box 1.1: Definition of Biology

The word biology is derived from the Greek words bios meaning life and logos meaning study and so is defined as the science of life and living organisms

1.2 Characteristics of Living Things

When you look at your environment, you will discover there are both living and non-living things. But the question is ‘what actually distinguishes living things from the non-living things?
To say an organism exists is the same thing as saying that it is busy, it is full of life, it is going on, it is alive, it is full of energy.

Living things can be distinguished from non-living things by a number of characteristics.

Some of them as you must have been taught in your secondary school days (the acronym MR NIGER D) are given in the figure below with explanations following.

***Figure 1.2**: Characteristics of Living Things*

Movement: - All living things move. We all move from one place to another. Movement simply means a change in position. It could be a total movement (as in the case of animals) or it could be limited to one part of the body as in plant.

Are you wondering how plants move? Plants move in so many ways. They move in response to an external factor such as light or sun. This will be discussed more in Irritability!

Respiration: - When you don't eat for a period of time, you feel very weak and tired, isn't it? The foods we eat give us energy to carry out our daily activities. These foods are broken down through a process known as Respiration. Respiration is simply the breakdown of food substances taken in by the organism to release energy.

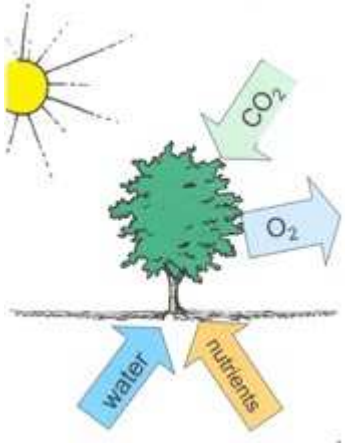


***Figure1.3**: Respiration in Plants*
***Source:** http://www.ext.colostate.edu/mg/gardennotes/images/141-1.jpg*

Nutrition: - As it was mentioned above, living organisms need food to supply the energy and materials for life. Nutrition involves the total process of taking in, and the utilization of foods in animals; as well as taking in of mineral substances and their utilization in plants.

***Figure 1.4**: Nutrition*
***Source**: http://harboranimalhospital.com/files/2014/07/dog_eating_food2.jpg*

Irritability (Sensitivity):- If your friend pricks you with a sharp object, what do you do? Or if when cooking, you mistakenly touch a very hot pot, you quickly take off your hands, isn't it? All these are instances of your response to an external factor.

Irritability is the ability of a living organism to receive an external stimulus and respond to it. There are certain ways your body responds to external factors such as light, sun, noise, heat etc.
Plants are also sensitive to external factors, they respond to sun, light, touch and other factors in different ways. In some plants, the leaves close up when you touch them. Example is the plant Mimosa.

***Figure 1.5**: Mimosa Plant that closes up when touched*
***Source**: http://www.sarracenia.com/photos/miscplant/mimospudic002.jpg*

Growth: - If you sow a seed in your garden or in a pot, after few days you would find a tiny seedling coming out from the seed. As days pass, the tiny seedling grows in size, the number of leaves increases, and later, it grows into a mature plant. Growth in

living organisms may be defined as an irreversible increase in the number and size of a cell, organ or whole organism. The materials used for growth are derived from the food taken in by the organism.

In text question

The process by which food is broken down to release energy is called_____

A. Respiration
B. Movement
C. Nutrition
D. Irritability
E. Growth

In text answer

Answer is (A) Respiration

Excretion: - This is the removal of waste products of metabolism from the body of a living organism.

Reproduction: - When a photograph is reproduced, a copy is made. Does the same thing happen when an organism reproduces?

Reproduction could then be defined as a process of giving rise to new individuals of the same kind for the continuation of life. Reproduction may be sexual or asexual in nature. Plants reproduce when you plant a seed and it brings forth more plants, fruits and seeds!

In text question

What is the difference between growth and movement?

In text answer

Movement is simply a change in position and it is external, while growth is an increase in size which is usually accompanied by development and it occurs internally but externally obvious.

Death: All living organisms die! The end of life is death.

Another characteristic of living organisms that differentiates them from non-living organisms is Adaptation.
Adaptation is the possession of features (structures or functions) which enable organisms to live successfully and to survive in their respective environments. For example, some plants can survive in deserts where there is limited amount of water while some cannot.

***Figure 1.6**: The Cactus Plant that grows in the deserts*
***Source**: http://cdn.searchenginejournal.com/wp-content/uploads/2013/05/hugging-cactus.jpg*

Also, fishes can live in water because they possess features such as gills and fins that enable them survive in water. You can live all your life in water because you don't have these features.

Activity1.1: Irritability in Plants

Plant a maize seed in a dark room, allowing only a single source of light, probably from one small window! You will discover after growth that the plant will grow in the direction of the light. That is, it will grow towards the light source.

1.2.1 Differences between Plants and Animals

There are notable differences between plants and animals. These are shown in Table 1.1

Table 1.1: Differences in Plants and Animals

Features	**Plants**	**Animals**
Movement	Rooted on one spot. Movement is generally slow since usually is as a result of growth.	The whole animal can move about quickly.
Nutrition	Plants are Autotrophic, i.e., they make their food through the process called photosynthesis in the presence of sunlight.	Animals are heterotrophic; they can make their foods by themselves, but instead depend on complex organic matter, already made by other organisms.
Growth	May grow large with branching body. Growth which is mostly at meristems, is indefinite	Body is compact, growth stops at maturity in higher animals.
Support	Depend on tugor and lignifield tissues	Many Possess an endoskeleton or an exoskeleton
Sensitivity	Responds slowly to stimulus by means of hormones.	Sensory system allows rapid responses.

1.3 Underlying Principles of Modern Biology

The four underlying principles of modern Biology are given in figure 1.7

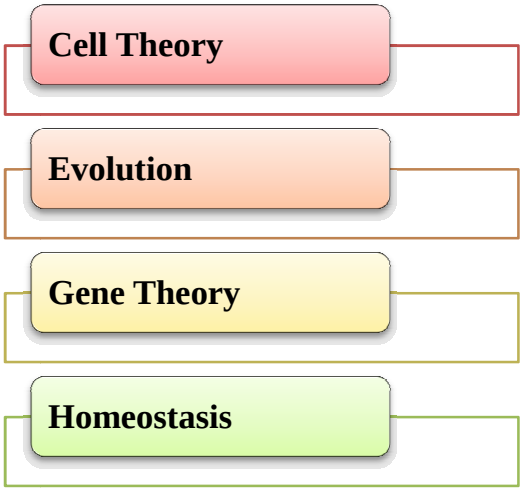


Figure 1.7 *the Four Underlying Principles of Modern Biology*

1. Cell Theory

Cell theory is the study of everything that involves cells. All living organisms are made of at least one cell, which is the basic unit of function in all organisms.

Cell theory studies:

- How cells are made
- How they reproduce
- How they interact with their environment
- What they are composed of
- How the materials that make up a cell work and interact with other cell sections.

2. Evolution

In the broadest sense, evolution is merely change, and so is all-pervasive; galaxies, languages, and political systems all evolve. Thus Evolution is a process that results in heritable changes in a population spread over many generations

Through natural selection and genetic drift, a population's inherited traits change from generation to generation.

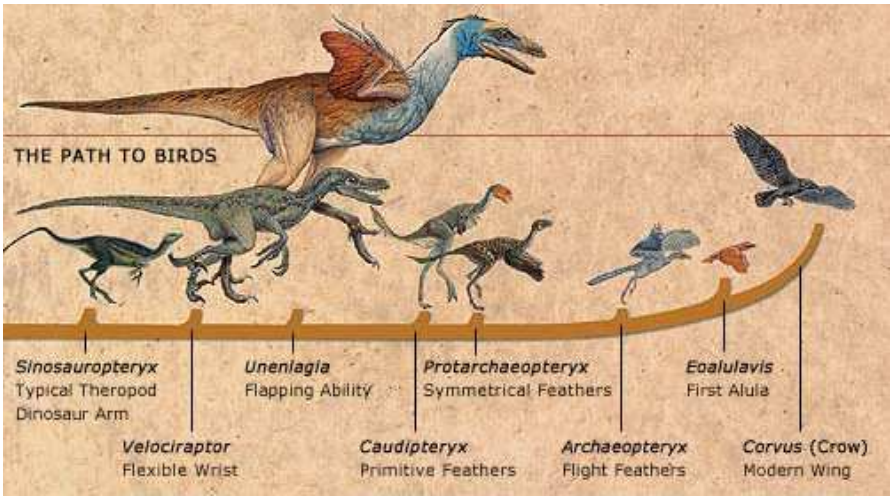


***Figure 1.8**: Evolution of Birds*
***Source:** http://ragenstrial.weebly.com/*

3. Gene Theory

A living organism's traits are encoded in DNA (De-Oxyribonucleic Acid), the fundamental component of genes. In addition, traits are passed on from one generation to the next by way of these genes.

4. Homeostasis

The physiological processes that allow an organism to maintain its internal environment, notwithstanding its external environment is called homeostasis

In text question

The following are the underlying principles of modern biology except_____

A. Gene Theory
B. Gene Mutation
C. Homeostasis
D. Cell Theory
E. Evolution

In text answer

B. Gene Mutation

Summary of Study Session 1

In this study session, you have learnt that:

1. The word 'biology' is from the Greek – 'bios' means life, while 'logos' means science.
2. When you look at your environment, you will discover there are both living and non-living things.
3. Nutrition involves the total process of taking in, and the utilization of foods in animals; as well as taking in of mineral substances and their utilization in plants
4. Irritability is the ability of a living organism to receive an external stimulus and respond to it.

5. This is an increase in size which is usually accompanied by development (a change in form and abilities).
6. Cell theory is the study of everything that involves cells.
7. The physiological processes that allow an organism to maintain its internal environment, notwithstanding its external environment.

Self-Assessment Questions (SAQs) for Study Session 1

Now that you have completed this study, you can assess how well you have achieved its Learning outcomes by answering the following questions. You can check your answers with the Notes on the Self-Assessment questions at the end of this study.

SAQ 1.1 (Testing Learning outcomes 1.1)

Define the term 'Biology'

SAQ 1.2 (Testing Learning outcomes 1.2)

State the characteristicsof living things

SAQ 1.3 (Testing Learning outcomes 1.3)

Define Homeostasis

Notes on SAQ for Study Session 1

SAQ 1.1

It can therefore be simply put as the science of life.

SAQ 1.2

1. Movement
2. Respiration
3. Nutrition
4. Irritability
5. Growth
6. Excretion
7. Reproduction
8. Death

SAQ 1.3

Homeostasis is the physiological processes that allow an organism to maintain its internal environment, notwithstanding its external environment.

Study Session 2: The Concept of Behaviour

Expected duration: 1 week or 2 contact hour

Introduction

Tunde combs his hair, drives to work, reads a book, plays his favorite song over again, and mentally calculates how many bottles of wine he will need for his upcoming party, all this could be termed as behaviors

Just like everybody, you have reasons for the way you behave. There is said to be rational and irrational forms of behaviour. Why should a normal person behave irrationally? How does behaviour come about? Is it learned or innate? All these questions would be addressed in this study session.

Learning Outcomes for Study Session 2

At the end of this study session, you should be able to:
2.1 Explain the term Behaviour
2.2 Discuss how Behaviour comes about
2.3 Identify what necessitates a particular pattern of behaviour in man

2.1 Behaviour

Psychology, although describing itself as "the science of behavior," has not to date arrived at any consensus in the matter of what the concept of "behavior" means but some psychologist have been able to come up with some definitions.

Behaviour can be described as the response to a stimulus. A stimulus is any event, which is perceived by the human sense receptors. A stimulus could be a visual event, a sound, a taste, a touch, a smell or any combination of these, while a response is an event or process which is elicited by (or results from) a stimulus.

Some responses are purely reflexive (innate) in nature. For example, when you touch a hot object, you perceive a stimulus pain, and you automatically respond by withdrawing your hand. Other responses develop as a function of learning.

Box 2.1 Defining Stimulus
A stimulus is any event, which is perceived by the human sense receptors.

For instance, when you are asked to mention the characteristics of a living thing, the response to this question had been learned. Both desirable and undesirable behaviours are learned

A group of psychologists have defined behaviour as the activity performed by the organisms, including man. This behaviour may be described as the activity of human beings. Others have described behaviour as a response of the neuromata system to the environmental contingencies.

This emphasizes the neurological basis of behaviour. It also indicates that behaviour is prompted by a number of physiological as well as environmental factors. Some of the factors outside the skin of man that may provoke behaviour include needs, motives, social stimuli and others.

In-Text Question

Behaviour is defined as the activity performed by the organisms and man exclusively. True or False

In-Text Answer

False

2.2. Some Behaviourist Theories

Pavlov and Skinner made findings in their experiments into the psychology of learning.

2.2.1 Ivan P. Pavlov's Theory of Classical Conditioning

Ivan P. Pavlov (1849 – 1936), a Russian psychologist, performed some laboratory experiments about 1902 which give some insight into the learning process. He put a piece of meat in a dog's mouth and saliva was rushing out.

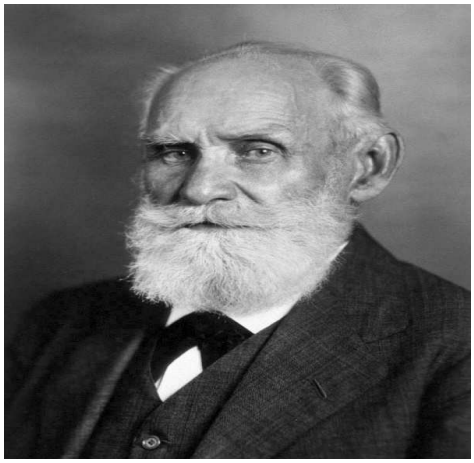


Figure 2.1*:Ivan P. Pavlov*
Source: https://upload.wikimedia.org/wikipedia/commons/7/7d/Ivan_Pavlov_NLM3.jpg

He collected the saliva and measured the strength of the response produced by the number of drops of saliva secreted. He then put the dog in a specially designed room, which cut out extraneous stimuli and locked the dog in.

Every time he wanted to feed the dog, he rang the bell followed by presentation of meat which would induce salivation of the dog. He repeated this process it several

times, and eventually concluded that thus the dog had learned that the sound of the bell would soon lead to it being given something to eat.

The stimuli used were the sound of the bell and the meat in close sequence. After pairing the two stimuli, the saliva would flow out of the dog's mouth without the meat. He then discovered that merely striking the bell, the saliva would be produced without the meat again, thus conditioning has taken place.

The meat stimulus that produced response without prior training is called unconditioned stimulus (US). The unconditioned response (UR) is that response elicited by US. The UR is often a highly reflexive response, which happens quickly and quite automatically. The saliva that the dog produced in the experiment was the unconditioned response (UR), while the striking of the bell was the conditioned stimulus (CS).

In-Text Question
The Russian psychologist, laboratory experiments performed about 1902 can be considered ineffective. True or False

In-Text Question
False

2.2.1 B. F. Skinner's Theory of Operant Conditioning

This is the conditioning of behaviour that operates upon the environment to produce some effect.

Skinner's B. F. (1904), an American psychologist, suggested that learning is a series of experiences, each of which influences behaviour in the same way that conditioning does. In his view, each learning experience is a stimulus that produces a behavioural response.

Skinner carried out an experiment associated with conditioning. He constructed a box called Skinner box. This was a box containing a lever that released a pellet of food into a tray and, at the same time automatically registered the responses on a time chart.

To produce operant conditioning, Skinner placed a hungry rat in the box. The inside of the box was plain except for the protrusion of the food dish beneath it. A small light bulb above the bar could be lighted at the experimenter's direction.

Left alone in a box, the rat moved about restlessly and occasionally pressed its paws upon the bar. A container with pellets of food was attached so that every time the rat pressed the bar, a pellet of food fell into the dish.

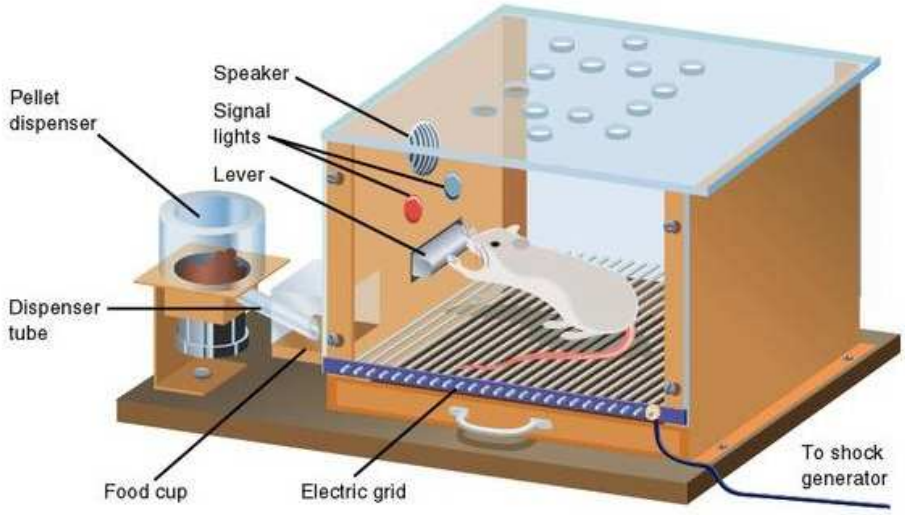


Figure 2.3: *Skinner's Box*
Source: *http://cdn-5.simplypsychology.org/skinner%20box.jpg*

The rat ate and soon pressed the bar again. The food reinforced bar-pressing. The pressing response was instrumental in producing a reinforce (food) which then acted as a stimulus for response (bar pressing).

The terms "instrumental learning" and "operant conditioning" can be considered to be synonymous, since both refer to the strengthening and weakening of behaviour by the stimulus consequences by these behaviours.

Behaviourist counsellors believe that if the experimental animals used by Pavlov and Skinner could be conditioned to new behaviour patterns, human beings can equally be made to change their behaviours by the application of learning principles used by both Pavlov and Skinner.

Summary of Study Session 2

In Study Session 2, you have learnt that:

1. Behaviour can be described as the response to a stimulus.
2. The works of behaviourist counsellors are largely based on the findings of Pavlov and Skinner in their experiments into the psychology of learning.
3. Ivan P. Pavlov (1849 – 1936), a Russian psychologist, performed some laboratory experiments about 1902 which give some insight into the learning process
4. Skinner's B. F. (1904), an American psychologist, suggested that learning is a series of experiences, each of which influences behaviour in the same way that conditioning does

Self-Assessment Questions (SAQs) for Study Session 2

Now that you have completed this study, you can assess how well you have achieved its Learning outcomes by answering the following questions. You can check your answers with the Notes on the Self-Assessment questions at the end of this study.

SAQ 2.1 (Testing Learning outcomes 2.1)

Described in your own words with examples the statement, ‘behaviour can either be reflexive or learned

SAQ 2.2 (Testing Learning outcomes 2.2)

Describe in detail a learning theory.

Notes on SAQ for Study Session 2

SAQ 2.1

Some responses are purely reflexive (innate) in nature. For example, when you touch a hot object, you perceive a stimulus pain, and you automatically respond by withdrawing your hand. Other responses develop as a function of learning. For instance, when you are asked to mention the characteristics of a living thing, the response to this question had been learnt

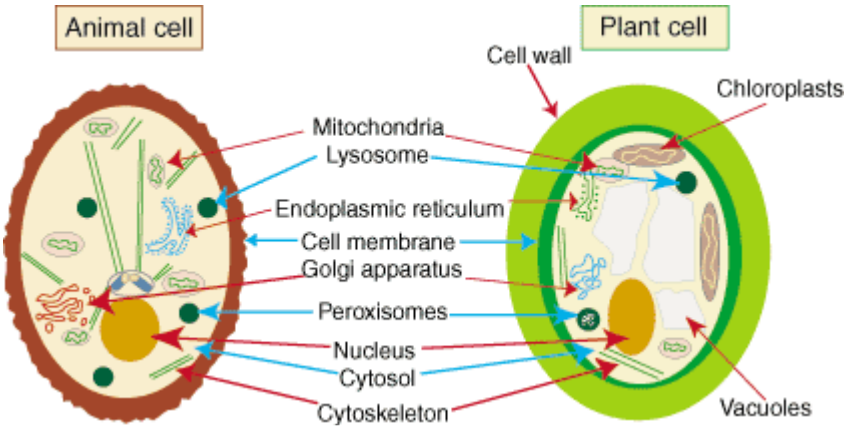
SAQ 2.2

F. Skinner’s Theory of Operant Conditioning is the conditioning of behaviour that operates upon the environment to produce some effect.

Skinner’s B. F. (1904), an American psychologist, suggested that learning is a series of experiences, each of which influences behaviour in the same way that conditioning does.

Study Session 3: The Cell

Expected duration: 1 week or 2 contact hour



Introduction

Life starts from somewhere and a lot of complex processes are involved in the formation or bringing a life into existence. In this study session you shall focus our attention on the cell, as the smallest unit of life.

Learning Outcomes for study session 3

At the end of this study session you should be able to:

1. Explain what the cell is all about; and
2. Discuss how the division of cells leads to living entities.

3.1 What is a Cell?

Cell is the smallest unit of life that can carry out all the functions of a living thing. Cells are the basic units of all life; all organisms are made of one or more cells and all cells arise from existing cells.

Cells are classified into two categories: simple, non-nucleated prokaryotic cells, and complex, nucleated eukaryotic cells. These two classes of cells do not divide in the same way.

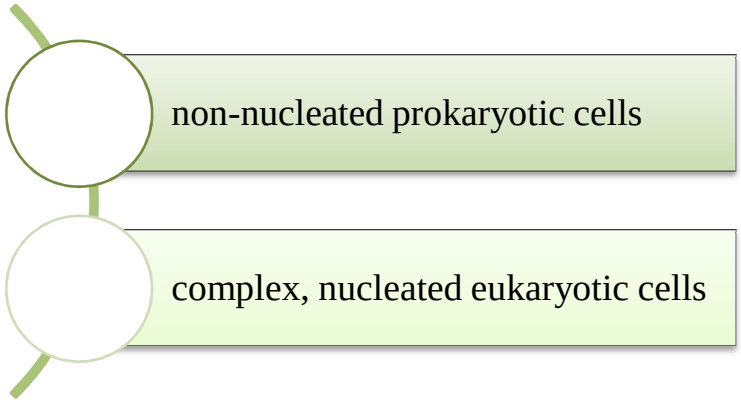


Figure 3.1: Classification of cell

Prokaryotic cells were the first form of life on earth, characterized by having vital biological processes including cell signaling and being self-sustaining. They are simpler and smaller than eukaryotic cells, and lack membrane-bound organelles such as the nucleus. Prokaryotes include two of the domains of life, bacteria and archaea.

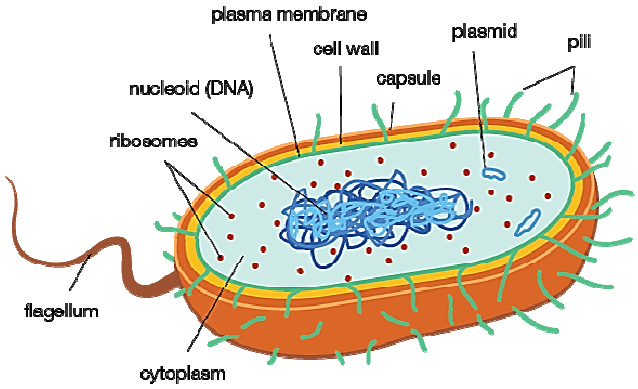


Figure 3.2: *Prokaryotic cells*
Source: *http://media1.shmoop.com/images/biology/biobook_cells_12.png*

The DNA of a prokaryotic cell consists of a single chromosome that is in direct contact with the cytoplasm. The nuclear region in the cytoplasm is called the nucleoid. Most prokaryotes are the smallest of all organisms ranging from 0.5 to 2.0 µm in diameter.

Plants, animals, fungi, slime molds, protozoa, and algae are all *Eukaryotic*. These cells are about fifteen times wider than a typical prokaryote and can be as much as a thousand times greater in volume. The main distinguishing feature of eukaryotes as compared to prokaryotes is compartmentalization: the presence of membrane-bound organelles (compartments) in which specific metabolic activities take place.

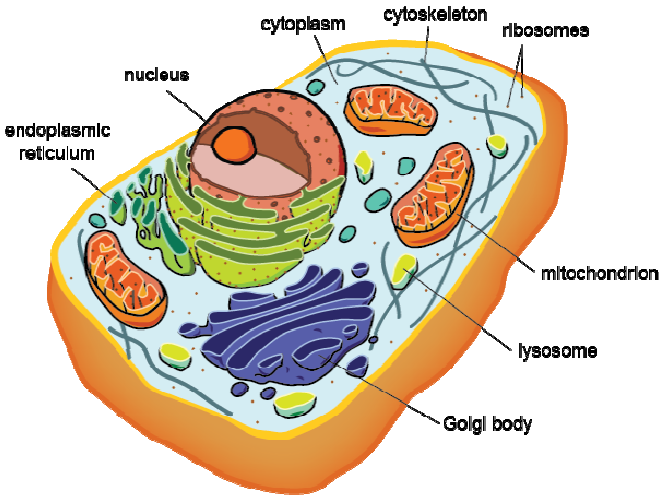


Figure 3.3: *Eukaryotic cell*
Source: *http://media1.shmoop.com/images/biology/biobook_cells_1.png*

In-Text Question
What do you understand by ‘cell’?

In-Text Answer
Cell is the smallest unit of life by which other organs of the body exist

Most important among these is a cell nucleus, an organelle that houses the cell's DNA. This nucleus gives the eukaryote its name, which means "true kernel (nucleus)". The eukaryotic DNA is organized in one or more linear molecules, called chromosomes, which are associated with histone proteins. All chromosomal DNA is stored in the cell nucleus, separated from the cytoplasm by a membrane. Some eukaryotic organelles such as mitochondria also contain some DNA.

Many eukaryotic cells are ciliated with primary cilia. Primary cilia play important roles in chemo sensation, mechanosensation, and thermosensation. Cilia may thus be "viewed as a sensory cellular antennae that coordinates a large number of cellular signalling pathways, sometimes coupling the signalling to ciliary motility or alternatively to cell division and differentiation.

The plasma membrane resembles that of prokaryotes in function, with minor differences in the setup. Cell walls may or may not be present.

3.1.1 Cell structure and function
A typical cell has an outer non-living layer called cell wall. The cell membrane is present below the cell wall. The cell membrane encloses protoplasm. The protoplasm has a semi fluid matrix called cytoplasm and a large membrane bound structure called Nucleus.

The cytoplasm has many membrane bound structures like endoplasmic reticulum, Golgi bodies, mitochondria, plastids, micro bodies, vacuoles; and non-membranous

structures like Centrosome and ribosomes. These are called cell organelles. The cytoplasm without these cell organelles is called cytosol. The cytoplasm also contains non-living inclusions called ergastic substances and cytoskeleton (microfilaments and microtubules)

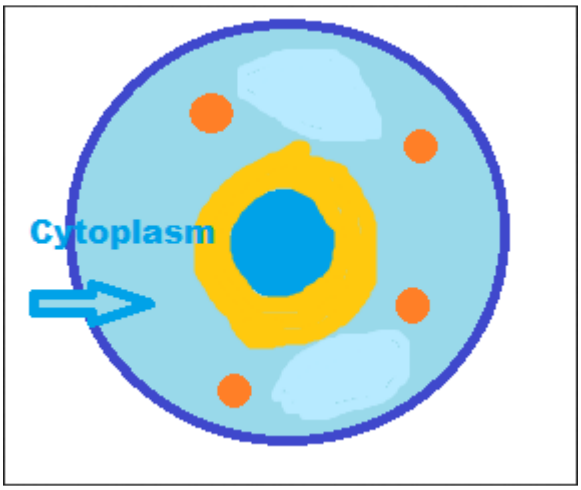


Figure 3.4: *Cytoplasm*

The content of the cell within cell wall is called *Protoplast*. The cytoplasm without living cell organelles is called *Cytosol*.

Table 3.1: Comparison of plant and animal cell

Plant cell	Animal cell
Cell wall is present	Cell wall is absent
Centrioles are absent	Centrioles are present
Plastids are present	Plastids are absent
Have large vacuole	May have small vacuoles

In-Text Question

The content of the cell within cell wall is called _____

A. Protoplast
B. Cytoplast
C. Nucleus
D. Golgi Body

In-Text Answer

A. Protoplast

3.1.2 Description of the cell contents

1. Cell wall:

It is an outer non-living, rigid layer of cell. It is present in bacterial cells, fungal cells and plant cells. It is a permeable membrane chiefly composed of cellulose. It gives rigidity, mechanical support and protection to the cell.

2. Protoplast:
It includes cell membrane and protoplasm.

I) Cell Membrane or Plasma Membrane
It is a semi permeable membrane present in all cells. It is present below the cell wall in plant cell and outermost membrane in animal cell. It is composed of phospholipids, proteins, carbohydrates and cholesterol.
It allows the outward and inward movement of molecules across it. The movement of molecules across the plasma membrane takes place by diffusion, osmosis, active transport.

ii) Protoplasm
It is a living substance of the cell that possesses all vital products made up of inorganic and organic molecules. It includes cytoplasm and nucleus.

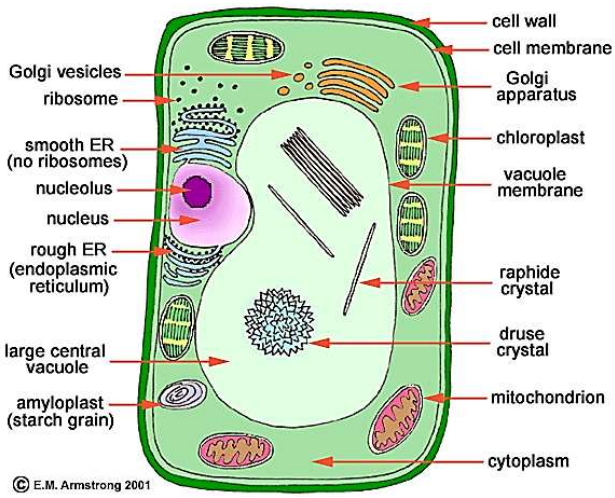


Figure 3.5: *Plant Cell*
Source*: http://waynesword.palomar.edu/images/plant3.gif*

CYTOPLASM:
It is the jellylike, semi fluid matrix present between the cell membrane and nuclear membrane. It has various living cell inclusions called cell organelles and non-living cell inclusions called ergastic substances and cytoskeletal elements. The cytoplasm without cell organelles is called cytosol.

GOLGI BODIES
Golgi complex has a group of curved, flattened plate like compartments called cisternae. They stacked one above the other like pancakes. The cisternae produce a network of tubules from the periphery. These tubules end in spherical enzyme filled vesicles.
Functions:

- They pack enzymes, proteins, carbohydrates etc.in their vesicles, hence called packaging centers.
- They produce Lysosomes.
- They secrete various enzymes, hormones and cell wall material.

- They help in phragmoplast formation.

Mitochondria / Chondriosome

Mitochondrion is a spherical or rod shaped cell organelle. It has two membranes. The outer membrane is smooth. The inner membrane produces finger like infolding called cristae. The inner membrane has stalked particles called Racker's particles

The mitochondrial cavity is filled with a homogenous granular mitochondrial matrix. The matrix has circular mitochondrial DNA, RNA, 70s ribosomes, proteins, enzymes and lipids.

Common name: Power houses of the cell / Storage batteries of the cell

Functions:

Mitochondria synthesize and store the energy rich molecules ATP (Adenosine triphosphate) during aerobic respiration. So, they are called "Power houses of the cell".

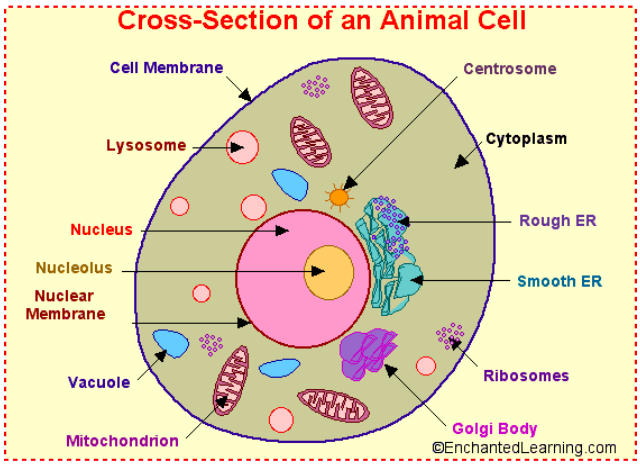


Figure 3.6: *Animal Cell*
Source: *http://www.enchantedlearning.com/subjects/animals/cell/anatomy.GIF*

Chloroplasts:

These are green colored plastids containing chlorophylls and carotenoids (carotenes & xanthophyll). Chloroplast is a double membranous cell organelle. The matrix is called stroma.

The stroma has many membranous sacs called Thylakoids. They arrange one above the other like a pile of coins to form Granum.

These membranous structures have photosynthetic pigments like chlorophylls, carotenes and xanthophyll (carotenols).

In-Text Question

Cell wall is an outer _____, rigid layer of cell?

A. Living
B. Nonliving
C. Open

D. Close

In-Text Answer

B. Nonliving

3.2 Cell Division

Cell division is a process by which a cell, called the parent cell, divides into two or more cells, called daughter cells. Cell division is usually a small segment of a larger cell cycle.

This type of cell division is known as mitosis, and it leaves the daughter cell capable of further division. In another type of cell division present only in eukaryotes, called meiosis, a cell is permanently transformed into a gamete, and it cannot divide again until fertilization.

In eukaryotes, there are two distinct types of cell division: a vegetative division, whereby each daughter cell is genetically identical to the parent cell (mitosis) and a reductive cell division, whereby the number of chromosomes in the daughter cells is reduced by half, to produce haploid gametes (meiosis)

The growth and division of cells (mitosis) and the formation of sperm and eggs (meiosis) are important for almost all organisms, including humans. We all began as a single cell that resulted from our father's sperm fertilizing our mother's egg. This single cell then divided by mitosis into two cells.

Daughter cells then continued again until we were 'grown up'. It is still happening right now as some of our cells use mitosis to replace old dead cells, such as skin cells. Meiosis, on the other hand, is a special form of mitosis that occurs only in a special subset of our cells to form eggs and sperm.

3.2.1 MITOSIS

In mitosis, a single cell divides to form two daughter cells. These cells grow and then divide to form a total of four cells. While in meiosis, a single cell divides twice, resulting in four daughter cells that do not grow and divide again. Instead, these cells are modified to become eggs or sperm in humans.

Mitosis is a part of the cell cycle in which chromosomes in a cell nucleus are separated into two identical sets of chromosomes, and each set ends up in its own nucleus. In general, mitosis (division of the nucleus) is often accompanied or followed by cytokinesis, which divides the cytoplasm, organelles and cell membrane into two new cells containing roughly equal shares of these cellular components.

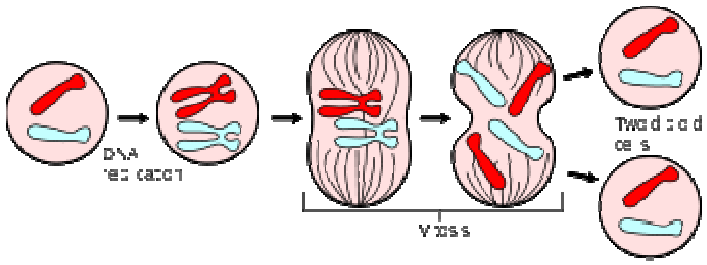


Figure 3.7: *Mitosis Cell Division*

Mitosis and cytokinesis together define the mitotic (M) phase of an animal cell cycle—the division of the mother cell into two daughter cells, genetically identical to each other and to their parent cell.

In-Text Question

In mitosis, a single cell divides to form ____ daughter cells. These cells grow and then divide to form a total of _____ cells.

A. Three and Six
B. One and Two
C. Two and Four
D. Five and Ten

In-Text Answer

C. Two and Four

The process of mitosis is divided into stages corresponding to the completion of one set of activities and the start of the next. These stages are prophase, prometaphase, metaphase, anaphase, and telophase. During mitosis, the chromosomes, which have already duplicated, condense and attach to spindle fibres that pull one copy of each chromosome to opposite sides of the cell.

3.2.2 MEIOSIS

Meiosis results in four haploid daughter cells by undergoing one round of DNA replication followed by two divisions: homologous chromosomes are separated in the first division, and sister chromatids are separated in the second division. Both of these cell division cycles are used in sexually reproducing organisms at some point in their life cycle, and both are believed to be present in the last eukaryotic common ancestor

In meiosis, DNA replication is followed by two rounds of cell division to produce four potential daughter cells, each with half the number of chromosomes as the original parent cell. The two meiotic divisions are known as Meiosis I and Meiosis II. Before meiosis begins, during S phase of the cell cycle, the DNA of each chromosome is replicated so that it consists of two identical sister chromatids, which remain held together through sister chromatid cohesion.

This S-phase can be referred to as "premeiotic S-phase" or "meiotic S-phase." In some cases all four of the meiotic products form gametes such as sperm, spores, or pollen.

In female animals, three of the four meiotic products are typically eliminated by extrusion into polar bodies, and only one cell develops to produce an ovum.

Prokaryotes also undergo a vegetative cell division known as binary fission, where their genetic material is segregated equally into two daughter cells. All cell divisions, regardless of organism, are preceded by a single round of DNA replication.

In-Text Question

_____ results in four haploid daughter cells by undergoing one round of DNA replication followed by two divisions

In-Text Answer

Meiosis

One of the most important requirements of a successful mitosis or meiosis is that the blue-print of life, the DNA (De-Oxyribonucleic Acid), is provided in equal amounts to each of the daughter cells. The DNA in all human cells, except eggs and sperm, is housed in 46 chromosomes. Eggs and sperm consist of only half that number, 23 chromosomes per cell.

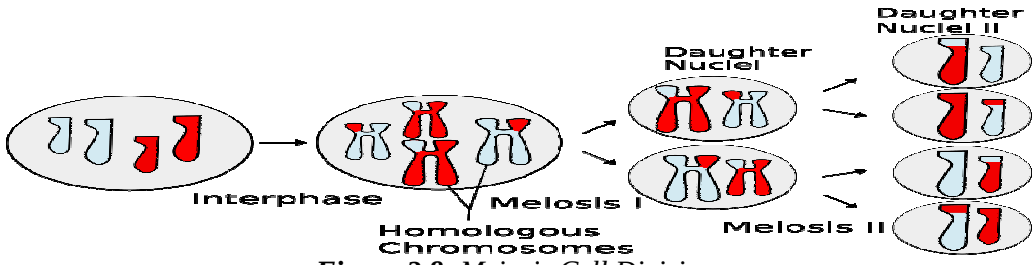


Figure 3.8: *Meiosis Cell Division*

Every person inherits one set of chromosomes from their mother (in the egg) and the other set of chromosomes from their father (in the sperm). It is imperative that when mitosis and meiosis are complete, the appropriate number of chromosomes exists in each cell. If there are extra or missing chromosomes, the cells usually do not live.

Fission is the division of a cell (or body, population, or species) into two or more parts and the regeneration of those parts into separate cells (bodies, populations, or species). Binary fission produces two separate cells, populations, species, etc., whereas multiple fission produces more than two cells, populations, and species.

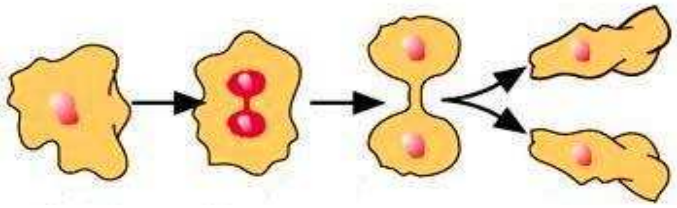


Figure 3.9: *Binary Fission*

In-Text Question

What is Fission?

In-Text Answer

Fission is the division of a cell into two or more parts and the regeneration of those parts into separate cells.

Definition of Terms

DNA (De-Oxyribonucleic Acid) is the hereditary materials of life and molecules of the nucleus that direct all chemical reactions (metabolism) that go on in the cell.

Mitosis - is the growth and division of cells.
Meiosis - is the formation of sperm and eggs.

Summary of Study Session 3

At the end of this study session, you have learnt that:

1. The cell is of great significance to living entities. We stated that cells are the basic units of life and all organisms are made of one or more cells. Cells are classified into two categories
2. Cell division is a process by which a cell, called the parent cell, divides into two or more cells called daughter cells.

Self-Assessment Questions for Study Session 3

Now that you have completed this study session, you can assess how well you have achieved its Learning outcomes by answering the following questions.. You can check your answers with the Notes on the Self-Assessment questions at the end of this Study.

SAQ 3.1 (Testing Learning outcomes 3.1)

1. What are Cells?
2. List the categories of cell

SAQ 3.2 (Testing Learning outcomes 3.2)

- Discuss cell division
- Explain Mitosis
- Define Meiosis

Notes on SAQ for Study Session 2

SAQ 3.1

Cell is the smallest unit of life that can carry out all the functions of a living thing.

SAQ 3.2

Cell division is a process by which a cell, called the parent cell, divides into two or more cells, called daughter cells.

Mitosis is a part of the cell cycle in which chromosomes in a cell nucleus are separated into two identical sets of chromosomes, and each set ends up in its own nucleus

In meiosis, DNA replication is followed by two rounds of cell division to produce four potential daughter cells, each with half the number of chromosomes as the original parent cell.

Study Session 4: Neuroses

Expected duration: 1 week or 2 contact hour

Introduction

Most of us have periods when we feel anxious, depressed, unreasonably angry, or inadequate in dealing with life's complexities. Is it always clear when behaviour moves from the normal to the abnormal then, we described the new development as a neurotic condition. In this study session we will be learning the symptoms and causes of neuroses.

Learning outcomes for study session 4

At the end of this study session you should be able to:

1. Define neuroses
2. Enumerate general characteristics of neurosis
3. Discuss Types and symptoms of neurosis
4. Explain Causes of neuroses.

4.1 What is Neurosis?

Neurosis is a term generally used to describe a non-psychotic mental illness, which triggers feelings of distress and anxiety that impair bodily functioning. It can simply be defined as a poor ability to adapt to one's environment, an inability to change one's life patterns, and the inability to develop a richer, more complex, more satisfying personality. Neurosis should not be mistaken for psychosis, which refers to loss of touch with reality.

Box 4.1: Definition of Neurosis
Neurosis is a poor ability to adapt to one's environment, an inability to change one's life patterns, and the inability to develop a richer, more complex, more satisfying personality.

The term connotes an actual disorder or disease, but under its general definition, neurosis is a normal human experience, it is part of the human condition. Most people are affected by neurosis in some form.

A psychological problem develops when neuroses begin to interfere with, but not significantly impair, normal functioning, and thus cause the individual some anxiety. The word 'neurosis' means "Nerve disorder", (Nerve is made up of a cluster or neurons, which relays messages in the body).

The neurotic disorders are distinct from psychotic disorders in that the individual with neurotic symptoms has a firm grip on reality, while the psychotic patient does not.

Some professionals use the term to describe anxious symptoms and associated behaviour, or to describe the range of mental illness outside of the psychotic disorders (such as schizophrenia, delusional disorder).

Others, particularly psychoanalysts (Psychiatrists and Psychologists who follow a psychoanalytical mode of treatment, as popularized by Sigmund Freud and Carl Jung), use the term 'neurosis' to describe the internal process itself (called an unconscious conflict) that triggers the anxiety characteristic.

Neurosis can also be defined as a functional behaviour disorder with no apparent underlying physical cause for the feelings of ill-health it engenders. Neuroses include a number of affective disorders, such as anxiety, depression, and obsessive states.
It is also defined as a mental disorder for which professional help may be needed but that is milder than a psychosis, a functional disorder in which there is a gross personality disorganization and there is an inability to cope effectively with some routine frustrations, anxieties, and daily problems.
A mental and emotional disorder that affects only part of the personality, is accompanied by less distorted perception of reality than in a psychosis, and is characterized by various physiological and mental disturbances.

In-Text Question

Neurosis can also be defined as a functional behaviour disorder with no apparent underlying physical cause for the feelings of ill-health it engenders. TRUE/FALSE?

In-Text Answer

TRUE

4.2 General Characteristics of Neurotic Disorder

Although neuroses manifest themselves in various ways – each neurotic being almost unique in the particular symptom pattern show – certain common characteristic are found in all neurotic reactions.
These are: presence of anxiety, inability to measure up to his capacity level, pattern of rigid or repetitive behaviour, egocentricity, hypersensitivity, immaturity, somatic complaints, unhappiness and a great deal of unconsciously motivated behaviour. The prominence of any one or all of these characteristics varies from one form of reaction to another.

1. Anxiety

It has been stated that the hallmark of the neuroses is the presence of anxiety. Anxiety is a feeling of dread, fearful anticipation and apprehensiveness in even the most routine circumstances. Neurotic anxiety is a reaction that is disproportionate to the amount of danger present.

2. Inability to measure up to his capacity

Despite the fact of possible high intelligence or superior talent, the neurotic usually fails to realize his/her potential and frequently fails miserable in his achievement efforts. Effective functioning is interfered with by disabling somatic symptoms,

fearfulness and timidity, time spent in self-pre-occupation, and inability to effect sound human relationships.

3. Rigid or Repetitive Behaviour

The individual here seems incapable of learning new means of adjusting to life problems. He or she adheres to rigid patterns; he becomes maladaptive in his responses time after time.

4. Egocentricity

The neurotic is constantly self-preoccupied. He is more keenly aware of himself than it is with a normal person and, as a consequence, he is habitually comparing himself and his situation with other persons and their situations.

5. Hypersensitivity

Because of the high degree of tension he has experienced, the neurotic characterically over-reacts to life situation. This is manifested in a low threshold for irritation, inability to tolerate criticism, over-reaction to praise or flattery, frequency of complaints about even minor physical discomforts, and reactions of agitation to normal stress situations.

6. Immaturity

Neurotics, generally, are people who have failed to develop mature emotional and motivation patterns; their emotional relationships are often typified by dependency and exaggerated needs for affection and social approval.

7. Somatic Complaints and Symptoms

Uncomfortable or disabling symptoms are the things which most frequently lead to the neurotic to consider himself a sick person. The physical ailment, which is psychologically oriented, may take on any form of pain in any area of the body, dysfunction of any organ system, hypersensitivity, even muscular paralysis.

8. Unhappiness

Anxiety, tension, fear, threat, apprehensions, conflict and lack of self-confidence make the life of a neurotic unbearable

Beset with many handicaps, it is easy to see why the neurotic will be an unhappy person. Feelings of loneliness, of being hurt or missing the “good things in life” are characteristics of neurotic patients. The prevailing mood for the neurotic is one of depression, despair, and pessimism about the future.

9. Unconscious Motivation

While unconscious motivation forms the basis of much of the behaviour of the “normal individual”, it dominates the major reactions of the neurotic to life situations. He has much greater need for the unconsciously developed defence mechanisms. His

awareness of reality is to a much greater extent coloured by unconscious fears and hostilities, which constitute the basis for the neurotic behavioural pattern.

In-Text Question

The following are characteristics of neurotic disorder except _____

A. Unconscious motivation
B. Somatic Complaints
C. Deactivation
D. Repetitive Behaviour

In-Text Answer

C. Deactivation

4.3 Types and Symptoms of Neuroses

1. Anxiety Disorder

Anxiety is defined as "feelings" of fear, apprehension and dread. The two major disorders under anxiety disorders are:

a. panic disorder; and
b. Generalized anxiety disorder.

Symptoms

For panic disorder, sudden onset of palpitations, chest pain, choking sensations, dizziness, and feeling of unreality are common. There is also invariably a secondary fear of dying, losing control, or going mad. Individual attacks usually last for minutes only. Though sometimes longer, their frequency and the course of the disorder are both rather variable. A panic attack is often followed by a persistent fear of having another attack.

In generalized anxiety disorder as in other anxiety disorders, the dominant symptoms are highly variable complaints of continuous feelings of nervousness, trembling, muscular tension, sweating light-headedness, palpitations, dizziness. This disorder is more common in women, and it is often related to chronic environment stress.

2. Phobia

Most people have fears of specific things like a fear of the dark or spiders, but rarely do these fears dominate their lives. When the fears become preoccupying and the individual takes special steps to avoid the feared thing (like a mother asking her son to read through all her magazines first to ensure that there are no pictures of spiders) then a minor fear becomes a specific phobia.

This is the most common type of anxiety disorder. It involves specific situations, which cause irrational anxiety attacks. Perceived imminent exposure to the feared object or experience triggers avoidance behaviour. Phobic anxiety often co-exists with depression.

The phobic disorders are divided into three types: (a) Agoraphobia (b) Social phobia (c) specific phobia.

a. Agoraphobia (Fear of Open Spaces): This include fears not only of open spaces but also of related aspects such as the presence of crowds and the difficulty of immediate easy escape to a safe place

b. Social Phobia: Social phobias often start in adolescence and are centred on a fear of socialising with other people comparatively small groups.

c. Specific Phobia: This usually arises in childhood or early adult life and can persist for decades if they remain untreated. These are phobias restricted to highly specific situation such as proximity to particular animals, heights, thunder, darkness, flying, closed spaces and the fear of exposure to specific diseases.

Symptoms

Agoraphobia refers to an interrelated and often overlapping cluster of phobias embracing fear of leaving home, fear of entering shops, crowds, and public places or of travelling alone in trains, buses, planes. This is the most incapacitating of the phobia disorders and some sufferers become completely house-bound.

For social phobia, direct eye to eye confrontation may be particularly stressful. It is usually associated with low self-esteem and fear of criticism. They may be present as a complaint of blushing, hand tremor, nausea, etc.

In-Text Question

What is Anxiety?

In-Text Answer

Anxiety is defined as “feelings” of fear, apprehension and dread.

3. Obsessive – Compulsive Disorder

The essential features of this disorder are recurrent obsessional thought such as ideas, images or impulse that enters the individual’s mind again and again in a stereotyped term. They are violent and obscene. They may also be disturbing simply because they are perceived as senseless and the sufferer often tries, unsuccessfully, to resist them.

Symptoms

These may take the form of ideas, mental images, or impulses to act. They are very variable in content but nearly always distressing to the individual. A woman may be tormented, for example, by a fear that she might eventually be unable to resist an impulse to kill the child she loves.

The majority of compulsive acts are concerned with repeated checking to ensure that a potential dangerous situation is not allowed to develop or orderliness and tidiness are duly mentioned. Compulsive ritual acts may occupy many hours every day and are sometimes associated with marked indecisiveness and slowness.

4. Post-Traumatic Stress Disorder

Occurring in the wake of a particular traumatic event (e.g. natural or man-made disaster, combat, serious accidents, witnessing the violent death of others, or being the victim of torture, terrorism, rape or other crime), post-traumatic stress disorder can lead to severe flashbacks and a lack of responsiveness to stimuli.

Boko Haram insurgents in north east Nigeria made many people seek psychiatric treatment because of Post-Traumatic Stress Disorder (PTSD).

Symptoms

It includes episodes of repeated reliving of the trauma in instructive memories ("flashback") or dreams, occurring against the persistent background of a sense of"numbness" and emotional blunting, detachment from other people, unresponsiveness to surroundings, and avoidance of activities and situations reminiscent of the trauma. Commonly, there is fear and avoidance of duties that remind the sufferer of one original trauma.

5. Somatoform Disorders

Hypochondriasis and hysteria (now generally known as conversion disorder) are now classified as somatoform disorders, and they involve physical symptoms of psychological distress.

The main feature of somatoform disorders is repeated presentation of physical symptoms, together with persistent requests for medical investigations, in spite of repeated negative findings and reassurances by doctors that the symptoms have no physical basis.

Symptoms

The main features are multiple, recurrent and frequently changing physical symptoms. Symptoms may be referred to any part of system of the body, but gastrointestinal sensation (pain, belching, regurgitation, vomiting, nausea, etc.) and abnormal skin sensations (etching, burning, tingling, numbness, soreness, etc.) and blotchiness are among the commonest. Sexual and menstrual complaint is also common.

4.4 Causes of Neurotic Behaviour

In understanding the causes of neurotic reactions, four kinds of factors must be evaluated: biological, psychodynamic, behavioural, and cognitive existential theories which seem to play a part in determining the form of reaction.

1. Biological Factors

Various investigators have suggested that anxiety disorders or neuroses have biological origins.

The autonomic nervous systems of some patients with anxiety disorder, especially those with panic disorder, exhibit increased sympathetic tone, adapt slowly to repeated stimuli and respond excessively to moderate stimuli.

Structural studies revealed the following abnormalities in neurosis:

1. increase in size of cerebral ventricles in anxiety disorders;
2. a specific defect in the right temporal lobe in panic disorder;

3. abnormality in the caudate (a tail or tail appendage) nucleus; and
4. Some studies claim that during somatization disorder, the patients have characteristic attention and cognitive impairments that result in the faulty perception and assessment of somatosensory inputs.

Stress is the prime causative factor in the development of post-traumatic stress disorder.

2. Psychodynamics

If you know very little about psychology, and you have heard of just one psychologist, the chances are that this is Sigmund Freud, the founder of the psychodynamic approach to psychology and psychoanalysis.

The psycho-dynamics model begins with the assumption that the symptoms of anxiety disorders come from underlying psychic conflicts or fears. The symptoms are attempts to protect the individual from psychological pain. Thus panic attacks are the result of unconscious conflicts bursting into consciousness.

In obsessive-compulsive disorders, the obsessive behaviour is seen as an attempt to displace anxiety created by a related but far more feared desire or conflict. By substituting an obsession that symbolically captures the forbidden impulse, a person gains some relief.

Neuroses, according to Sigmund Freud, arose from inner conflicts and could lead to anxiety. In his formulation, the causal factors could be found roughly in the first six years of life, when the personality, or ego, is weak and afraid of censure. He attributed neurosis to the frustration of infantile sexual drives, as when severe eating and toilet habits and other restrictions are parentally imposed, (Oedipus complex), which appear in adulthood as neurotic symptoms.

Some of the psychoanalysts, (Karen Horney), emphasized insecurity in childhood as causes of neurosis.

3. Behavioural Theories

According to behavioural theories, anxiety is a conditioned response to specific environmental stimuli. According to their conceptualization of non-phobic anxiety states, faulty, distorted, or counterproductive thinking patterns accompany or precede maladaptive behaviours and emotional disorders. Patients with anxiety disorders tend to over-estimate the degree of danger and the probability of harm in a given situation and tend to under-estimate their abilities to cope with perceived threats to their physical or psychological well-being.

Pain behaviours are reinforced when rewarded and are inhibited when ignored or punished. A behavioural analysis of obsessive-compulsive disorders suggests that compulsive behaviours tend to reduce the anxiety associated with obsessive thoughts thus reinforcing the compulsive behaviours. For example, if a woman fears contamination by touching garbage, then washing her hands reduces the anxiety and is therefore reinforcing.

4. Cognitive

According to this model, it is one's cognitions - thoughts and beliefs- that shape one's behaviours and emotions**.** Cognitive perspectives on anxiety concentrate on the perceptual processes or attitudes that may distort a person's estimate of the danger that he or she is facing.
People who suffer from anxiety disorders may often interpret their own distress as a sign of impending disaster. Their reaction may set off a vicious cycle in which the person fears disaster, which leads to an increase in anxiety which in turn worsens the anxiety sensations and confirms the person's fears.

In-Text Question

The Psychodynamics Theory assumes that the symptoms of anxiety disorders come from underlying psychic_____.
A. Torture
B. Rape
C. Abuse
D. conflicts or fears

In-Text Answer

D. conflicts or fears

Existential Theories

These posit that there is a great concern in the existence and meaning of live. Anxiety is the response to the vast void in existence and meaning. The central concept of existential theory is that people become aware of feelings of profound nothingness in their lives; feelings that may be even more discomforting than an acceptance of their inevitable death.

Summary of Study Session 4

In this study session, you have learnt that

1. Neurosis basically means nerve disorder, and it is distinct from psychotic disorders.
2. Neurotic disorders are characterized by various physiological and mental disturbances, such as, anxiety, inability to function at capacity, rigid or repetitive behaviour, etc.
3. Anxiety is defined as "feelings" of fear, apprehension and dread
4. The autonomic nervous systems of some patients with anxiety disorder, especially those with panic disorder, exhibit increased sympathetic tone, adapt slowly to repeated stimuli
5. In understanding the causes of neurotic reactions, four kinds of factors must be evaluated: biological, psychodynamic, behavioural, and cognitive existential theories which seem to play a part in determining the form of reaction.

Self-Assessment Questions for Study Session 4

Now that you have completed this study session, you can assess how well you have achieved its Learning outcomes by answering the following questions. You can check

your answers with the Notes on the Self-Assessment questions at the end of this Module.

SAQ 4.1 (Testing Learning outcomes 4.1)

Define Neurosis

SAQ 4.2 (Testing Learning outcomes 4.2)

Mention three characteristics of the neurotic disorder

SAQ 4.3 (Testing Learning outcomes 4.3)

Explain the symptoms of anxiety disorder

SAQ 4.4 (Testing Learning outcomes 4.4)

Mention and explain the four determining factors to be considered in explaining the causes of neurotic behaviours.

Notes on SAQ for Study Session 4

SAQ 4.1

Neurosis is a poor ability to adapt to one's environment, an inability to change one's life patterns, and the inability to develop a richer, more complex, more satisfying personality

SAQ 4.2

- Anxiety
- Inability to measure up to his capacity
- Rigid or Repetitive Behaviour

SAQ 4.3

For panic disorder, sudden onset of palpitations, chest pain, choking sensations, dizziness, and feeling of unreality are common. There is also invariably a secondary fear of dying, losing control, or going mad. Individual attacks usually last for minutes only. Though sometimes longer, their frequency and the course of the disorder are both rather variable. A panic attack is often followed by a persistent fear of having another attack.

SAQ 4.4

- Biological Factors
- Psychodynamics
- Behavioural Theories
- Cognitive

Study Session 5: The Human Brain

Expected duration: 1 week or 2 contact hour

Introduction
Sometimes one wonders how the brain functions and how the chemical and the physical factors in the environment affect or influence its functioning. This knowledge is crucial for a practitioner of guidance and counselling. This study session focuses on the significance of the human brain.

Learning Outcomes for Study Session 5
At the end of this study session, you should be able to:
5.1 Identify the important parts of the brain
5.2 Explain how the parts function and how the brain works.

5.1: The Human Brain
A lay man can say that the brain is the reasoning faculty. This is actually true. However, the brain does not function on its own or alone. The nervous system is your body's decision and communication center. The basic unit of the nervous system is the individual cell called neuron. Neurons cluster together in a nerve.

The main function of neurons is to relay messages. The nervous system has two broad divisions:

1. The central nervous system (CNS) is made up of the brain and the spinal cord.
2. The peripheral nervous system (PNS) is made of nerves.

The major neurons are sensory neurons, which relay messages over long distances from receptor organs towards the brain. Nerves reach from your brain to your face, ears, eyes, nose and spinal cord and from the spinal cord to the rest of your body.

The Brain
The brain is divided into 3 compartment:

- The Forebrain
- The Midbrain
- The Hindbrain

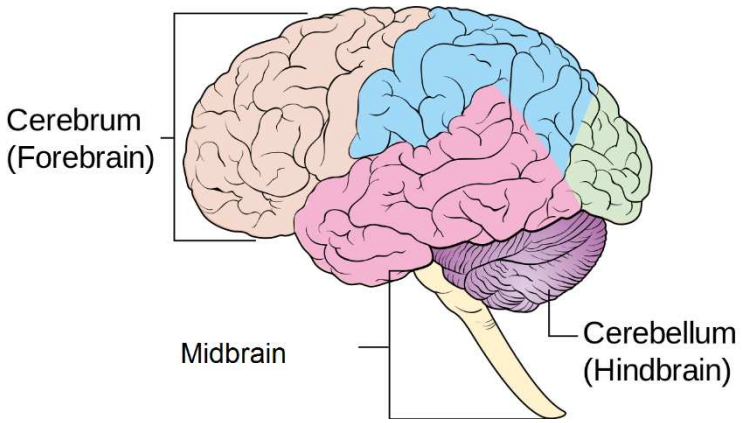


***Figure 5.1**: The Brain*

5.1.1 The Forebrain

Important structures of the forebrain are

- Thalamus
- Hypothalamus
- Limbic system
- Cerebrum

Thalamus

All sensory impulses pass through thalamus to the higher centers, therefore it is usually known as the relay station. In addition, the thalamus has some control over the autonomic nervous system and also plays a role in the control of sleep and alertness.

Hypothalamus

Hypothalamus lies below the thalamus. It exerts a key influence on all kind of emotional as well as motivational behaviour. Centers in the hypothalamus have control over the important body processes like eating/ drinking, sleeping, temperature control and sex. It also has control, over the activities of pituitary gland.

The Limbic System

The limbic system consists of structures in the thalamus, hypothalamus and cerebrum which form a ring around the lower part of the forebrain. Major structures within this system include the olfactory bulb, the septal nuclei the hippocampus, the amygdale and the cingulated gyms of the cerebral cortex.

The limbic system often called the emotional brain, functions in emotional aspects of behavior related to survival, memory, smell, pleasure and pain, rage and aggression, affections/ sexual desire, etc.

The Cerebrum

The cerebrum is the most complex and largest part of the brain. The cerebrum is covered by a thick layer of tightly packed neurons called the cerebral cortex. It is divided into two hemispheres; the left and right hemispheres.

In-Text Question

Centers in the _____ have control over the important body processes like eating/ drinking, sleeping, temperature control and sex.

In-Text Answer

A. Thalamus
B. Hypothalamus
C. Limbic system
D. Cerebrum

Different areas of the cerebral cortex like sensory projection areas, motor projection areas, association areas etc. are responsible for different functions like storing sensory information, controlling body movements, coordinating all information that comes to the brain and regulating highly cognitive functions such as thinking, reasoning and problem solving.

Each cerebral hemisphere is divided in four lobes namely:

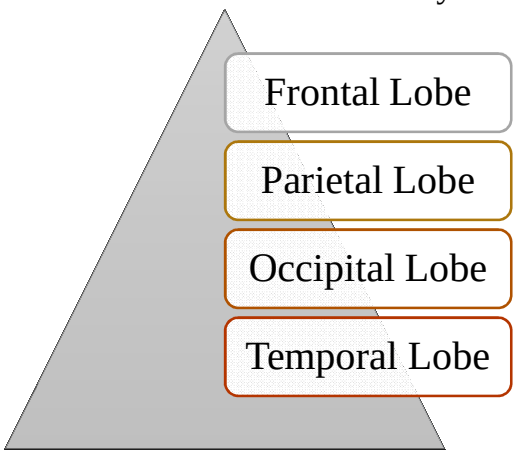


Figure 5.2: *Divisions of the Cerebral Hemisphere*

The different parts of the cerebrum- are connected with different mental functions. The visual area lying in the occipital lobe is connected with the visual organs or eye through the optic nerve. It is the seat of visual sensations.

The auditory area lies in the temporal lobe and is connected with the auditory organs or ears through the auditory nerves. It is the seat of auditory sensations and also involved in memory.

The parietal lobe lies in the upper rear portion of the brain and is connected with the information about special relationship and structure

Frontal lobes contain several parts and are concerned with organizing and planning our actions, learning new tasks generating motivation and regulation of behavior.

In-Text Question

The part of the Cerebral Hemisphere that is connected with the auditory organs or ears through the auditory nerves lies in which of the lobes

In-Text Answer

Temporal Lobe

5.1.2 The Midbrain

It is concerned with the relaying of messages particularly those related to hearing and sight to higher brain centers. One of its important structures is known as Reticular Activating System (RAS). With the help of this structure an individual is able to decide which impulses should be registered consciously and "which should be rejected.

5.1.3 The Hindbrain

It is composed of three structures, the medulla, the pons and the cerebellum. Medulla controls breathing and many important reflexes, such as those that help us maintain our upright postures. It also regulates the highly complex processes like digestion, respiration and circulation.

Trie pons assist in breathing, transmitting impulses from the cerebellum to the higher brain regions and in coordinating the activities of both sides of the brain. Cerebellum is responsible for body balance and the co-ordination of body movements like dancing, typing, playing etc

Spinal Cord

It works as a channel of communication from and to the brain. It is a rope like structure made up of long round nerve fibers. It also works as an organ for effective reflex actions like withdrawal of the hand when something is hot. These reflex actions are almost automatic in nature.

The Major Parts of the Brain and their Functions

1. **Cerebrum:** This is the seat of sense of perception, voluntary movement, learning, remembering, thinking, emotions and consciousness.
2. **Cerebral cortex:** This is the thick layer of nerve cell bodies covering the cerebrum. It is the centre where all complex mental activities take place.
3. **Medulla:** This controls breathing, swallowing, digestion and heartbeat.
4. **Cerebellum:** This part of the brain responsible for body balance, coordinating of voluntary movement of fingers and thumb.
5. **Hypothalamus:** This regulates endocrine activity, governs eating, drinking, sexual behaviour, sleeping and temperature control. It maintains homeostatis which is the general level of functioning of the healthy organism such as normal body temperature.

6. **Spinal cord:** The path for conducting motor and sensory impulses and reflexes.
7. **The peripheral nervous system:** The peripheral nervous system comprises the somatic and autonomic nervous systems. The somatic system is concerned with body movement and overt reaction to internal and external stimuli. The autonomic system, (comprising sympathetic and parasympathetic systems) is primarily concerned with controlling the body's involuntary activities, such as the breathing of the heart, digesting and secreting sweat so as to maintain an optimal balance in temperature and other aspects of the body's internal environment.

5.2 Peripheral Nervous System

The nerve tissues lying outside the bony case of the central nervous system come in the region of the peripheral nervous system. It consists of a network of nerves which helps in passing the sense impressions to the central nervous system as well as in conveying the orders of the central nervous system to the muscles.

This peripheral nervous system is subdivided into two parts, namely:

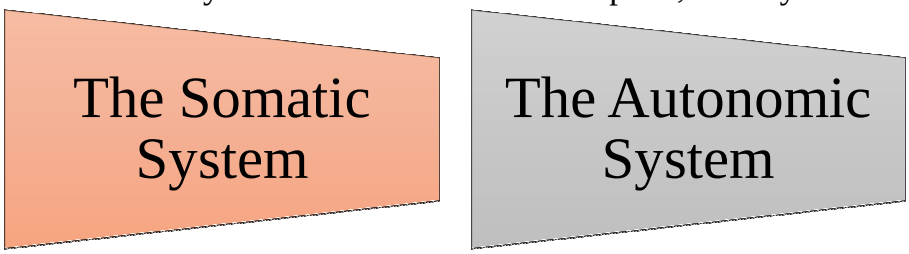


***Figure 5.3**: Sub division of the Peripheral Nervous System*

The somatic system is both a sensory and a motor system. The autonomic system is only a motor system consisting of two divisions,

- The sympathetic and
- Parasympathetic system.

The sympathetic system is connected to the spinal cord and carries messages to the muscles and glands particularly in stress situations to prepare for an emergency.
The parasympathetic system is connected to the brain and to the lower portion of the spinal cord. It tends to be active when we are calm and relaxed.

The messages conveyed by the nerve fibers of this system direct the organs to do just the opposite of what the sympathetic system had done. It directs the body organs to return to the normal state after the emergency has passed. The sympathetic and parasympathetic divisions of the autonomic nervous system work in close co-ordination for maintaining the equilibrium of the body function.

Integrative Function of the Nervous System

The cerebral cortex has primary areas which control the incoming sensory stimuli and the outgoing motor responses. An individual is able to adjust himself effectively to the environment because the various nerve impulses are systematically integrated by the brain. There are millions of nerve fibers which connect the various neurons of the brain.

The connecting nerve fibers are known as 'associate fibers'. The associate fibers are the foundations of memory, language, reasoning and other higher mental processes. There is great coordination between the various parts of the brain.

Autonomic nervous system is autonomous and works independently of voluntary control. It is made up of the nerves connecting with the glands and smooth muscles which are involved in respiration, circulation and digestion.

These processes go on automatically without our knowledge. The system operates actively during emotional states. When we are well, physical and mental activities are integrated. We receive stimuli and are able to think, to learn and to remember.

We are able to experience the various types of feelings. In illness, the normal healthy functioning of the body and its various organs is upset. Illness affects the threshold levels of our nervous system, may cause abnormal reactions to ordinary stimuli. It may adversely affect our coordination, may disturb our thinking processes.

Even the process of association is adversely affected, resulting in funny and stray thoughts. Specific diseases and conditions have their own effects, some causing permanent damage to the nervous system and others causing a temporary damage only.

In -Text Question

The autonomic system is both a sensory and a motor system while the somatic system is only a motor system, True or false?

In-Text Answer

False

Neuron

A nerve cell with all its branches is called a neuron. These are the basic elements of the nervous system. A neuron has a nucleus, a cell body, and a cell membrane to enclose the whole cell. There are tiny fibers extending out from the cell body called dendrites.

Their role is to receive messages through electrical impulses from the sense organs or adjacent neurons and carry them to the cell body. The messages from the cell body further travel the length of a nerve fibre known as the axon.

A group of axons, bundled together like parallel wires in an electrical cable, is referred to as a nerve. The axon (but certainly not all of them) is surrounded by a fatty covering called the myelin sheath. It serves to increase the velocity with which the electrical impulses travel through the axons.

Those axons that carry the most important and urgently required information have the greatest concentrations of myelin. If our hand touches a hot stove, the information

regarding the burning sensation is passed through axons in the hand and arm that have a relatively thick coating of myelin, speeding the message of burning pain to the brain.

In certain diseases, for example, multiple sclerosis, the myelin sheath surrounding the axon deteriorates, exposing parts of the axon that are normally covered. This short-circuits messages between the brain and the muscles resulting in symptoms such as the inability to walk, difficulties in vision and general muscle impairment. The messages thus transmitted are further carried to a muscle or a gland or a neighbouring neuron through the terminal branches of the nerve fibre.

There are three types of neurons.

- The sensory neurons - they help in the process of sensation and perception.
- The motor neurons - they are responsible for physical movements and activation of glands.
- The inter-neurons or association neurons - they carry signals in the form of memories and thoughts and add reflex or automatic activities.

Neural Impulse

Neurons are the receivers and transmitters of messages. These messages are always in the form of electrochemical impulses. A neuron in its resting position is supposed to maintain a sort of electrical equilibrium, i.e. state of polarization.

This state of polarization may be disturbed on account of the effect of trigger like action of a stimulus applied to the membrane. It causes a sudden change in the electrical potentiality of the neuron. It gets depolarized and neural impulse is initiated. These impulses are carried along the neuron axons.

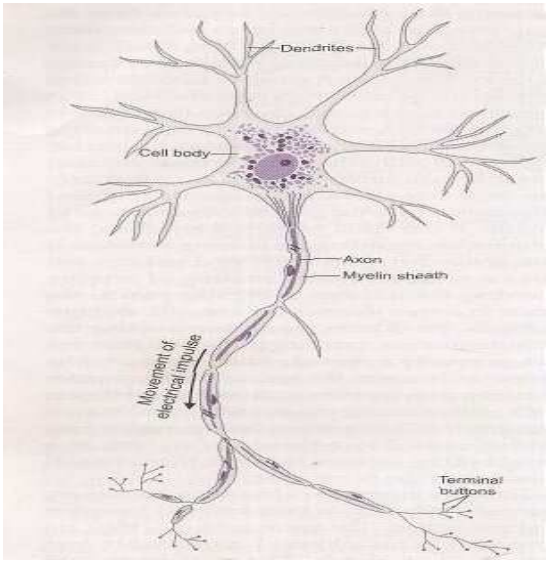


Figure 5.4: *The structure ofNeuron*

There is a fluid-filled space called the synapse between the axon of the neuron and the receiving dendrite of the next neuron. Enlargements of the axon endings of the transmitting neurons called boutons, contain neurotransmitter chemicals which are stored in small vesicles.

A nerve impulse reaching these boutons causes a neurotransmitter to be released into the synapse. With the help of the release of a neurotransmitter into the synapse, one neuron is capable of sending its message on to many other neurons. It makes it possible for a single neuron to receive messages from thousands of other neurons.

Synapses

Information is transmitted through the body from one neuron to another. The junction between two neurons is called a synapse. The small space between the axon terminals of one neuron and the cell body or dendrites of another is called the synaptic cleft.

Neurons conducting impulses toward the synapse are called presynaptic neurons and those conducting impulses away are called postsynaptic neurons.A chemical, called neurotransmitter is stored in the axon terminals of the presynaptic neuron. An electrical impulse through the neuron causes the release of this neurotransmitter into the synaptic cleft.

The neurotransmitter then diffuses across the synaptic cleft and combines with receptor sites that are situated on the cell membrane of the postsynaptic neuron.

The cell body or dendrite of the postsynaptic neuron also contains a chemical in activator that is specific to the neurotransmitter that has been released by the presynaptic neuron. When the synaptic transmission has been completed, the chemical inactivation quickly inactivates the neurotransmitter to prevent unwanted continuous impulses.

Neurotransmitters

Neurotransmitters play an essential function in the role of human emotion and behaviour. These are chemicals that convey information across synaptic cleft to neighbouring target cells. They are stored in small vesicles in the axon terminals of neurons.

When electrical impulse reaches this point, the neurotransmitters are released from the vesicles. They cross the synaptic cleft and bind with receptor sites 'on the cell body of dendrites of the adjacent neuron to allow the impulse to continue its course or to prevent the impulse from continuing.

After the neurotransmitter has performed its function in the synapse, it either returns to the vesicles to be stored and used again or it is inactivated and dissolved by enzymes. The process of being stored for reuse is called reuptake. Major categories of neurotransmitters include cholinergics, ammo acids and monoamines, neuropeptides.

The Functioning of the Brain

The sensory nerves gather information from the environment; send that information to the spinal cord, which then speeds the message to the brain. The brain then makes sense of that message and fires of a response.
Motor neurons deliver the instructions from the brain to the rest of your body. The spinal cord is made up of a bundle of nerves running up and down the spine, speeding messages to and from the brain at every second. The spinal cord is similar to a super-highway.

Summary of Study Session 5

In this study, you have learnt that

1. The major neurons are sensory neurons, which relay messages over long distances from receptor organs towards the brain.
2. Important structures of the forebrain are
   - Thalamus
   - Hypothalamus
   - Limbic system
   - Cerebrum
3. The cerebrum is the most complex and largest part of the brain. The cerebrum is covered by a thick layer of tightly packed neurons called the cerebral cortex.
4. The nerve tissues lying outside the bony case of the central nervous system come in the region of the peripheral nervous system.
5. A nerve cell with all its branches is called a neuron.

Self-Assessment Questions for Study Session 5

Now that you have completed this study session, you can assess how well you have achieved its Learning outcomes by answering the following questions. You can check your answers with the Notes on the Self-Assessment questions at the end of this Module.

SAQ 5.1 (Testing Learning outcomes 5.1)

Mention and explain the functions of 5 parts of the brain

SAQ 5.2 (Testing Learning outcomes 5.2)

Explains how brain works

Notes on SAQ for Study Session 5

SAQ 5.1

1. Cerebrum: This is the seat of sense of perception, voluntary movement, learning, remembering, thinking, emotions and consciousness.

2. **Cerebral cortex:** This is the thick layer of nerve cell bodies covering the cerebrum. It is the centre where all complex mental activities take place.

3. **Medulla:** This controls breathing, swallowing, digestion and heartbeat.

4. **Cerebellum:** This is the part responsible for body balance, coordinating of voluntary movement of fingers and thumb.

5. **Hypothalamus:** This regulates endocrine activity, governs eating, drinking, sexual behaviour, sleeping and temperature control. It maintains homeostasis which is the general level of functioning of the healthy organism such as normal body temperature.

SAQ 5.2

The sensory nerves gather information from the environment; send that information to the spinal cord, which then speeds the message to the brain. The brain then makes sense of that message and fires of a response.

Study Session 6: The Endocrine System

Expected duration: 1 week or 2 contact hour

Introduction

Imagine your body without glands; you would be without all the ooze, sweat, mucus, chemicals and juices in your body which make your body home. What then are these glands and their functions?

The ability to maintain homeostasis and respond to stimuli is largely due to hormones secreted within the body. Without hormones, you could not grow, maintain a constant temperature, produce offspring, or perform the basic actions and functions that are essential for life.

In this study session, you will be introduced to various glands in the body, to include the endocrine glands and hormones secreted by the glands.

Learning Outcomes for Study Session 6

At the end of this study session, you should be able to:

6.1 Explain what the endocrine system is

6.2 Identify the various endocrine glands and their functions within the body

6.1: The Endocrine System

The endocrine (or ductless gland) is a system in the body that is made up of a whole collection of glands. The glands of internal secretion. The endocrine or ductless glands discharge their secretions (hormones) directly into the blood stream with effects upon growth, behaviour and personality.

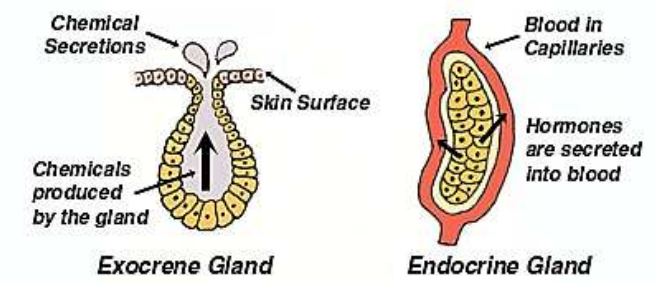


Figure 6.1: *The endocrine System*

These glands are different from the duct glands, such as tear glands, or salivary glands, which secrete their products on the surface of the body but not into the blood stream.

The ductless glands may be stimulated to secrete either by receiving impulses from the central nervous system or by a hormone from another gland.

In-Text Question

How do the duct glands differ from the ductless glands?

In-Text Answer
The ductless glands discharge their secretions (hormones) directly into the blood stream, unlike the duct glands.

6.1.1 What are Hormones?
'Hormone' means to excite or "spur on" and that's exactly what hormones do. They cause other things to start happening. They are chemical substances produced in the ductless glands and necessary for the proper functioning of the cells.

They have no ducts but the secretions enter the blood directly and pass to other parts of the body where they affect metabolism of the cells.

There are over 30 of these amazing hormones busily orchestrating and regulating such things as: when you feel; how you sleep; your body temperature; how you break down and utilize the food you eat and whether you are fat or thin; when you start puberty and how long it takes; how you handle stress; how much adrenaline you have in an emergency situation even how and when you grow.

Though the genes determine things like how tall you're going to be, the fact is that when, and if, you grow as tall as the instructions from your genes would suggest depends on hormones in this case growth hormones.

In-Text Question
Hormones are produced in the _____

A. Body fluid
B. Ductless gland
C. Duct gland
D. Growth gland

In-Text Answer
B. Ductless gland

6.1.2 The Chief Ductless Glands
1. **Pituitary Gland –** This is responsible for normal height of a human being. If it is deficient or under-developed, it leaves the child short, physically and sexually under-developed. However, overproduction of it leads to overweight giantism and pre-cocious sexual maturity.

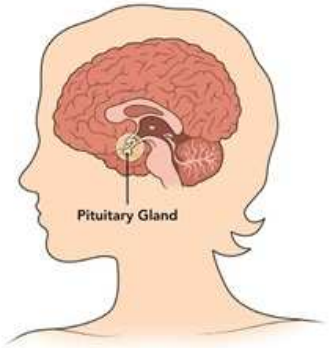


Figure 6.2: *Pituitary Gland*

2. **Thyroid Gland –** This produces thyroxin, which includes iodine. The effect of its deficiency causes cretinism in children, that is, it reduces mental growth or intelligence, leads to inaction or feeble – mindedness. The child who lacks iodine is incapable of taking care of himself. Over-development or hyper-function of the thyroid gland causes increased nervous tension, accelerated pulse, loss of body weight and increased oxygen consumption.

3. **Pancreas –** This produces insulin in the cells. It is arranged in groups called islets of Langerhands. It enables muscle to oxidize sugars, and convert sugars into glycogen. The deficiency of insulin causes diabetes mellitus (too much sugar in blood), whereas over-production leads to removal of sugar from the blood.

4. **Parathyroid Gland –** Removal of the parathyroid glands or marked deficiency in their function causes cramps and convulsions (tetany) which may result in the death of the individual. Less marked deficiency of function produces hyper excitability, lack of agreeableness, mental depression and other numerous disorders.

5. Adrenal Gland – This produces adrenaline which causes slow reaction in emergency, weak heart action, low blood pressure and fatigue if it is under-produced. Similarly, an effect of its over-production is over-reaction in emergency. Girls suffering from adrenal virilism may develop excessive facial hair, deep voice, and other masculine characteristics.

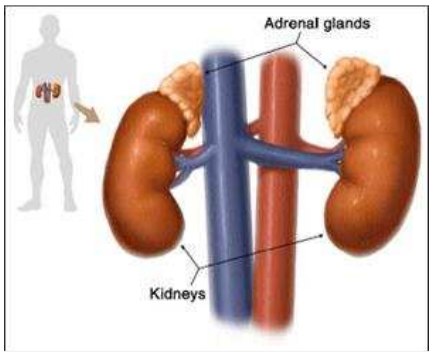


Figure 6.3: *Adrenal Gland*

6. **The Gonads (testes in male and ovaries in females) -** The gonads work with adrenal glands to stimulate the reproductive organs to become mature. They also account for the appearance of secondary sexual characteristics.

The gonads produce several hormones called sex hormones, which are three types; the androgens, estrogens and progestrins.

a. The androgens are responsible for promoting secondary sexual characteristic in males.
b. The estrogens promote the development of secondary sexual characteristics in females.
c. The progestrins prepare the female's body for pregnancy and birth and for nursing of the infant.

In-Text Question

_____ is responsible for normal height of a human being.

A. Pituitary Gland

B. Thyroid Gland
C. Pancreas
D. Adrenal Gland

In-Text Answer
A. Pituitary Gland

6.2 The Functioning of the Endocrine
The endocrine system or the ductless glands regulate, coordinate and control, an extraordinary number of the body functions. Like the nervous system that uses electricity to orchestrate all sorts of things in the body. The endocrine system does even more through the wonder of chemicals.
The chemicals that the endocrine system uses to perform its functions in the body come from the glands and a few organs like the stomach, pancreas, kidneys, etc. that produce them and ooze them.

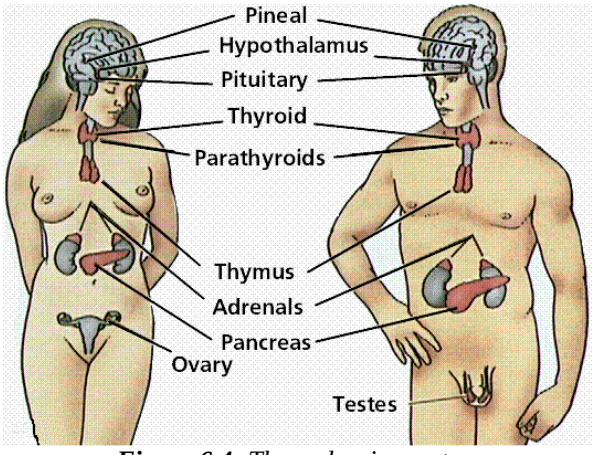


Figure 6.4: *The endocrine system*

The endocrine glands throughout your body make chemicals called hormones that travel much further. Endocrine glands spew their hormones directly into your blood stream. You are not likely to be aware that all these chemicals are traveling to all parts of your body. But they are and they're acting as chemical messengers.

Summary for Study Session 6
In this study, you have learnt:
1. The endocrine (or ductless gland) is a system in the body that is made up of a whole collection of glands.
2. 'Hormone' means to excite or "spur on"
3. Removal of the parathyroid glands or marked deficiency in their function causes cramps and convulsions (tetany) which may result in the death of the individual.
4. The effect of its deficiency causes cretinism in children, that is, it reduces mental growth or intelligence, leads to inaction or feeble – mindedness.
5. The endocrine glands throughout your body make chemicals called hormones that travel much further

Self-Assessment Questions for Study Session 6

Now that you have completed this study session, you can assess how well you have achieved its Learning outcomes by answering the following questions. You can check your answers with the Notes on the Self-Assessment questions at the end of this Module.

SAQ 6.1 (Testing Learning outcomes 6.1)

Explain the function of the thyroid gland

SAQ 6.2 (Testing Learning outcomes 6.2)

Explain the function of the endocrine system

Notes on SAQ for Study Session 6

SAQ 6.1

Thyroid Gland – This produces thyroxin, which includes iodine. The effect of its deficiency causes cretinism in children, that is, it reduces mental growth or intelligence, leads to inaction or feeble – mindedness. The child who lacks iodine is incapable of taking care of himself. Over-development or hyper-function of the thyroid gland causes increased nervous tension, accelerated pulse, loss of body weight and increased oxygen consumption.

SAQ 6.2

The endocrine system or the ductless glands regulate, coordinate and control, an extraordinary number of the body functions. Like the nervous system that uses electricity to orchestrate all sorts of things in the body. The endocrine system does even more through the wonder of chemicals.

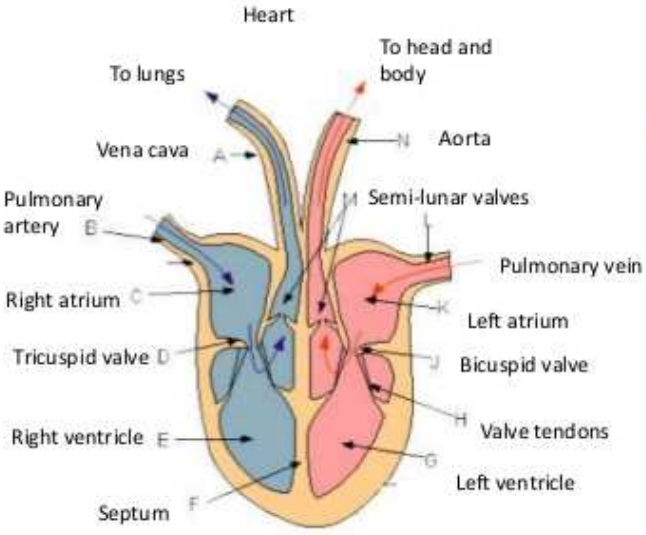
The chemicals that the endocrine system uses to perform its functions in the body come from the glands and a few organs like the stomach, pancreas, kidneys, etc. that produce them and ooze them.

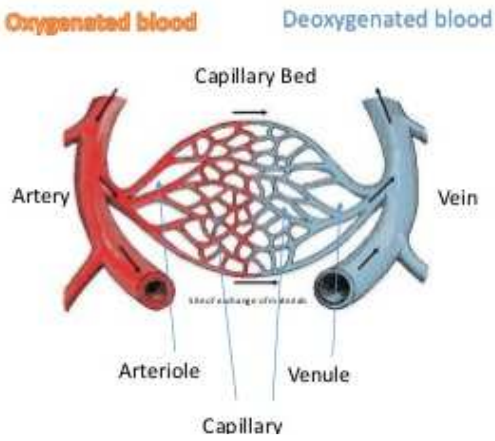
Study Session 7: The Circulatory System

Expected duration: 1 week or 2 contact hour

Introduction

The circulatory or cardiovascular system is a major system in the body. It performs various functions in the human body which are necessary for man's total well-being. In this study you will learn about the components of the circulatory system and the functions of each of the components.





Learning outcomes for study session 7

At the end of the study, you should be able to

7.1 Outline the components of the circulatory system

7. 2 Discuss the function of each of the components unit of the circulatory system.

7.1 The circulatory system

The circulatory or cardiovascular system (circulatory system) is one of the most important systems in our body; it is made up of the heart, blood and blood vessels. The circulatory system is responsible for transporting oxygen, nutrients, hormones, and cellular waste products throughout the body. It is powered by the heart.

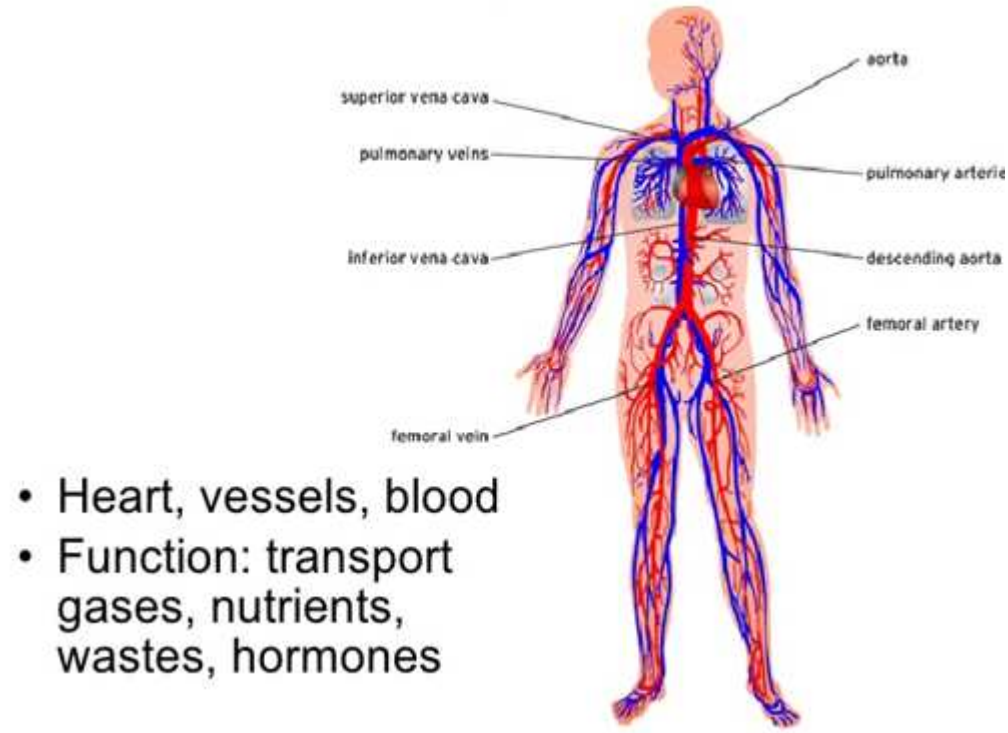


Figure 7.1:*The circulatory system*

The circulatory system is your body's delivering system. Blood moving from the heart delivers oxygen and nutrients to every part of the body. On the return trip, the blood picks up waste products so that your body can get rid of them.

In-Text Question

The circulatory system is responsible for transporting the following except _____

A. Oxygen
B. Nutrients
C. Hormones,
D. Uncultured waste products

In-Text Question

D. Uncultured waste products

7.2 Functions of the components of the circulatory system

The components of the circulatory system i.e. the heart, blood veins, and blood have several functions. They are highlighted below.

7.2.1 Human Heart

The heart is about the size of your clenched fist, and it is made up of muscles. The heart contracts and relaxes some 70 or 80 times a minute. It could even be more if you are exercising. It squeezes and pumps blood through its chambers to all parts of the body, and it does this through an extra ordinary collection of blood vessels.

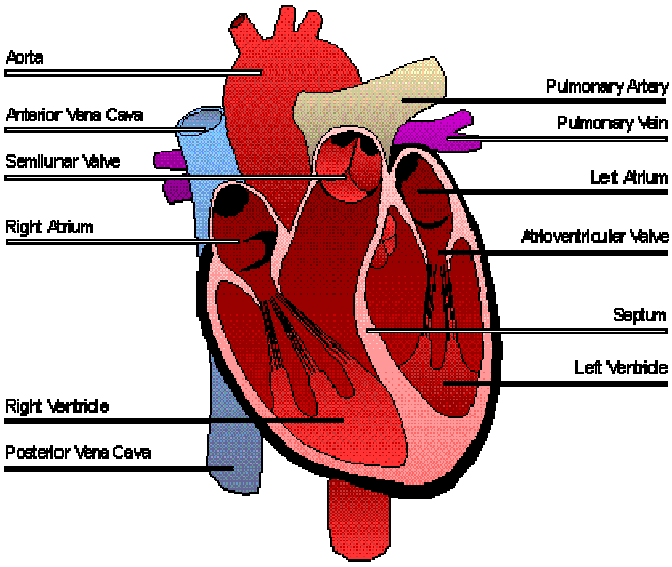


Figure 7.2: The human heart.

Our human heart has four chambers: two upper chambers (the atria) and two lower ones (the ventricles) The right atrium and right ventricle together make up the "right heart," and the left atrium and left ventricle make up the "left heart." A wall of muscle called the septum separates the two sides of the heart.

A double-walled sac called the pericardium encloses the heart, which helps to safeguard the heart and link it inside the chest. Between the outer layer, the parietal pericardium, and the inner layer, the serous pericardium, runs pericardial fluid, which greases the heart during shrinkages and activities of the lungs and diaphragm.

The heart's outer wall consists of three layers.

- The outermost wall layer, or epicardium, is the inner wall of the pericardium.
- The middle layer, or myocardium, contains the muscle that contracts.
- The inner layer, or endocardium, is the lining that contacts the blood.

The tricuspid valve and the mitral valve consists of the atrioventricular (AV) valves, which connect the atria and the ventricles. The pulmonary semi-lunar valve splits the right ventricle from the pulmonary artery, and the aortic valve separates the left ventricle from the aorta. The heartstrings, or chordae tendinae, anchor the valves to heart muscles. The sinoatrial node produces the electrical pulses that energies heart shrinkages.

7.2.2The Blood Stream or Vessels

The blood travels through a rubbery pipeline with many branches, both big and small. Strung together end to end, the blood vessels could circle the globe 21/2 times.

The tubes that carry blood away from your heart are called arteries; they are hoses that carry blood pumped under high pressure to smaller branched tubes called capillaries. The tubes that more gently drain back to the heart are called veins. The blood vessels are the part of the circulatory systemthat transports blood throughout the human body

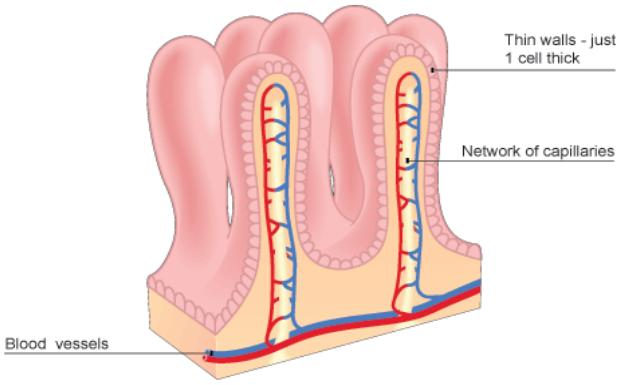


Figure 7.3: *Blood Vessels*

The main types of blood vessels include the following:

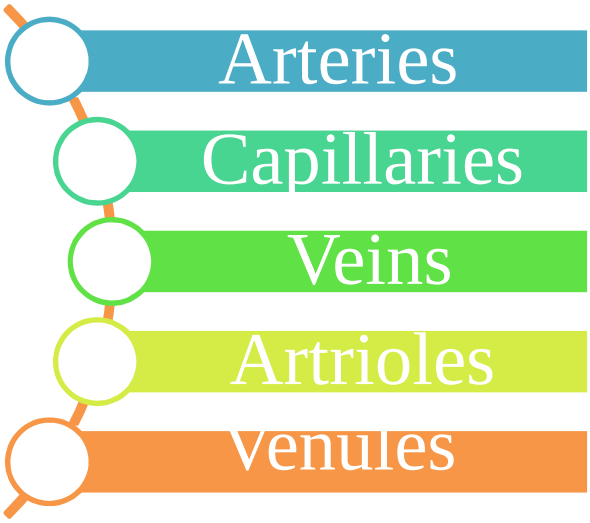


Figure 7.4:*Types of Blood vessels*

	Structure	Functions
Arteries	The walls (outer structure) of arteries contain smooth muscle fibre that contract and relax under the instructions of the sympathetic nervous system.	• Transport blood away from the heart • Transport oxygenated blood only (except in the case of the pulmonary artery).
Arterioles	Arterioles are tiny branches of arteries that lead to capillaries. These are also under the control of the sympathetic nervous system, and constrict and dialate, to regulate blood flow.	• Transport blood from arteries to capillaries • Arterioles are the main regulators of blood flow and pressure.
Capillaries	Capillaries are tiny (extremely narrow) blood vessels, of approximately 5-20 micro-metres (one micro-metre = 0.000001metre) diameter. There are networks of capillaries in most of the organs and tissues of the body. These capillaries are supplied with blood by arterioles and drained by venules. Capillary walls are only one cell thick (see diagram), which permits exchanges of material between the contents of the capillary and the surrounding tissue.	• Function is to supply the tissues of the body with the components of blood, and (carried by the blood), and also to remove waste from the surrounding cells ... as opposed to simply moving the blood around the body (in the case of other blood vessels) • Exchange of oxygen, carbon dioxide, water, salts, etc., between the blood and the surrounding body tissues.
Venules	Venules are minute vessels that drain blood from capillaries and into veins. Many venules unite to form a vein.	• Drains blood from capillaries into veins, for return to the heart.
Veins	The walls (outer structure) of veins consist of three layers of tissues that are thinner and less elastic than the corresponding layers of aerteries. Veins include **valves** that aid the return of blood to the heart by preventing blood from flowing in the reverse direction.	• Transport blood towards the heart. • Transport deoxygenated blood only (except in the case of the pulmonary vein).

7. 2.3 The Blood

Much of your blood is colourless liquid called plasma. Red blood cells make the blood look red and deliver oxygen to the cells in the body and carry back waste gases in exchange. The white blood cells are part of your body's defenses against diseases. Some attack and kill germs by gobbling them up, others by manufacturing chemical warfare agents that attack. Platelets are other cells that help your body repair itself after injury.

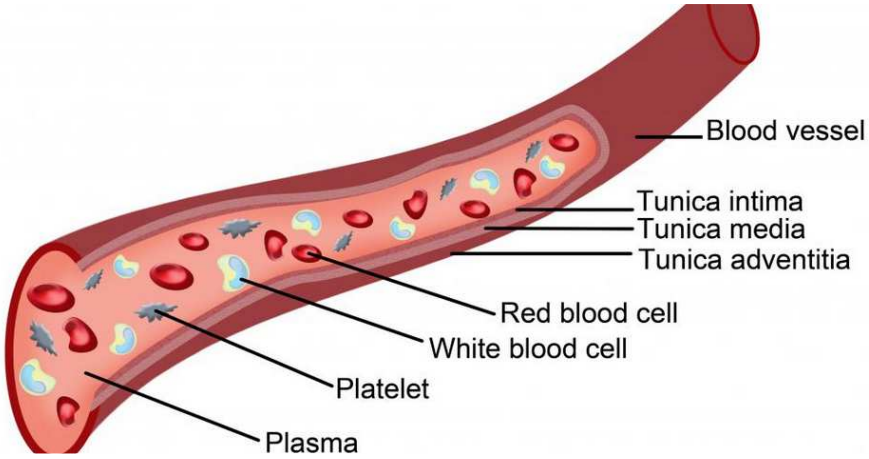


Figure 7.5: *Blood Composition*

How the Blood gets Oxygen

When you inhale, you breathe in air and send it down to your lungs. Blood is pumped from the heart to your lungs, where oxygen from the air you have breathed in gets mixed with it. That oxygen-rich blood then travels back to the heart where it is pumped through arteries and capillaries to the whole body, delivering oxygen to all the cells in the body, including bones, skins and other organs. Veins then carry the oxygen-depleted blood back to the heart for another ride.

In-Text Question

The tubes that carry blood away from your heart are called

A. Arteries
B. Veins
C. Capillaries
D. Indifferent hole

In-Text Answers

A. Arteries

Summary for Study Session 7

In this study, you have learnt that

1. Our circulatory or cardiovascular system (circulatory system) is one of the most important systems in the body; it is made up of the heart, blood and blood vessels.
2. he heart is about the size of your clenched fist, and it is made up of muscles. The heart contracts and relaxes some 70 or 80 times a minute.

3. The human heart has four chambers: two upper chambers (the atria) and two lower ones (the ventricles) The right atrium and right ventricle together make up the "right heart," and the left atrium and left ventricle make up the "left heart.

4. Much of your blood is colourless liquid called plasma. Red blood cells make the blood look red and deliver oxygen to the cells in the body and carry back waste gases in exchange

Self-Assessment Questions (SAQs) for Study Session 7

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. You can check your answers with the Notes on the Self-Assessment questions at the end of this Module

SAQ for Study Session 7.1

How does the circulatory system work?

SAQ for Study Session 7.1

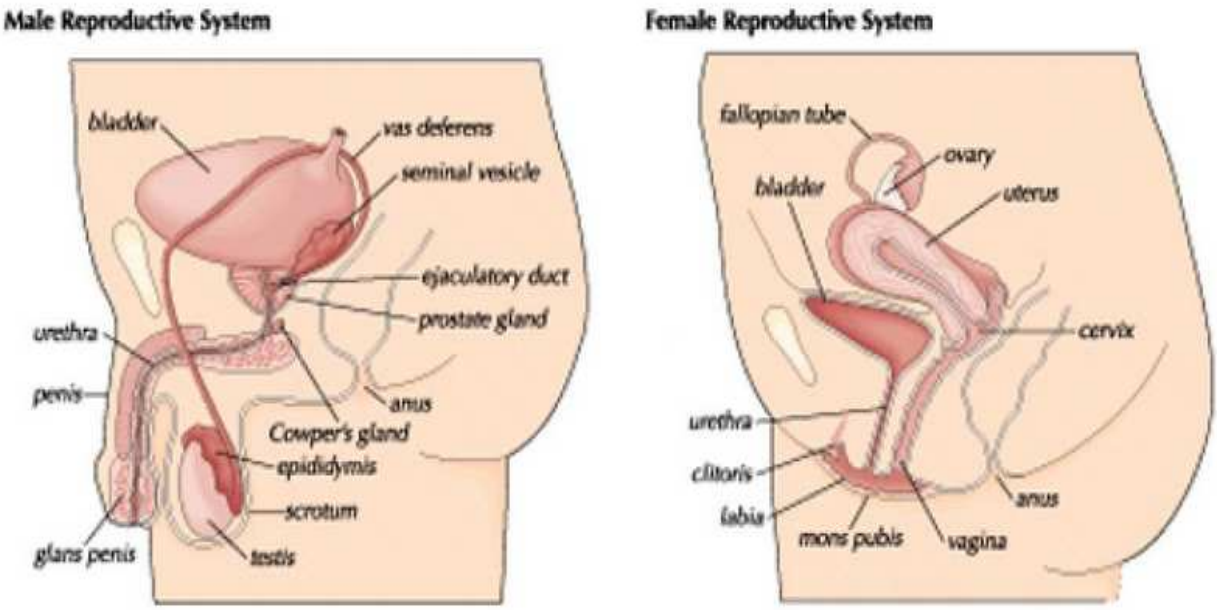
Which organs are involved in the functioning of the circulatory system?

References

Boundless. “Arteries, Veins, and Capillaries.” *Boundless Biology*. Boundless, 08 Jan. 2016. Retrieved 05 Feb. 2016

Study Session 8: The Human Reproductive System

Expected duration: 1 week or 2 contact hour



Introduction

The life of every human being begins at the time of conception, and this involves some processes in the human body. To this extent, the human reproductive system would be discussed in these combined study sessions.

Learning Outcomes for Study Session 8

At the end of this study session, you should be able to:

8. 1. Explain the concept of human conception
8. 2. Discuss the differences between the reproductive system of the male and that of the female
8. 3. Explain the major phases of pre-natal period in the female.

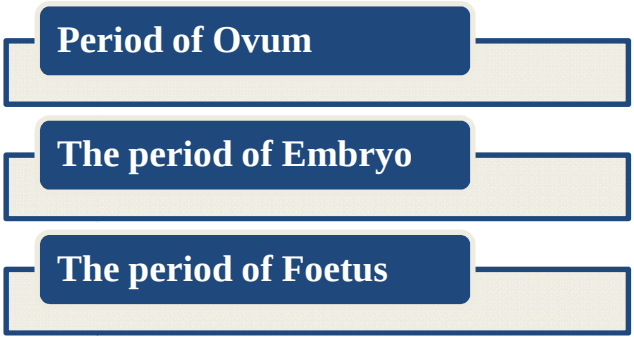
8.1 Human Conception

The reproductive system is a system of organs within an organism, which works together with others for the purpose of reproduction. Many non-living substances such as fluids, hormones, are also important accessories to the reproduction system.

Human reproduction takes place as internal fertilization by sexual intercourse. The life of a human being begins at the time of conception, when the nucleus of the sperm

(male reproductive cell or gamete) fuses with the nucleus of the ovum (egg) in the fallopian tube (oviduct).
The male sperm is ejaculated into the female during sexual intercourse. The sperm then travels through the vagina and cervix into the uterus or fallopian tubes for fertilisation and implantation, after which gestation (the process of development in the womb between conception and birth) of the foetus then occurs within the female's uterus for approximately nine months.

Pre-natal Development
The process of development from conception to birth is called pre-natal period and is usually divided into three phases and they are:



Period of the Ovum: This lasts from fertilization until the time that the foetus is firmly implanted in the wall of the uterus (10 – 14 days). The fertilized ovum continues multiplying its cells as it moves from the oviduct to the uterus.

The Period of Embryo: The period of embryo lasts from the time of the ovum attachment to the wall of the uterus until the first occurrence of ossification (the formation of solid bones) (2 – 8 weeks). At this period, cellular division continues to occur at a very rapid rate, and cellular differentiation or specialization occurs.
By two months, the embryo is approximately 1 inch or 3cm and is beginning to resemble a human being. The placenta and umbilical cord are developed, and these maintain the connection with the mother's body from which the embryo obtains nutrients (digested food) and through which the embryo expels wastes.

The Period of Foetus: This stage extends from the end of second month (from time of ossification) until birth (8 – 40 weeks). The various body systems which emerge during the embryonic period become well developed and begin to function. Muscular and nervous systems develop at great speed. By the fifth month, reflexes such as swallowing or sucking occur.
By the sixth month, the foetus eye lids have developed and functional. At approximately 28 weeks after fertilization, physical development is far advanced enough and that the foetus could survive if it were born prematurely and properly taken care of. Gestation ends with birth, the process of birth is known as labour. Labour consists of the muscles of the uterus contracting, the cervix dilating, and the baby passing out of the vagina.

Some important conditions that lead to conception are as follows:

- ❖ An egg is usually released at each menstrual cycle.
- ❖ The egg is released about 14 days before menstrual cycle.
- ❖ The eggs live for 12-24 hours.
- ❖ Sperm can live for five days in a woman's genital tract when deposited. This means that a woman is fertile for as long as five days before ovulation due to sperm life. And after ovulation she is considered fertile for up to three days due to egg life. This amounts to seven to eight days of her cycle each month. The rest are not considered to be fertile days and intercourse during that part of the cycle could not result in pregnancy.

In-Text Question

The process of development from conception to birth include all the following except

(a) Period of ovum
(b) The period of embryo
(c) The period of foetus
(d) Fertilization period

In-Text Answer

Fertilization period

8.2 The Female Reproductive System

The female reproductive system is a series of organs primarily located inside the body and around the pelvic region that contribute towards the reproductive process. This female reproductive system contains mainly:

1. **Ovary –** produces ova/eggs/female gametes.
2. **Fallopian tube/oviduct –** is the path that leads eggs to uterus/womb. Site of fertilization by spermatozoa.
3. **Fallopian funnel –** is the path that receives ripe eggs/cells (ova) as they are released by the ovary.
4. **Uterus/womb –** shelters fertilized egg/embryo/foetus during development.
5. **Vagina –** passage through which male organ introduces sperm/male gametes into the uterus. It is also the passage of foetus during birth.
6. **Cervix –** entrance to the uterus; it regulates the opening of vagina.
7. **Vulva –** opening of the vagina.

8.2.1 The Male Reproductive Organ

The male reproductive system is a series of organs located outside of the body and around the pelvic region of a male that contribute towards the reproductive process. The primary direct function of the male reproductive system is to provide the male gamete or spermatozoa for fertilization of the ovum.

The major reproductive organs of the male are:

1. **Testes** – this is where the sperm is produced, which is then housed in the temperature regulating scrotum.

2. **Penis -** The penis is the male organ. It has a long shaft and an enlarged bulbous-shaped tip called the glans penis, which supports and is protected by the foreskin in uncircumcised males.

3. **Scrotum -** The scrotum is a pouch-like structure that hangs behind the penis. It holds and protects the testicles. It also contains numerous nerves and blood vessels.
4. **Epididymis -** The epididymis, a whitish mass of tightly coiled tubes cupped against the testicles, acts as a maturation and storage for sperm before they pass into the vas deferens, that carry sperm to the ampullary gland and prostatic ducts.
5. **Vas Deferens -** The vas deferens, also known as the sperm duct, is a thin tube approximately 30 centimetres (0.98 ft.) long that starts from the epididymis to the pelvic cavity.
6. **Accessory Glands -** Three accessory glands provide fluids that lubricate the duct system and nourish the sperm cells. They are the seminal vesicles, the prostate gland, and the bulbourethral glands (Cowper glands).

In-Text Question

Cervix is the entrance to the uterus and it regulates the opening of vagina. True or false

In-Text Answer

True

8.3 Phases of Pre-Natal Period in the Female

The process of prenatal development occurs in three main stages which are:

- The first two weeks after conception are known as the germinal stage
- The third through the eighth week are known as the embryonic period
- The time from the ninth week until birth is known as the fetal period

The Germinal Stage

The germinal stage begins with conception, when the sperm and egg cell unite in one of the two fallopian tubes. The fertilized egg, known as a zygote, then moves toward the uterus, a journey that can take up to a week to complete. Cell division begins approximately 24 to 36 hours after conception.

Within just a few hours after conception, the singe-celled zygote begins making a journey down the fallopian tube to the uterus where it will begin the process of cell division and growth. The zygote first divides into two cells, then into four, eight, sixteen, and so on. Once the eight cell point has been reached, the cells begin to differentiate and take on certain characteristics that will determine the type of cells they will eventually become.

As the cells multiply, they will also separate into two distinctive masses: the outer cells will eventually become the placenta while the inner cells will form the embryo. Cell division continues at a rapid rate and the cells then develop into what is known as a blastocyst.

The blastocyst is made up of three laters:

- The ectoderm (which will become the skin and nervous system)
- The endoderm (which will become the digestive and respiratory systems)
- The mesoderm (which will become the muscle and skeletal systems)

Finally, the blastocyst arrives at the uterus and attached to the uterine wall, a process known as implantation.

Implantation occurs when the cells nestle into the uterine lining and rupture tiny blood vessels. The connective web of blood vessels and membranes that forms between them will provide nourishment for the developing being for the next nine months. Implantation is not always an automatic and sure-fire process.

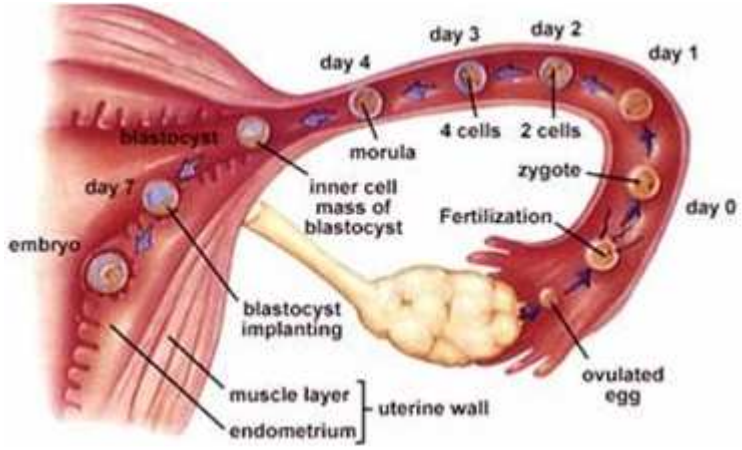


Figure 8.1: *Germinal Stage*

Researchers' estimate that approximately 58 percent of all natural conceptions never become properly implanted in the uterus, which results in the new life ending before the mother is ever aware she is pregnant.

When implantation is successful, hormonal changes halt a woman's normal menstrual cycle and cause a whole host of physical changes. For some women, activities they previously enjoyed such as smoking and drinking alcohol or coffee may become less palatable, possibly part of nature's way of protecting the growing life inside her.

The Embryonic Stage

The mass of cells is now known as an embryo. The beginning of the third week after conception marks the start of the embryonic period, a time when the mass of cells becomes a distinct human being. The embryo begins to divide into three layers each of which will become an important body system. Approximately 22 days after conception, the neural tube forms.

This tube will later develop into the central nervous system including the spinal cord and brain. Around the fourth week, the head begins to form quickly followed by the eyes, nose, ears, and mouth. The cardiovascular system is where the earliest activity begins as the blood vessel that will become the heart start to pulse. During the fifth week, buds that will form the arms and legs appear.

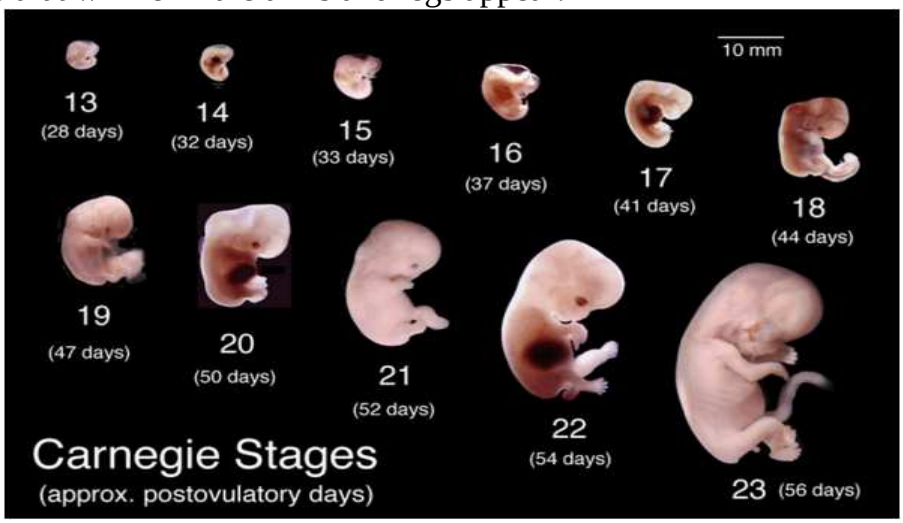


Figure 8.2: *The Embryonic Stage*

By the time the eight week of development has been reached, the embryo has all of the basic organs and parts except those of the sex organs. It even has knees and elbows! At this point, the embryo weight just one gram and is about one inch in length.

The Fetal Stage

Once cell differentiation is mostly complete, the embryo enters the next stage and becomes known as a fetus. This period of develop begins during the ninth week and lasts until birth. The early body systems and structures established in the embryonic stage continue to develop.

The neural tube develops into the brain and spinal cord and neurons form. Sex organs begin to appear during the third month of gestation.

The fetus continues to grow in both weight and length, although the majority of the physical growth occurs in the later stages of pregnancy.

This stage of prenatal development lasts the longest and is marked by amazing change and growth. During the third month of gestation, the sex organs begin to differentiate and by the end of the month all parts of the body will be formed. At this point, the fetus weight around three ounces.

The end of the third month also marks the end of the first trimester of pregnancy. During the second trimester, or months four through six, the heartbeat grows stronger and other body systems become further developed.

Figure 8.3*: Fetal Stage*

Fingernails, hair, eyelashes and toenails form. Perhaps most noticeably, the fetus increases quite dramatically in size, increasing about six times in size. The brain and central nervous system also become responsive during the second trimester. Around 28 weeks, the brain starts to mature much faster with activity that greatly resembles that of a sleeping newborn.

During period from seven months until birth, the fetus continues to develop, put on weight, and prepare for life outside the womb. The lungs begin to expand and contract, preparing the muscles for breathing. While prenatal development usually follows this normal pattern, there are times when problems or deviations occur.

In-Text Question

Once cell differentiation is mostly complete, the embryo enters the next stage and becomes known as a fetus. True or false

In-Text Answer

True

Summary of Study Session 8

In Study Session 1, you have learned that:

1. The reproductive system is a system of organs within an organism, which works together with others for the purpose of reproduction. Many non-living substances such as fluids, hormones, are also important accessories to the reproduction system.
2. The female reproductive system is a series of organs primarily located inside the body and around the pelvic region that contribute towards the reproductive process.
3. The male reproductive system is a series of organs located outside of the body and around the pelvic region of a male that contribute towards the reproductive process. The primary direct function of the male reproductive system is to provide the male gamete or spermatozoa for fertilization of the ovum.
4. The process of prenatal development occurs in three main stages which are:
    - ❖ The first two weeks after conception are known as the germinal stage
    - ❖ The third through the eighth week are known as the embryonic period
    - ❖ The time from the ninth week until birth is known as the fetal period

Self-Assessment Questions (SAQs) for Study Session 8

Now that you have completed this study session, you can assess how well you have achieved its learning outcomes by answering the following questions. Write your answers in your Diary and discuss them with your Tutor at the next study support meeting. You can check your answers with the Notes on the Self-Assessment questions at the end of this Study Session.

SAQ for Study Session 8.1

Explain the concept of human conception

SAQ for Study Session 8.2

Discuss the differences between the reproductive system of the male and that of the female

SAQ for Study Session 8.3

Explain the major phases of pre-natal period in the female.

References

http://psychology.about.com/od/developmentalpsychology/a/prenataldevelop.htm

Study Session 9: The Concept of Heredity

Expected duration: 1 week or 2 contact hour

Introduction

Growth and development are the result of the interaction of the influences of heredity, environment, maturation and learning. However, the subject of heredity would be examined in this session

In this study session you will be introduced to the meaning of heredity and the influence on the behaviour of man

Learning Outcomes for study session 9

At the end of this lecture, you should be able to:

9.1 Explain the meaning of heredity; and

9.2 Highlight the influence on the behaviour of man.

9.1 Meaning of Heredity

The sum of all biological processes by which particular characteristics are transmitted from parents to their offspring is called heredity. It refers to the transmission of potentialities or traits of physical, mental and other characteristics from parents to off-spring (child) at conception nature of the individuals make up as contained in the genes.

Children of the same parents may be tall or short, or thin, dark in complexion or light, clever or dull, extroverted or introverted. All these are due to the influence of heredity.

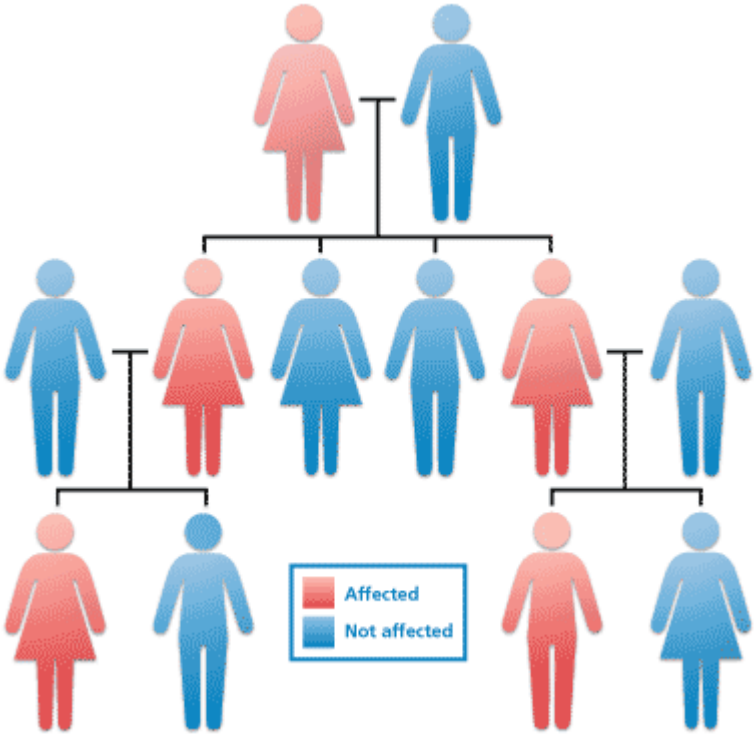


Figure 9.1: *Heredity*
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Heredity is the passing of traits from parents to their offspring, either through asexual reproduction or sexual reproduction. This is the process by which an offspring cell or organism acquires or becomes predisposed to the characteristics of its parent cell or organism. Through heredity, variations exhibited by individuals can accumulate and cause some species to evolve through the natural selection of specific phenotype traits. The study of heredity in biology is called genetics, which includes the field of epigenetics.
In humans, eye color is an example of an inherited characteristic: an individual might inherit the "brown-eye trait" from one of the parents. Inherited traits are controlled by genes and the complete set of genes within an organism's genome is called its genotype

Types of Heredity
There are two types of heredity which are:
1. Dominant and
2. Recessive alleles

An allele is said to be dominant if it is always expressed in the appearance of an organism (phenotype) provided that at least one copy of it is present. For example, in peas the allele for green pods, G, is dominant to that for yellow pods, g.

Thus pea plants with the pair of alleles either GG (homozygote) or Gg (heterozygote) will have green pods. The allele for yellow pods is recessive. The effects of this allele are only seen when it is present in both chromosomes, gg (homozygote).

The description of a mode of biological inheritance consists of three main categories which includes the following in the diagram below

In-Text Question

Heredity is the passing of traits from parents to their offspring, either through asexual reproduction or sexual reproduction. True/False

In-Text Answer

True

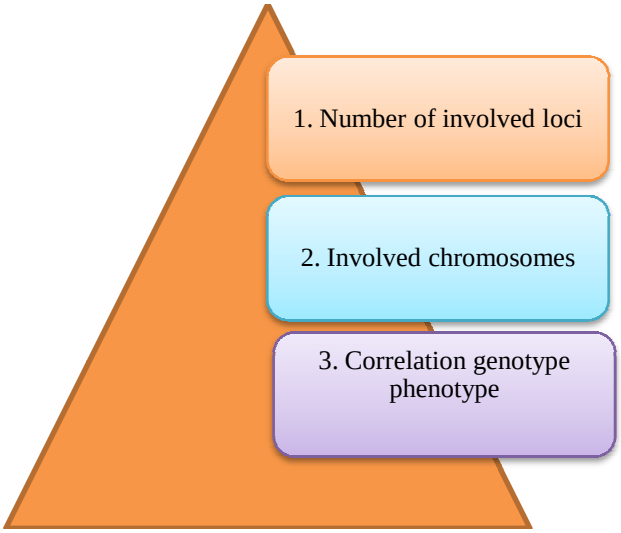

Figure 9.2: The description of a mode of biological inheritance

1. Number of involved loci: The number of involved loci consists of the following below:

i. Monogenetic (also called "simple") – one locus
ii. Oligogenetic – few loci
iii. Polygenetic – many loci

2. Involved chromosomes: The involved chromosomes consist of the following below:
Autosomal: loci are not situated on a sex chromosome
Gonosomal: loci are situated on a sex chromosome
X-chromosomal: loci are situated on the X-chromosome (the more common case)
Y-chromosomal: loci are situated on the Y-chromosome
Mitochondrial: loci are situated on the mitochondrial DNA

3. Correlation genotype phenotype: It is consists of the following below

i. Dominant
ii. Intermediate (also called "codominant")
iii. Recessive
iv. Overdominant
v. Underdominant

These three categories are part of every exact description of a mode of inheritance in the above order. In addition, more specifications may be added as follows:

4. Coincidental and environmental interactions

Penetrance

i. Complete
ii. Incomplete (percentual number)

Expressivity

i. Invariable
ii. Variable

Heritability (in polygenetic and sometimes also in oligogenetic modes of inheritance)
Maternal or paternal imprinting phenomena (also see epigenetics)

5. Sex-linked interactions: This is consists of the following below:

i. Sex-linked inheritance (gonosomal loci)
ii. Sex-limited phenotype expression (e.g., cryptorchism)
iii. Inheritance through the maternal line (in case of mitochondrial DNA loci)
iv. Inheritance through the paternal line (in case of Y-chromosomal loci)

6. Locus–locus interactions: This is consist of the following below

i. Epistasis with other loci (e.g., overdominance)
ii. Gene coupling with other loci (also see crossing over)
iii. Homozygotous lethal factors
iv. Semi-lethal factors

Determination and description of a mode of inheritance is achieved primarily through statistical analysis of pedigree data. In case the involved loci are known, methods of molecular genetics can also be employed.

9.1.1 Transmission of Heredity Characteristics

The nature of the make-up of an individual is contained in the genes. The reproductive cells contain the hereditary materials of life-chromosomes and DNA (De-Oxyribonucleic Acid) molecules. The DNA molecules of the nucleus direct all chemical reactions (metabolism) that go on in the cell.

Genetic factors often manifest themselves in characteristics like

- ✓ Height,
- ✓ Colours,
- ✓ Intelligence,
- ✓ Aggressive and
- ✓ Behaviour.

Definition of terms

1. **Genes**: These are units of materials of inheritance located on the chromosomes, which contain information for expression of characteristics which are passed from parents to offspring through the gametes and which influence every aspect of the organism of the latter.
2. **Chromosomes:** These are structures found in the nucleus/cell, arranged in pairs during cell division and carriers of heredity factors/characters genes. Genes control developmental processes.

Note: Genes may be recessive or dominant

Recessive gene: This is a character which does not produce its effect in the presence of the dominant character. For example in Tt combination, “t” is a recessive gene.
Dominant gene: The character that produces its effect even though the opposite or contrasting character is present. For example, in Tt, “T” is dominant gene over “t”.

Phenotype -This is the physical expression or observable characteristic of an organism.

Genotype -This is composed of the genetic characteristics or genetic make- up inherited from both parents.

In-text Question

The nature of the make-up of an individual is contained in the _____
A. Genes B. Allele C. Genotype D. Phenotype

In-Text Answer

A. Genes

The complete set of observable traits of the structure and behavior of an organism is called its phenotype. These traits arise from the interaction of its genotype with the environment As a result; many aspects of an organism's phenotype are not inherited.

For example, suntanned skin comes from the interaction between a person's phenotype and sunlight thus, suntans are not passed on to people's children. However, some people tan more easily than others, due to differences in their genotype: a striking example is people with the inherited trait of albinism, who do not tan at all and are very sensitive to sunburn.

Heritable traits are known to be passed from one generation to the next via DNA, a molecule that encodes genetic information. DNA is a long polymer that incorporates four types of bases, which are interchangeable. The sequence of bases along a particular DNA molecule specifies the genetic information.
This is comparable to a sequence of letters spelling out a passage of text. Before a cell divides through mitosis, the DNA is copied, so that each of the resulting two cells will inherit the DNA sequence. A portion of a DNA molecule that specifies a single functional unit is called a gene; different genes have different sequences of bases.
Within cells, the long strands of DNA form condensed structures called chromosomes. Organisms inherit genetic material from their parents in the form of homologous chromosomes, containing a unique combination of DNA sequences that code for genes. The specific location of a DNA sequence within a chromosome is known as a locus.

If the DNA sequence at a particular locus varies between individuals, the different forms of this sequence are called alleles. DNA sequences can change through

mutations, producing new alleles. If a mutation occurs within a gene, the new allele may affect the trait that the gene controls, altering the phenotype of the organism.

However, while this simple correspondence between an allele and a trait works in some cases, most traits are more complex and are controlled by multiple interacting genes within and among organisms. Developmental biologists suggest that complex interactions in genetic networks and communication among cells can lead to heritable variations that may underlie some of the mechanics in developmental plasticity and canalization.

Recent findings have confirmed important examples of heritable changes that cannot be explained by direct agency of the DNA molecule. These phenomena are classed as epigenetic inheritance systems that are causally or independently evolving over genes.

Research into modes and mechanisms of epigenetic inheritance is still in its scientific infancy, however, this area of research has attracted much recent activity as it broadens the scope of heritability and evolutionary biology in general.

DNA methylation marking chromatin, self-sustaining metabolic loops, gene silencing by RNA interference, and the three dimensional conformation of proteins (such as prions) are areas where epigenetic inheritance systems have been discovered at the organismic level. Heritability may also occur at even larger scales.
For example, ecological inheritance through the process of niche construction is defined by the regular and repeated activities of organisms in their environment. This generates a legacy of effect that modifies and feeds back into the selection regime of subsequent generations. Descendants inherit genes plus environmental characteristics generated by the ecological actions of ancestors.

Other examples of heritability in evolution that are not under the direct control of genes include the inheritance of cultural traits, group heritability, and symbiogenesis. These examples of heritability that operate above the gene are covered broadly under the title of multilevel or hierarchical selection, which has been a subject of intense debate in the history of evolutionary science.

When Charles Darwin proposed his theory of evolution in 1859, one of its major problems was the lack of an underlying mechanism for heredity. Darwin believed in a mix of blending inheritance and the inheritance of acquired traits (pangenesis).

Blending inheritance would lead to uniformity across populations in only a few generations and then would remove variation from a population on which natural selection could act. This led to Darwin adopting some Lamarckian ideas in later editions of On the Origin of Species and his later biological works.

Darwin's primary approach to heredity was to outline how it appeared to work (noticing that traits that were not expressed explicitly in the parent at the time of

reproduction could be inherited, that certain traits could be sex-linked, etc.) rather than suggesting mechanisms.

Darwin's initial model of heredity was adopted by, and then heavily modified by, his cousin Francis Galton, who laid the framework for the biometric school of heredity. Galton found no evidence to support the aspects of Darwin's pangenesis model, which relied on acquired traits. The inheritance of acquired traits was shown to have little basis in the 1880s when August Weismann cut the tails off many generations of mice and found that their offspring continued to develop tails

9.2 The influence on the behaviour of man.

The man behaviour can be influence by the following below

1. Culture
2. Personality
3. Level of Analysis
4. Indigenous, Cultural, and Cross-Cultural Psychologies

Culture

The conceptualization of culture is by no means a simple matter. One possible way to think about culture is that “culture is to society what memory is to individuals” (Kluckhohn 1954). It includes what has worked in the experience of a society, so that it was worth transmitting to future generations.

Sperber (1996) used the analogy of an epidemic. A useful idea (e.g., howto make a tool) is adopted by more and more people and becomes an element of culture (Campbell 1965). Barkow et al. (1992) distinguished three kinds of culture: Meta culture, evoked culture, and epidemiological culture.

In-Text Question

Mention two ways by which behaviour of man can be influenced

In-Text Answer

Behaviour of man can be influenced by the following:

1. Culture
2. Personality

They argue that “psychology underlies culture and society, and biological evolution underlies psychology” (p. 635). The biology that has been common to all humans as a species distinguishable from other species, results in a “meta culture” that corresponds to panhuman mental contents and organization.

Biology in different ecologies results in “evoked culture” (e.g., hot climate leads to light clothing), which reflects domain-specific mechanisms that are triggered by local circumstances, and leads to within-group similarities and between-groups differences. What Sperber describes, Barkow et al. call “epidemiological culture.”

Elements of culture

i. The elements are
ii. shared standard operating procedures,
iii. unstated assumptions,
iv. tools,

v. norms,
vi. values,
vii. habits about sampling the environment,

Because perception and cognition depend on the information that is sampled from the environment and are fundamental psychological processes, this culturally influenced Sampling of information is of particular interest to psychologists.

Cultures develop conventions for sampling information and determine how much to weigh the sampled elements from the environment (Triandis 1989). For example, people in hierarchical cultures are more likely to sample clues about hierarchy than clues about aesthetics.

Personality

Funder (1997) defined personality as "an individual's characteristic pattern of thought, emotion, and behavior, together with the psychological mechanisms— hidden or not—behind those patterns" (pp. 1–2). Characteristic sampling of the information in the environment, which corresponds to the sampling that occurs in different cultures, can be one of the bases of individual differences in personality.

Personality may also be conceptualized as a configuration of cognitions, emotions, and habits activated when situations stimulate their expression. Generally, they determine the individual's unique adjustment to the world. This view is supported by data that indicate the importance of the situation.

Summary of study session 9

1. The sum of all biological processes by which particular characteristics are transmitted from parents to their offspring is called heredity
2. Heredity is the passing of traits from parents to their offspring, either through asexual reproduction or sexual reproduction.
3. The nature of the make-up of an individual is contained in the genes. The reproductive cells contain the hereditary materials of life-chromosomes and DNA (De-Oxyribonucleic Acid) molecules.
4. **Genes**: These are units of materials of inheritance located on the chromosomes, which contain information for expression of characteristics which are passed from parents to offspring through the gametes and which influence every aspect of the organism of the latter.
5. The conceptualization of culture is by no means a simple matter. One possible way to think about culture is that "culture is to society what memory is to individuals
6.Personality may also be conceptualized as a configuration of cognitions, emotions, and habits activated when situations stimulate their expression.

Self-Assessment Questions (SAQs) for Study Session 9

Now, that you have completed this study session, you can assess how well you have achieved its learning outcomes by answering the following questions. Write your answers in your study diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this study session.

SAQ.9.1 (Testing Learning Outcome 9.1)

1. What is heredity? It refers to the transmission of potentialities or traits of physical, mental and other characteristics from parents to off-spring (child) at conception nature of the individuals make up as contained in the genes..
2. Explain the term gene **Genes**

SAQ 9.2 (Testing Learning Outcome 9.2)

Briefly explain the culture as one of the behaviour of man

The conceptualization of culture is by no means a simple matter. One possible way to think about culture is that “culture is to society what memory is to individuals” (Kluckhohn 1954). It includes what has worked in the experience of a society, so that it was worth transmitting to future generations.

2. As regard to behaviour of man discuss personality

Notes on SAQ for study session 9

SAQ 9.1

1. Heredity refers to the transmission of potentialities or traits of physical, mental and other characteristics from parents to off-spring (child) at conception nature of the individuals make up as contained in the genes.
2. Genes: These are units of materials of inheritance located on the chromosomes, which contain information for expression of characteristics which are passed from parents to offspring through the gametes and which influence every aspect of the organism of the latter.

SAQ 9.2

1. The conceptualization of culture is by no means a simple matter. One possible way to think about culture is that “culture is to society what memory is to individuals” (Kluckhohn 1954). It includes what has worked in the experience of a society, so that it was worth transmitting to future generations.
2. Personality may be conceptualized as a configuration of cognitions, emotions, and habits activated when situations stimulate their expression. Generally, they determine the individual’s unique adjustment to the world. This view is supported by data that indicate the importance of the situation.

Reference

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Study Session 10: The Immune System

Expected duration: 1 week or 2 contact hour

Introduction

Immunology is the study of the physiological mechanisms that humans and other animals use to defend their bodies from invasion by other organisms. The origins of the subject lie in the practice of medicine and in historical observations that people who survived the ravages of epidemic disease were untouched when faced with that same disease again they had become immune to infection.

The human body has been built in such a way that it can fight some germs and 'overcome' them. This study session deals basically with the immune system, how it works to fight against diseases.

Learning Outcomes for Study Session 10

At the end of this study session, you should be able to:

10.1 Discuss immune system

10.2 Explain the cells in the immune system

10.1: The Immune System

The immune system is crucial to human survival. In the absence of a working immune system, even minor infections can take hold and prove fatal. Without intensive treatment, children born without a functional immune system die in early childhood from the effects of common infections.

However, in spite of their immune systems, all humans suffer from infectious diseases, especially when young. This is because the immune system takes time to build up its strongest response to an invading microorganism, time during which the invader can multiply and cause disease.

To provide immunity that will provide protection from the disease in the future, the immune system must first do battle with the microorganism. This places people at highest risk during their first infection with a microorganism and, in the absence of modern medicine, leads to substantial child mortality, as witnessed in the developing world.

Box 10.1: Definition of Immune System

The immune system is a network of cells, tissues, and organs that work together to defend the body against attacks by "foreign" invaders. These are primarily microbe's tiny organisms such as bacteria, parasites, and fungi that can cause infections. Viruses also cause infections, but are too primitive to be classified as living organisms.

The human body provides an ideal environment for many microbes. It is the immune system's job to keep them out or, failing that, to seek out and destroy them. When

entire populations face a completely new infection, the outcome can be catastrophic, as experienced by indigenous.

In-Text Question

_____ is a network of cells, tissues, and organs that work together to defend the body against attacks.

A. Respiratory System
B. Excretion System
C. Immune System
D. Symptoms

In-Text Answer
Option C

Americans who were killed in large numbers by European diseases to which they were suddenly exposed after 1492.Today, infection with human immunodeficiency virus (HIV) and the acquired immune deficiency syndrome (AIDS) it causes are having a similarly tragic impact on the populations of several African countries.

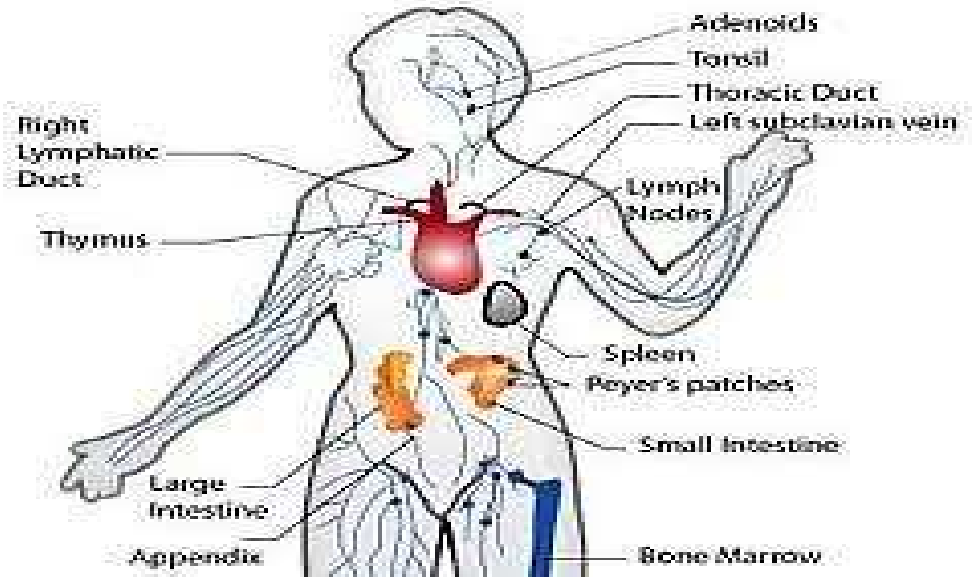


Figure 10.2: The Immune System
Source:https://www.ltisdschools.org/Page/10442

The immune system, which is made up of special cells, proteins, tissues, and organs, defends people against germs and micro-organisms every day. In most cases, the immune system does a great job of keeping people healthy by preventing infections. However, sometimes problems with the immune system can lead to illness and infection. The immune system is composed of many interdependent cell types that collectively protect the body from bacteria, parasite, and fungal, viral infections and from the growth of tumor cells. Many of this cell types have specialized functions.

In-Text Question

To provide immunity that will provide protection from the disease in the future, the immune system must first do battle with the microorganism. True/False

In-Text Answer

True

The immune system is amazingly complex. It can recognize and remember millions of different enemies, and it can produce secretions (release of fluids) and cells to match up with and wipe out nearly all of them. The secret to its success is an elaborate and dynamic communications network. Millions and millions of cells, organized into sets and subsets, gather like clouds of bees swarming around a hive and pass information back and forth in response to an infection.

Once immune cells receive the alarm, they become activated and begin to produce powerful chemicals. These substances allow the cells to regulate their own growth and behavior, enlist other immune cells, and direct the new recruits to trouble spots.

In-Text Question

Once _____ receive the alarm, they become activated and begin to produce powerful chemicals.

A. Immune Cells
B. Bacteria Cells
C. Blood Diffusion
D. Sense Organs

In-Text Answer

Option A

10.1.1 Functions of the Immune System

The immune system is composed of specialized cells, various proteins, tissue and organs. The immune system works to defend us against hordes of microorganisms and germs that we are exposed to every day. In majority of the cases, the immune system performs and excellent job of preventing diseases and infections and keep us healthy. However, in some cases, problems can occur in the immune system, which can lead to occurrence of numerous illnesses and diseases.

The immune system is the body's defense against infectious organisms and other invaders. Through a series of steps called the immune response, the immune system attacks organisms and substances that invade our systems and cause diseases. The immune system is made up of a network of cells, tissues, and organs that work together to protect the body. This entire are constitute to its functions which are discussed below.

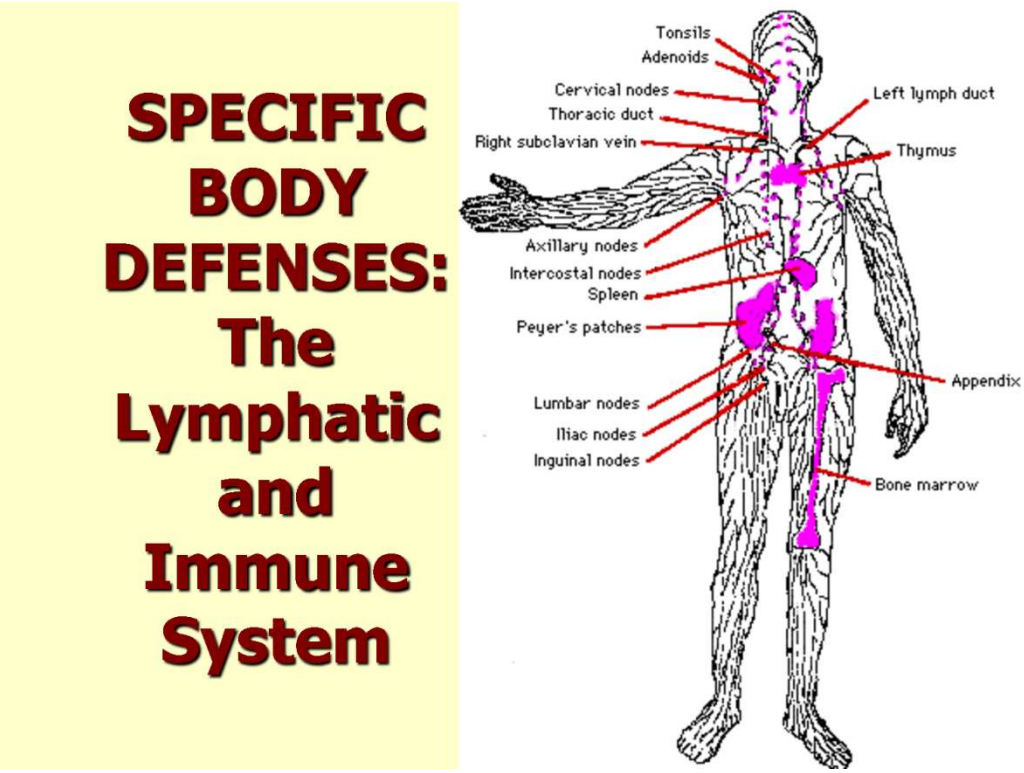


Figure 10.3: *The function of Immune System*
Source:*http://hd-images.info/immune-system-function*

10.1.2 How Does the Immune System Work?

When foreign particles or antigens invade the body, the various types of immune system cells work in combination to recognize and destroy them. The B lymphocytes are triggered in the process producing antibodies, which are specialized proteins that block specific antigens.

Once these antibodies are produced, they remain in the body and if the same antigen invades the body again, they are already present to block the antigen. Hence, if a person gets a specific disease, that person will not get sick with that disease again. This is the principle used behind immunizations used to prevent diseases.
After an antigen is locked by an antibody, the T cells come into action and destroy the antigens tagged by a particular antibody. T cells are therefore, sometimes referred to as killer cells.

Antibodies can also help in neutralizing toxins secreted by the microorganisms. They also help in activating a specialized group of proteins referred to as complement that helps in destroying viruses, bacteria and other infected cells. The body is thus protected against diseases by these specialized cells of the immune system and this protection is referred to as immunity.

10.2 The Cells of the Immune System

The cells that are part of this defense system are white blood cells, or leukocytes. They come in two basic types, which combine to seek out and destroy the organisms or substances that cause diseases.

Leukocytes are produced or stored in many locations throughout the body, including the thymus, spleen, and bone marrow. For this reason, they care called the **lymphoid organs**. There are also clumps of lymphoid tissue throughout the body, primarily in the form of lymph nodes that house the leukocytes.

The leukocytes (white blood cells) circulate through the body between the organs and nodes by means of the lymphatic vessels. Leukocytes can also circulate through the blood vessels. The immune system works in a coordinated manner to monitor the body for germs or substances that might cause problems.

The two basic types of leukocytes (white blood cells) are:

- Phagocytes, these are cells that chew up individual organisms.
- Lymphocytes, cells that allow the body to remember and recognise previous invaders and help the body destroy them.

A number of different cells are considered phagocytes. The most common type is the **neutrophil**, which primarily fights bacteria. Other types of phagocytes have their own jobs to make sure that the body responds appropriately to a specific type of invader.

In-Text Question

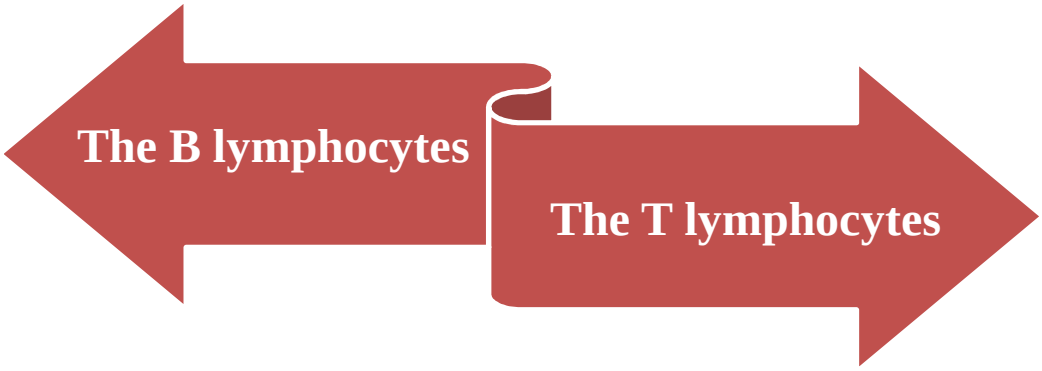
_____ circulate through the body between the organs and nodes by means of the lymphatic vessels.

A. Blood Cell
B. Neutrophil
C. Phagocytes
D. Leukocytes

In-Text Answer

Option D

There are two kinds of lymphocytes



T Lymphocytes: This start out in the bone marrow and either stay there and mature into B cells, or they leave for the thymus gland, where they mature into T cells. B lymphocytes and T lymphocytes have separate jobs to do:

B lymphocytes: This is like the body's military intelligence system, seeking out their targets and sending defenses to lock onto them. T cells are like the soldiers, destroying the invaders that the intelligence system has identified.

In-Text Question

The type of lymphocytes start out in the bone marrow and either stay there and mature into B cells is called _____

A. K lymphocytes
B. M lymphocytes
C. B lymphocytes
D. T lymphocytes

In-Text Answer

Option D

10.2.1 The Functioning of the Cells

Antigens are foreign substances that invade the body. When an antigen is detected several types of cells work together to recognise and respond to it. These cells trigger the B lymphocytes to produce antibodies, specialised proteins that lock onto specific antigens. Antibodies and antigens fit together like a key and a lock.

Once the B lymphocytes have produced antibodies, these antibodies continue to exist in a person's body, so that if the same antigen is presented to the immune system again, the antibodies are already there to do their job.

Box 10.2: Definition of the Cells

Cells are the basic building blocks of all living things. The human body is composed of trillions of cells. They provide structure for the body, take in nutrients from food, convert those nutrients into energy, and carry out specialized functions. Cells also contain the body's hereditary material and can make copies of them.

Cells have many parts, each with a different function. Some of these parts, called organelles, are specialized structures that perform certain tasks within the cell. Human cells contain the following major parts, listed in alphabetical order.

That's why if someone gets sick with a certain disease, like chickenpox, that person typically doesn't get sick from it again. This is also why we use immunizations to prevent getting certain diseases. The immunization introduces the body to the antigen in a way that doesn't make a person sick, but it does allow the body to produce antibodies that will then protect that person from future attack by the germ or substance that produces that particular disease.

In-Text Question

_____ refers to the basic building blocks of all living things.

A. Cell
B. Organs
C. Immune System
D. B lymphocytes

In-Text Answer

Option A

Although antibodies can recognise an antigen and lock onto it, they are not capable of destroying it without help. That is the job of the T cells. The T cells are part of the system that destroys antigens that have been tagged by antibodies or cells that have been infected or somehow changed. (There are actually T cells that are called "killer cells"). T cells are also involved in helping signal other cells (like phagocytes) to do their jobs.

10.2.1Things that can go wrong with the Immune System

Disorders of the immune system can be broken down into four main categories:

- Immunodeficiency disorders (primary or acquired).
- Autoimmune disorders (in which the body's own immune system attacks its own tissue as foreign matter).
- Allergic disorders (in which the immune system over-reacts in response to an antigen).
- Cancers of the immune system.

Immunodeficiency's Disorders

Immune-deficiencies occur when a part of the immune system is not present or is not working properly. Sometimes, a person is born with an immune-deficiency, – and this is called primary immune-deficiency. (Although primary immune-deficiencies are conditions that a person is born with, symptoms of the disorder sometimes may not show up until later in life).Immune-deficiencies can also be acquired through infection or produced by drugs. These are sometimes called secondary immune-deficiencies HIV.

In-Text Question

_____ occur when a part of the immune system is not present or is not working properly.

A. The cell membrane
B. Protozoans
C. Immunodeficiency's Disorders
D. None of the above

In-Text Answer

Option C

Autoimmune disorders

An autoimmune disease develops when your immune system, which defends your body against disease, decides your healthy cells are foreign. As a result, your immune system attacks healthy cells. Depending on the type, an autoimmune disease can affect one or many different types of body tissue. It can also cause abnormal organ growth and changes in organ function.

There are as many as 80 types of autoimmune diseases. Many of them have similar symptoms, which makes them very difficult to diagnose. It's also possible to have more than one at the same time. Autoimmune diseases usually fluctuate between periods of remission (little or no symptoms) and flare-ups (worsening symptoms). Currently, treatment for autoimmune diseases focuses on relieving symptoms because there is no curative therapy.

Autoimmune diseases often run in families, and 75 percent of those affected are women, according to AARDA. African Americans, Hispanics, and Native Americans also have an increased risk of developing an autoimmune disease.

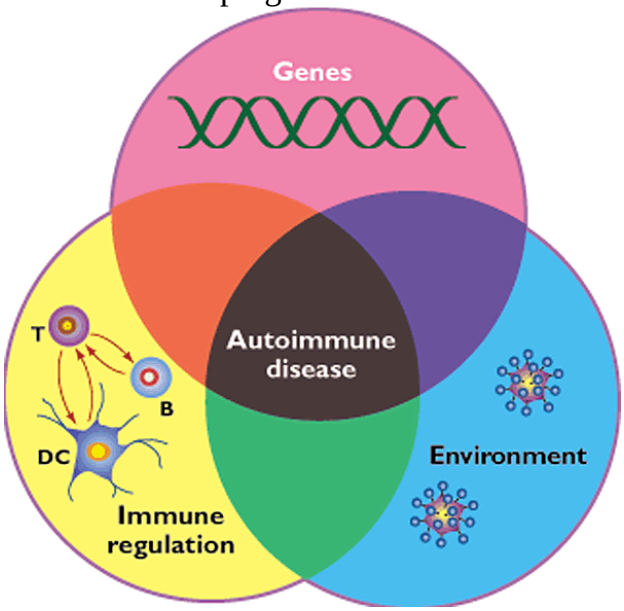


Figure 10.4: Autoimmune Disorders
Source:http://www.drhagmeyer.com/the-truth-and-the-facts-about-autoimmune-disease/

Autoimmune disorders used to be thought of as a genetic disease only. We now know that genetics plays a role in autoimmune disease, but environmental factors, such as food sensitivity, toxins, infections, stress and leaky gut also play a part in autoimmune disease. Along with the causes of autoimmune disease, we've also been able to determine other myths about our previous knowledge of autoimmune disease**.**

In-Text Question

_____ develops when your immune system, which defends your body against disease, decides your healthy cells are foreign.

A. The cell membrane
B. Protozoans
C. Immunodeficiency's Disorders
D. Autoimmune Disorders

In-Text Answer

Option D

Summary for Study Session 10

In this study session, you have learnt the following:

1. The immune system is crucial to human survival. In the absence of a working immune system, even minor infections can take hold and prove fatal. Without intensive treatment, children born without a functional immune system die in early childhood from the effects of common infections.
2. The immune system is composed of specialized cells, various proteins, tissue and organs. The immune system works to defend us against hordes of microorganisms and germs that we are exposed to every day. In majority of the cases, the immune system performs and excellent job of preventing diseases and infections and keep us healthy. However, in some cases, problems can occur in the immune system, which can lead to occurrence of numerous illnesses and diseases.
3. The function of cell is also explained. Antigens are foreign substances that invade the body. When an antigen is detected several types of cells work together to recognise and respond to it. These cells trigger the B lymphocytes to produce antibodies, specialised proteins that lock onto specific antigens. Antibodies and antigens fit together like a key and a lock.

The two basic types of leukocytes (white blood cells) are:

4. Phagocytes, these are cells that chew up individual organisms.
5. Lymphocytes, cells that allow the body to remember and recognise previous invaders and help the body destroy them.
6. A number of different cells are considered phagocytes. The most common type is the **neutrophil**, which primarily fights bacteria. Other types of phagocytes have their own jobs to make sure that the body responds appropriately to a specific type of invader.

7. Cells are the basic building blocks of all living things. The human body is composed of trillions of cells. They provide structure for the body, take in nutrients from food, convert those nutrients into energy, and carry out specialized functions. Cells also contain the body's hereditary material and can make copies of them.

8. Cells have many parts, each with a different function. Some of these parts, called organelles, are specialized structures that perform certain tasks within the cell. Human cells contain the following major parts, listed in alphabetical order.

9. Things that can go wrong with the Immune System: Disorders of the immune system can be broken down into four main categories:

- Immunodeficiency disorders (primary or acquired).
- Autoimmune disorders (in which the body's own immune system attacks its own tissue as foreign matter).
- Allergic disorders (in which the immune system over-reacts in response to an antigen).
- Cancers of the immune system.

Self-Assessment Questions (SAQs) for study session 10

Now that you have completed this study session, you can assess how well you have achieved its Learning outcomes by answering the following questions. Write your answers in your study Diary and discuss them with your Tutor at the next study Support Meeting. You can check your answers with the Notes on the Self-Assessment questions at the end of this Module.

SAQ 10.1 (Testing Learning Outcomes 10.1)

What do you understand by immune system?
Explain the function of immune system
How does immune system work?

SAQ 10.2 (Testing Learning Outcomes 10.2)

Mention the cells of the immune system.
How do cells work?

References

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