UIDLC

PSY 101
Introduction to Psycho-Biological Basis of Behaviour

Course Manual

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COURSE MANUAL

Introduction to Psycho-Biological Basis of Behaviour

PSY101

University of Ibadan Distance Learning Centre
Ibadan Open and Distance Learning Course Series Development
Version 1.0 ev1

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ISBN: 978-021-282-5

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Page layout, Instructional Design & UI Open Class Development by EDUTECHportal, www.edutechportal.org

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Vice-Chancellor's Message

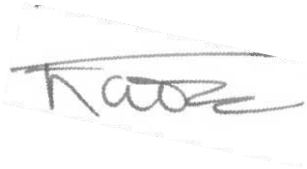
The Distance Learning Centre is building on a solid tradition of over two decades of service in the provision of External Studies Programme and now Distance Learning Education in Nigeria and beyond. The Distance Learning mode to which we are committed is providing access to many deserving Nigerians in 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. Isaac Adewole

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.

Acknowledgements

The University of Ibadan Distance Learning Centre wishes to thank those below for their contribution to this course manual:

Course Writer / Facilitator	Adebayo O. Adejumo
Content Editor	Prof. Remi Raji-Oyelade
Production Editor	Dr. Gloria O. Adedoja
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Contents

About this course manual

Introduction to Psycho-Biological Basis of Behaviour PSY101 has been produced by University of Ibadan Distance Learning Centre. It is structured in the same way, as other psychology course.

How this course manual is structured

The course overview

The course overview gives you a general introduction to the course. Information contained in the course overview will help you determine:

- If the course is suitable for you.
- What you will already need to know.
- What you can expect from the course.
- How much time you will need to invest to complete the course.

The overview also provides guidance on:

- Study skills.
- Where to get help.
- Course assessments and assignments.
- Activity icons.
- Study sessions.

We strongly recommend that you read the overview *carefully* before starting your study.

The course content

The course is broken down into study sessions. Each study session comprises:

- An introduction to the study session content.
- Learning outcomes.
- Content of study sessions.
- A study session summary.
- Assessments and/or assignment, as applicable.

Your comments

After completing this course, Introduction to Psycho-Biological Basis of Behaviour, we would appreciate it if you would take a few moments to give us your feedback on any aspect of this course. Your feedback might include comments on:

- Course content and structure.
- Course reading materials and resources.
- Course assessments.
- Course assignments.
- Course duration.
- Course support (assigned tutors, technical help, etc).
- Your general experience with the course provision as a distance learning student.

Your constructive feedback will help us to improve and enhance this course.

Course overview

Welcome to Introduction to Psycho-Biological Basis of Behaviour PSY101

This course exposes learners to human behaviour. It emphasizes the relationship between the human mind, behaviour and the physical structure of the body.

This course manual supplements and complements PSY101 UI Open Class Activities as an online course. The UI Open Class is a virtual platform that facilitates classroom interaction at a distance where you can discuss / interact with your tutor and peers while you are at home or office from your internet-enabled computer. You will also use this platform to submit your assignments, receive tutor feedback and course news with updates.

Introduction to Psycho-Biological Basis of Behaviour PSY101—is this course for you?

PSY101 is a *compulsory* introductory course to psychology students. The course exposes learners to nervous system, sensory processes, and fundamentals of motivation. It provides a means to grasp introductory scientific information required for effective learning of psychology by students coming into tertiary education in the area of psychology. .

Outcomes

Course outcomes

Upon a successful completion of Introduction to Psycho-Biological Basis of Behaviour PSY101, you will be able to:

- *analyze* the structure of human beings as directly related to the functioning of the human behaviour.
- *explain* the physiological basis of behaviour as a tool for analyzing human behaviours.

Timeframe

How long?

This is a 15 weeks course. It requires a formal study time of 45 hours. The formal study times are scheduled around online discussions / chats with your course facilitator / academic advisor to facilitate your learning. Kindly see course calendar on your course website for scheduled dates. You will still require independent/personal study time particularly in studying your course materials.

Need help?

Help

As earlier noted, this course manual complements and supplements PSY101 at UI Mobile Class as an online course.

You may contact any of the following units for information, learning resources and library services.

Distance Learning Centre (DLC)
University of Ibadan, Nigeria
Tel: (+234) 08077593551 – 55
(Student Support Officers)
Email: ssu@dlc.ui.edu.ng

Head Office
Morohundiya Complex, Ibadan-Ilorin Expressway, Idi-Ose, Ibadan.

Information Centre
20 Awolowo Road, Bodija, Ibadan.

Lagos Office
Speedwriting House, No. 16 Ajanaku Street, Off Salvation Bus Stop, Awuse Estate, Opebi, Ikeja, Lagos.

For technical issues (computer problems, web access, and etcetera), please send mail to webmaster@dlc.ui.edu.ng.

Academic Support

Help

A course facilitator is commissioned for this course. You have also been assigned an academic advisor to provide learning support. The contacts of your course facilitator and academic advisor for this course are available at onlineacademicsupport@dlc.ui.edu.ng

Activities

Activities

This manual features “Activities,” which may present material that is NOT extensively covered in the Study Sessions. When completing these activities, you will demonstrate your understanding of basic material (by answering questions) before you learn more advanced concepts. You will be provided with answers to every activity question. Therefore, your emphasis when working the activities should be on understanding your answers. It is more important that you understand why every answer is correct.

Assessments

Assessments

There are two basic forms of assessment in this course: in-text questions (ITQs) and self assessment questions (SAQs), and tutor marked assessment (TMAs). This manual is essentially filled with ITQs and SAQs. Feedbacks to the ITQs are placed immediately after the questions, while the feedbacks to SAQs are at the back of manual. You will receive your TMAs as part of online class activities at the UI Mobile Class. Feedbacks to TMAs will be provided by your tutor in not more than 2-week expected duration.

Schedule dates for submitting assignments and engaging in course / class activities is available on the course website. Kindly visit your course website often for updates.

Bibliography

For those interested in learning more on this subject, we provide you with a list of additional resources at the end of each study session; these may be books, articles or web sites.

Getting around this course manual

Margin icons

While working through this course manual you will notice the frequent use of margin icons. These icons serve to “signpost” a particular piece of text, a new task or change in activity; they have been included to help you to find your way around this course manual.

A complete icon set is shown below. We suggest that you familiarize yourself with the icons and their meaning before starting your study.

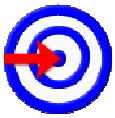
 Activity	 Assessment	 Assignment	 Case study
 Discussion	 Group Activity	 Help	 Outcomes
 Note	 Reflection	 Reading	 Study skills
 Summary	 Terminology	 Time	 Tip

Study Session 1

Neurones

Introduction

This Study Session introduces you to the general structure and function of neurones. Our focus will be on classification, characteristics and functions of neurones.



Learning Outcomes

When you have studied this session, you should be able to:

1.1 *show* how neurones are responsible for the nervous system activities.
1.2 *outline* the distinctive features and properties of neurons.
1.3 *classify* neurones according to their structure, functions, or possession of myelin sheath.
1.4 *represent* the process of nerve impulse in a chart.

1.1 What are Neurones?

Neurones A cell specialized to transmit electrical nerve impulses and so carry information from one part of the body to another.

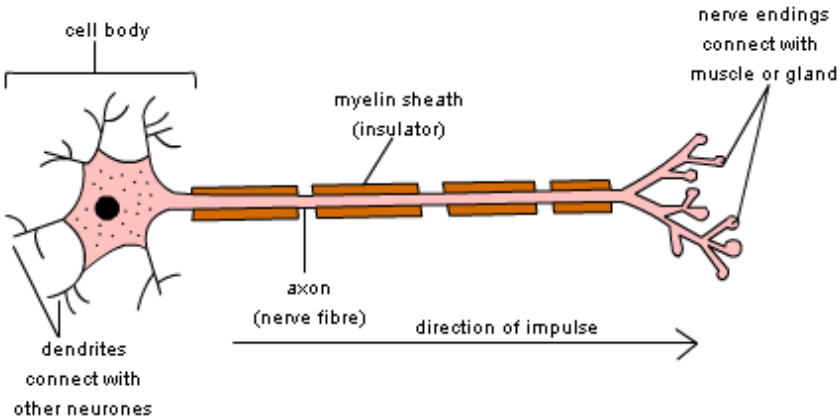
Neurones are commonly referred to as nerve cells. They are the basic structural unit of the **Nervous System**. They are organized to form complex networks that perform the functions of the nervous system. Neurones cannot divide. Each neurone consists of a cell body and its processes, one axon and many dendrites. Bundles of axons bound together are called nerves. For survival, neurones need a continuous supply of oxygen and glucose. Unlike many other cells, *neurones can synthesize chemical energy adenosine tri phosphate (ATP) only from glucose*.

Neurones are responsible for the electrical activities of the nervous system. In order to function, the nervous system relies on nerve impulses, or action potentials, which are similar to tiny electrical charges which it maintains throughout the length of the neurone. The nervous system carries out its functions effectively and rapidly because information and instructions travel speedily as electric impulses along nerves from one part of the body to another almost instantaneously.

A neurone consists of a nucleus, a membrane, mitochondria, ribosomes, endoplasmic reticulum, vacuoles and other structures typical of animal cells as shown in Fig 1.1. The membrane limits the flow of materials between the inside of the cell and the outside environment. A few chemicals such as water, oxygen, and carbon dioxide, flow fairly freely across the membrane, while other substances flow fairly poorly or not at all. The nucleus is responsible for regulating the activities of the cell including reproduction. The fluid inside the cell membrane is known as the cytoplasm. The mitochondrion is the site for the metabolic activities that provide energy the cell requires for its activities. Ribosomes are for

production of protein molecules. Some ribosomes float freely, others are attached to the endoplasmic reticulum. Vacuoles are fluid filled bubbles inside the cell.

Fig 1.1 Structure of a Neurone



ITQ

All chemicals cannot flow through a neuron; however, for the survival of the neuron it must have a through fare for which of the following?

a) Water
b) Oxygen
c) Zinc

- Feedback for (a) water indeed flows through the neuron however, this is not critical for the survival of the neuron. Try again.
- Feedback for (b) Oxygen is important for the neuron survival because without this neurons die with the longtime effect of inability to send impulses. This is the best choice
- Feed back for (c) Zinc are just part of the other chemicals which flow poorly through the neurons. Try again

1.2 Nerve Cell Bodies

Dendrites A short branched extension of a nerve cell, along which impulses received from other cells at synapses are transmitted to the cell body.

Axons The Portion of a nerve cell (neuron) that carries nerve impulses away from the cell body.

The distinctive feature that sets a neurone apart from other cells is its shape. The cell body is called the neurone cell body or soma, and the processes are called **dendrites** and **axons**. They form the grey matter of the nervous system and are found at the periphery of the brain and in the centre of the spinal cord. The cell body contains the nucleus, some ribosome and mitochondria and other structures found in most cells. Much of neural metabolic processes take place in the body. Nerve cell bodies vary in size and in shape. They are microscopic; and they range in diameter from 0.005mm to 0.1mm in mammals and up to a full millimetre in some invertebrates.

1.2.1 Dendrites & Axons

Dendrites are short, thin, highly branched cytoplasmic extensions of a neurone, which taper from their bases to their tips. *Dendrites are the input part of the neurone*. When stimulated, they generate small electric currents that are conducted to the neurone cell body.

Each nerve cell has only one axon. *Axon carries nerve impulses away from the cell body*. They are usually longer than dendrites, sometimes as long as a hundred centimetres. Large axons and those of peripheral nerves are surrounded by a myelin sheath which contains Schwann cells arranged along the length of the axon. Concentric layers of plasma membrane of Schwann cells wrap around the length of myelinated axons. There are tiny areas of exposed axolemma between adjacent Schwann cells, called nodes of Ranvier, which assists the rapid transmission of nerve impulses.

1.2.2 Properties of Neurones

Neurones have 2 major properties, which are: irritability and conductivity.

1. **Irritability** is the ability of neurons to initiate nerve impulses in response to stimuli from outside the body, e.g. touch, loud noise etc. or inside the body e.g. a huge and drastic blood loss may cause lead to a reduction in blood pressure, or the inhalation of toxic gases may trigger the vomit centre in the brain.
2. **Conductivity** refers to the ability of a neurone to transmit an impulse.

1.3 Types of Neurones

Neurones are usually classified according to their function or structure. They could also be classified based on myelin sheath possession.

1.3.1 Classification of Neurones according to their Function or Structure

The functional classification of neurones is based on the direction in which the action potentials are conducted. Sensory or afferent neurons conduct action potentials towards the central nervous system (CNS), while motor, or efferent neurons conduct action potentials away from the CNS toward muscles or glands. Interneurones or association neurons conduct action potentials from one neurone to another within the CNS.

The structural classification scheme is based on the number of processes that extend from the neurone cell body. This includes:

1. **Multipolar neurons:** They have many dendrites and a single axon. The dendrites vary in number and in their degree of branching. Most of the neurons within the CNS and motor neurons are multipolar.
2. **Bipolar neurons:** They have 2 processes: a dendrite and an axon. The dendrite is often specialised to receive the stimulus, and the axon conducts action potentials to the CNS. Bipolar neurons are located in some sensory organs, such as in the retina of the eye and in the nasal cavity.
3. **Unipolar neurons:** They have a single process extending from the cell body. One branch extends to the CNS, and the other extends to the periphery and has dendrite like sensory processes. The two branches function as a single axon. The sensory receptors respond

to stimuli resulting in the production of axon potentials that are transmitted to the CNS.

1.3.2 Classification according to Possession of Myelin Sheath

1. **Myelinated neurons** have myelin sheath which serves as an insulator and also increase the speed of conducting nerve impulses.
2. **Unmyelinated neurons** do not possess myelin sheath hence do not possess the properties described above.

1.4 The Nerve Impulse

Tip

The regulation of body activities is jointly carried out by the endocrine and nervous systems. Nervous system stimulation provides an immediate response while endocrine activity is slower and longer.

Nerve impulse is an electrical impulse travelling along an axon when a neurone is stimulated. For the nervous system to coordinate communication within and outside an organism, the neurons must receive nervous stimulation upon which the message is transmitted and interpreted; following which response stimuli is sent to the appropriate organ or tissue.

Humans depend on electric signals to communicate and process information. The electrical signals are produced by cells, and are called action potentials. Action potentials are important means by which cells transfer information from one part of the body to another. The ability to perceive our environment, perform complex mental activities and act therefore, depends on action potentials.

You will now be exposed to a basic knowledge of the electrical properties of cells, which is necessary for understanding many of the normal functions and pathologies of the body. These electrical properties result from ionic concentration differences across the plasma membrane and from the permeability characteristics of the plasma membrane.

1.4.1 Neuro-Chemical Changes in Neurons and Nerve Conductivity

In the resting state the nerve cell membrane is polarized due to differences in the concentrations of ions across the plasma membrane. This means that there is a different electrical charge on each side of the membrane that is called resting membrane potential. At rest the charge on the outside is positive and inside is negative. The major ions involved are: sodium which is the main cation in the extracellular space, and potassium which is the main cation in the intracellular space.

In the resting state there is a continual tendency for these ions to diffuse along their concentration gradients. i.e. potassium flows outwards and sodium into nerve cells. However, whenever any stimulus flows into the cell, the permeability of the plasma membrane to these ions changes.

Initially, sodium flows into the neuron from the extracellular fluid leading to what is known as depolarization. This creates a nerve impulse or action potential. This passage of electrical current occurs only in one way along the length of a nerve, and it occurs very rapidly.

Refractory period This represents a time during which the membrane cannot be depolarised again

For another cycle, i.e. repolarisation to occur, a longer time is taken. In the process, potassium ions flow out of the neurons reverting the membrane potential to its resting state. This phase is called the **refractory period** during which re-stimulation is not possible. The sodium pump returns sodium ions from the cell for potassium ions to flow back into the cell.

1.4.2 The All or None Principle

An action potential can be compared to the flash system of a camera. When the shutter is triggered (reaches threshold), the camera flashes (an action potential is produced). If the battery is weak, sufficient current is not generated, the trigger will not be excited and hence the flash will not work. When there is sufficient current (stimulus), the shutter will be triggered and the brightness of each flash will be similar to previous flashes. This means that action potentials requires sufficient threshold potential so that all the permeability changes responsible for an action potential will occur, and vice versa.

1.4.3 Saltatory Conduction

Saltatory conduction is the manner in which a nerve impulse is propagated along a myelinated nerve fibre in a sequence of jumps from one node of Ranvier to the other. This increases its speed of propagation such that the fastest fibres can conduct to skeletal muscles at a rate of 130 meters per second while the slowest fibre travels at 0.5 meters per second.

ITQ

The manner of electrical impulse passage from one part of the body can be described as _____, while the major chemicals are ____ and ____.

a) all or nothing principle, oxygen and potassium
b) Salutatory conduction, sodium and potassium

- Feedback for (a) All or nothing principle is a principle that says for permeability to occur in a neuron there must be sufficient threshold potential. Oxygen flows through the neuron however, this is not critical for the passage of action potential, though potassium does. You should try again.
- Feedback for (b) Salutatory Conduction this is the manner the fibers in the neurons send action potential to one another. Sodium is the major Cat ion extracellular space while Potassium is the major Cat ion in the intracellular space. This is the best choice.

Study Session Summary

Summary

In this Study Session, you were exposed to neurones. Neurones are cells organized to form complex networks that perform the functions of the nervous system. Dendrites are short, thin, highly branched cytoplasmic extensions of a neurone. Each nerve cell has only one axon, carrying nerve impulses away from the cell body. Neurones have 2 major properties i.e. irritability and conductivity. Neurones are usually classified according to their function or structure. Neurones could also be classified based on whether it has myelin sheath or not.

You also learned that the regulation of activities in the body is jointly carried out by the endocrine and nervous systems. Nervous system stimulation provides an immediate response while endocrine activity is slower and longer.

Bibliography

Resources

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Assessment

Assessments

SAQ 1.1(tests Learning Outcomes 1.1, 1.2, 1.3 and 1.4)

You are hungry and back from class on a sunny afternoon, with only indomie has your option you put it on the cooker and received call from your parents. After the call you rushed to the steaming pot, and screamed from the sudden touch of the pot.

1. Which of these best describes the resulting action?
   a. absent minded person
   b. nervous system carrying out its functions effectively*
   c. passage of chemicals in the neuron
2. If on carrying the hot pot it was dropped immediately, the neuron at work might be?
   a. sensory or afferent neurons
   b. motor or efferent neurons*
   c. interneurons or association neurons

Walking alone at night you heard the rustling of the bush behind you, after looking intently at the path you saw nothing, suddenly your heart started racing, goose pimples and faster breathing you took your heels only to hear raucous laughter and freezing in your race as your friends started laughing and you too busted to laughter.

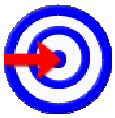
3. The sudden running despite seeing nothing can be best described as
   a. fear in a weakling due to neural learning
   b. hyper vigilance in a streetwise young man with complex mental processes
   c. Action potential by sending of neural impulses*
4. after the laughter the sudden stop in you track can be best be described as
   a. All or none principle*
   b. Saltatory conduction
   c. Depolarization
5. When you're now going home with your friends talking about other things without recourse to the preceding incidence, with your body becoming calm it can be what?
   a. repolarisation
   b. refractory*
   c. depolarization*

Study Session 2

The Nervous System

Introduction

The nervous system is the master control segment of living beings. It is responsible for the coordination of activities within the body. The nervous system comprises of two other sub-systems: central nervous system and peripheral nervous system (PNS). In this Study Session, we will first look at the components, functions and subdivision of the central nervous system. Thereafter, we shall examine the PNS. Finally, we shall point out how automatic actions take place within the nervous system.



Learning Outcomes

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

2.1 analyze the structural areas of the brain and the spinal cords with their specific functions.
2.2 highlight the functions of specific areas of the PNS.
2.3 point out how nerves regulates the activities of internal organs.

2.1 The Central Nervous System

The Central Nervous System is made up of the Brain and the Spinal Cord. Both the brain and spinal cord are surrounded by 3 membranes called the meninges. The membranes lie between the skull and the brain, and between the vertebrae and the spinal cord. Named from outside inwards, they are: dura, arachnoid and pia mater. The dura and arachnoid are separated by a potential space called the subdural space. The arachnoid and pia are separated by the subarachnoid space, containing cerebrospinal fluid.

2.1.1 The Brain

The brain lies within the cranial cavity (the head), and has four irregular-shaped cavities, or ventricles, containing cerebro spinal fluid (CSF). The parts of the brain are: cerebrum, the brain stem (composed of the midbrain, pons and medulla oblongata), and the cerebellum. It constitutes about one-fiftieth of the body weight, and receives about 15% of blood pumped by the heart, approximately 750 ml per minute.

The Cerebrum

This is the largest part of the brain. It occupies the anterior and middle portions of the brain. The functions of the cerebrum include:

- mental activities involved in memory, intelligence, sense of responsibility, thinking, reasoning, moral sense and learning attributed to higher centres.
- sensory perception, including the perception of pain, temperature, touch, sight, hearing, taste and smell.

- initiation and control of skeletal (voluntary) muscle contraction.

There are three distinguishable areas of the cerebrum, which are: precentral area, premotor area and the frontal area.

1. The cells in precentral area initiate the contraction of skeletal muscles (motor movement). Its nerve fibre passes downwards through the internal capsule to the medulla oblongata where it crosses to the opposite side then descends in the spinal cord. At the appropriate level in the spinal cord the nerve impulse crosses a synapse to stimulate a second neurone which terminates at the motor end plate of a muscle fibre.
2. The premotor area lies in the frontal lobe immediately anterior to the motor area. The cells assist in achieving orderly series of movements that requires manual dexterity e.g. tying a shoe lace. The Broca's area has nerve cells which controls movements necessary for speech.
3. The frontal area is responsible for communication between this and other regions in the cerebrum. They are responsible for the behaviour, character and emotional state of an individual.

ITQ

This is true of the brain and the spinal cord

a) They are surrounded by the meninges
b) They both receives about 15% of the blood the heart pumps
c) They are both made up cerebrum and cerebellum

□ Feedback for (a) Meninges is indeed the three membranes that cover the brain and the spinal cord. This is the best choice.
□ Feedback for (b) The brain receives 15% of the blood from the heart, however, this is not true of the spinal cord. Try again
□ Feed back for (c) They both do not have cerebellum and cerebrum, these are parts of the brain. Try again

Sensory Areas of the Cerebrum

The Postcentral Area
- The area lies behind the central sulcus. It is responsible for the sensation of pain, temperature, pressure and touch.

The Parietal Area
- It lies behind the postcentral area and a greater part of the parietal lobe. It helps in retaining accurate knowledge of objects. Because of knowledge retained from past experience (memory), objects stored in this area can be recognized by touch alone.

The Auditory Area
- It lies below the lateral sulcus in the temporal lobe. The cells here receive and interpret impulses transmitted from the inner ear by the cochlear part of the vestibulo-cochlear nerves.

The Sensory Speech Area
- It is located in the lower part of the parietal lobe extending into the temporal lobe. Spoken word is perceived here.

The Olfactory Area
- This lies within the temporal lobe where impulses from the nose via the olfactory nerves are received and interpreted.

The Taste Area
- This lies just above the lateral sulcus in the deep layers of the sensory area. Impulses from special nerve endings in taste buds in the tongue and in the lining of the cheeks, palate and pharynx are perceived and interpreted as taste.

The Visual Area
- It lies below the parieto-occipital sulcus and includes the greater part of the occipital lobe. The optic nerve from the eyes passes to this area which receives and interprets impulses as visual impressions.

Relay Stations

The cerebrum has other masses of grey matter which act as relay stations through which impulses are passed from one neurone to the other. The relay stations include:

1. The Basal Nuclei

This is found deep within the cerebral hemispheres, with connections to the cerebral cortex and thalalmus. They constitute part of the extra pyramidal tracts and are thought to be responsible for initiating muscle tone and slow and coordinated activities. Its deficiency could lead to jerky, clumsy and uncoordinated movements.

2. Thalamus

It lies below the corpus callosum one on each side of the third ventricle. It receives sensory input from the skin, viscera and special sense organs before redirecting them to the cerebrum.

3. Hypothalamus

It is situated below and in front of the thalamus, immediately above the pituitary gland. Being linked to the posterior pituitary gland, the hypothalamus controls the output of hormones from both sides of the

gland. This structure is also responsible for the control of the autonomic nervous system, appetite and satiety, thirst and water balance, body temperature, emotional reactions, e.g. pleasure, fear, rage. It is also concerned with sexual behaviour including child rearing, biological clocks e.g. sleeping and waking cycles, body temperature or including circadian rhythm.

The Brain Stem

The brain stem comprises of the midbrain, pons and medulla oblongata. The functions of these areas are highlighted as follows:

The Mid Brain

It has nerve fibres which connect the cerebrum with lower parts of the brain with the spinal cord. Its cell bodies act as relay stations for ascending and descending nerve fibres.

Pons

It lies in front of the cerebellum, below the mid brain and above the medulla. Some of its group of cells act as relay stations and some of these are associated with the cranial nerves.

Medulla Oblongata

It extends from the pons above and is continuous with the spinal cord below. The outer aspect is composed of white matter which passes between the brain and the spinal cord. Its cells act as relay stations for sensory nerves passing from the spinal cord to the cerebrum. It is responsible for decussation of pyramids, sensory decussation, cardio vascular control, control of respiration, control of blood vessels, and reflexes such as vomiting, coughing and sneezing.

Note

Reticular Formation

The reticular formation is a collection of neurons in the core of the brain stem, surrounded by neural pathways which conduct ascending and descending nerve impulses between the brain and the spinal cord. It is linked to other parts of the brain through which it receives information being transmitted in ascending and descending tracts. It is responsible for coordination in skeletal muscle activity related with voluntary motor movement and maintenance of balance. It coordinates activities under the control of the autonomic nervous system, e.g. respiration, digestion and cardio vascular activities. The area also controls the activities of the reticular activating system which selectively blocks or passes sensory information to the cerebral cortex.

Cerebellum

The cerebellum is situated behind the pons and immediately below the posterior portion of the cerebrum occupying the posterior cranial fossa. It is ovoid in shape and has two hemispheres. Grey matter forms the surface of the cerebellum, and white matter lies deeply. The cerebellum is responsible for coordinating voluntary muscle movement, posture and balance. Cerebellar activities are not under voluntary control. It controls and coordinates balance and equilibrium in the body. The sensory input for these functions is derived from the muscles and joints, the eyes and

the ears. Damage to the cerebellum usually results in clumsy uncoordinated muscular movement, staggering gait and inability to carry out smooth, steady, precise movements.

2.1.2 The Spinal Cord

The spinal cord is the elongated, almost cylindrical part of the central nervous system, which is suspended by the meninges and cerebrospinal fluid. It is continuous from above with the medulla oblongata and extends from the upper border of the atlas to the lower border of the first lumbar vertebra. The Spinal cord has 31 segments and therefore thirty one sensory and motor nerves. From above, there are eight cervical nerves, twelve thoracic nerves, five lumbar nerves, five sacral nerves, and one coccygeal nerve. A sensory spinal nerve which innervates a specific skin area is called a dermatone. The thickness of an area of the spinal cord depends on the density of muscles and receptors in the dermatone attached to it.

The spinal cord is the nervous tissue link between the brain and the rest of the body. Nerves convey impulses from the brain to the various organs and tissues descend through the spinal cord. At the appropriate level, they leave the cord and pass to the structure they supply. Similarly, sensory nerves from organs and tissues enter and pass upwards in the spinal cord to the brain.

ITQ

The part of the cerebrum associated with emotion such as anger, love and hate is the

a) Basal nuclei
b) Thalamus
c) Hypothalamus

- □ Feedback for (a) Basal nuclei is a part of the cerebrum, however, it is major concerned with muscle coordination. Try again.
- □ Feedback for (b) Thalamus is important for sensory organs information to get to the brain and not emotions. Try again.
- □ Feed back for (c) Hypothalamus is responsible for emotions and other autonomic nervous system such as fear, anger etc. This is the best choice

2.2 The Peripheral Nervous System

The peripheral nervous system (PNS) refers to all of the nervous tissue outside the brain and spinal cord. It includes the cranial nerves apart from the optic nerves, the spinal nerves and the autonomic nervous system. It encompasses those neurones that connect the central nervous system (CNS) to the receptors, muscles, and organs at the periphery of the body. Most of the nerves of the PNS are made up of sensory nerve fibres conveying afferent impulses from sensory end organs to the brain, and motor nerve fibres conveying efferent impulses from the brain through the spinal cord to effector organs. Each nerve has many nerve fibres compacted into a bundle.

The PNS consists of:

- 31 pairs of spinal nerves
- 12 pairs of cranial nerves and
- The autonomic part of the nervous system.

2.2.1 The Spinal Nerves

They are named according to the vertebrae with which they are associated. The spinal nerves arise from both sides of the spinal cord and emerge through the intervertebra foramina. Each nerve is formed by the union of a motor and sensory nerve root and is therefore a mixed nerve.

2.2.2 The Cranial Nerves

There are 12 pairs of cranial nerves originating from nuclei in the inferior surface of the brain. They exist in varieties such as: sensory, motor and mixed nerves. They are discussed in sequential order as follows:

Olfactory Nerves

They originate from the upper part of the mucous lining of the nasal cavity. They are sensory nerves responsible for the sense of smell.

Optic Nerves

The fibres originate in the retinae of the eyes and they combine to form optic nerves. The nerves which are sensory are responsible for sight.

Oculomotor Nerves

The nerves arise from nerve cells near the cerebral aqueduct. Its sensory component controls sensations to move four extraocular muscles which move the eyeball. They also:

- move the ciliary (intraocular) muscles to alter the shape of the lens thereby changing the refractory power.
- move the circular muscles of the iris to contract the pupil.
- move the levator palpebrae muscle which raises the upper eyelid.

Trochlear Nerves

They arise from the nerve cells near the cerebral aqueduct to supply the superior oblique muscles of the eyes.

Trigeminal Nerves

They are largest and contain both motor and sensory nerves, hence called mixed nerves. The ophthalmic and mandibular nerve branches of the trigeminal nerves are sensory. The ophthalmic component is responsible for stimulation of the lacrimal glands, conjuctiva, forehead, eyelids, anterior scalp and nasal mocosa. Trigeminal nerves have ophthalmic, maxillary and mandibular branches. The maxillary component is sensory and supplies the cheeks, gums, upper teeth and lower eyelids. The maxillary component is both sensory and motor. They supply the teeth, gums, lower jaw, pinnae, lower lip and tongue. With these, the nerves control chewing and mastication.

Abducents Nerves

It is a group of motor nerves centrally connected to the fourth ventricle of the brain. They are responsible for moving the lateral rectus muscle of the eye to move the eyes.

Facial Nerves

It has mixed nerves arising from the lower part of the pons. The motor component controls the muscles of facial expression. The sensory fibres transmit impulses from the taste buds in the anterior two-thirds of the tongue to the taste perception area in the cerebral cortex.

Vestibulo-Cochlear Nerves

These are sensory nerves otherwise called auditory nerves. The vestibular portion arises from the semicircular canals and conveys impulses to the cerebellum. They are responsible for maintaining posture and balance. The cochlear nerve originates in the organ of Corti in the inner ear and conveys impulses to the hearing areas in the cerebral cortex where sound is perceived.

Glossopharyngeal Nerves

These are mixed nerves arising from medulla oblongata. The motor fibre controls the muscles of the tongue, pharynx and secretory cells of the salivary (parotid) gland. The sensory fibres transmit nerve impulses to the cerebral cortex from the posterior third of the tongue, the tonsils, pharynx, taste buds in the tongue and pharynx. They are responsible for swallowing, salivation, and dilation of blood vessels.

Vagus Nerve

They are mixed nerves with the largest distribution of areas of innervation. They originate from the medulla oblongata and other nuclei and pass downwards into the thorax and abdomen to form an important part of the parasympathetic nervous system. Its motor fibres supply the gastro intestinal tract, heart, kidneys, urters, and blood vessels in the thoracic and abdominal cavities. The sensory fibres convey impulses from these areas to the brain.

Accessory Nerves

These motor nerve fibres arise from medulla and the spinal cord to supply the sternocleidomastoid and trapezius muscles. They are responsible for movement of the head, shoulders, pharynx and larynx.

Hypoglossal Nerves

These are motor nerves arising from the medulla oblongata. They supply muscles of the tongue and hyoid bone to contribute to swallowing and speech.

ITQ

The cranial nerves associated with head shoulder movement are:

a) Accessory Nerves*
b) Facial nerves
c) Optic nerves

- Feedback for (a) Accessory Nerves are the motor fibers responsible for head and shoulder etc movement, they arise from the medulla and spinal cord. This is the best choice.
- Feedback for (b) Facial nerves controls facial expression and taste perception. Try again.
- Feed back for (c) optic nerves controls for sensations necessary for sight and not muscle movement. Try again.

2.3 The Autonomic Part of the Nervous System

This is a set of nerves responsible for self regulation of the activities of internal organs. It is automatic and involuntary, i.e. not under the control of will. Such activities are initiated below the level of the cerebrum. Even though the stimulation may not be known by the individual, yet the effects may be perceived, e.g. the urge to void urine. It serves to respond to urgent changes in the body and the need to maintain **homeostasis**, i.e. balance in the body. The organs through which autonomic effects are carried out include areas with smooth muscles, cardiac muscles and glands. In these organs autonomic changes include; changes in the rate and force of the heartbeat, stimulation or depression of secretion of glands, vasoconstriction or vasodilatation, broncho-constriction or broncho-dilatation and changes in the size of the pupils of the eyes.

The autonomic nervous system is associated with the nervous system but lies outside it. It is divided into two divisions; the sympathetic and the parasympathetic. The sympathetic nervous system consists of two paired chains of ganglia (collection of nerve cells) lying just to the left and right of the spinal cord in its central regions (the thorax and lumbar areas) and connected by axons to those spinal cord regions. Axons also extend from the sympathetic ganglia to the internal organs of the body. The sympathetic nervous system prepares the body for “fight or flight” activities: It increases the heart rate and breathing rate and it decreases digestive activity. Because all the sympathetic ganglia are closely linked, they tend to act as a single system. That is, they act in sympathy with one another.

The term *para* means “next to”; this is why the parasympathetic system lies adjacent to the sympathetic system. The parasympathetic system relates closely with the cranial nerves of the medulla and to the sacral nerves in the lower spinal cord. The parasympathetic ganglia are not arranged in a chain near the spinal cord. Instead, long axons extend from the spinal cord to parasympathetic ganglia in the organs themselves. Because the parasympathetic ganglia are not linked to one another, they sometimes act more independently than the sympathetic ganglia do. Activity of the parasympathetic system decreases heart rate, increases digestive rate, and in general promotes energy-conserving, non emergency functions.

The sweat glands, the adrenal glands, the muscles that constrict the blood vessels, and the muscles that erect the hairs of the skin have sympathetic input only. Other organs are controlled by both the sympathetic and the parasympathetic systems, but in opposite ways. In other words while the sympathetic excites, the parasympathetic inhibits, and vice versa.

ITQ

The nervous system with works without the control of the person is

a) Autonomic nervous system
b) Peripheral nervous system

- Feedback for (a) Autonomic nervous system is automatic and involuntary; these activities are initiated below the level of the cerebrum and although the stimulation may not be known by the individual, but the effects are usually perceived. This is the best choice
- Feedback for (b) Peripheral nervous system is those neurons that connect the central nervous system (CNS) to the receptors, muscles, and organs at the periphery of the body.

The final synapses of the parasympathetic nervous system onto any organ use the transmitter **acetylcholine.** Most of the final synapses of the sympathetic nervous system use **norepinephrine**, although a few, such as the ones that control the sweat glands, use acetylcholine. Because the two systems use different synaptic transmitters, certain drugs may excite or inhibit one system or another. For example, over-the counter cold remedies exert their effects largely by blocking parasympathetic activity or by increasing sympathetic activity. This action is useful because the flow of sinus fluids is a sympathetic response; thus, drugs that block the parasympathetic system inhibit sinus flow. The common side effects of cold remedies also stem from their ability to excite sympathetic responses and block parasympathetic ones: they inhibit salivation, inhibit digestion, and increase heart rate. They also have two effects on sexual responses. Because sexual arousal depends on the parasympathetic system, if one does not manage to get aroused, the drugs may speed up orgasm. This is why nervousness interferes with sexual arousal while soft music and relaxation promote it.

Study Session Summary

Summary

In this Study Session, we discussed the coordination of activities within the body. We noted that nervous system consisted of central nervous system and the peripheral nervous system. The central nervous system is made up of the brain and the spinal cord. The brain is made up of the cerebrum, the brain stem (composed of the midbrain, pons and medulla oblongata), and the cerebellum. The spinal cord is a thick band of spinal tissue that runs though the spinal canal and to which 31 pairs of nerves are attached. The spinal cord conveys impulses from the brain and also convey this to the various organs and tissues.

We also discussed that the PNS encompasses those neurons that connect the CNS to the receptors, muscles, and organs at the periphery of the body. It consists of 31 pairs of spinal nerves, 12 pairs of cranial nerves and the autonomic part of the nervous system

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Assessment

Assessments

SAQ 2.1 (tests Learning Outcomes 2.1, 2.2 and 2.3)
The 9 O'clock news today reported that a bike man had a ghastly accident on the iwo road axis of the express road and he used his head to land twice on the hard road tar, he was rushed to UCH and the Clinical psychologist called to see him was you.

1. If the young man has problems with gait(walking as if drunk) after his treatment which area of his brain will you suspect for injury
   a) reticular formation
   b) basal Nuclei*
   c) broca area

A man left the home in the morning forgetting it was his wedding anniversary, at close of work somehow he remembered. Then it made a sense why his wife was acting grumpy when he called her at midday, trying to make-up he was driving home in haste, when he ran into a standing hold-up, he was swerving to take a detour and he hit an expensive car, with his heart racing , sweating eyes widening and instant feeling of urination.

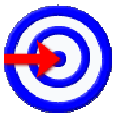
2. If this man discovers he is grinding his teeth which part of the cranial nerves is most probably working
   a) optic nerve
   b) trigeminal nerves *
   c) Vestibulo-cochlear nerves
3. The sudden desire of this man to urinate at this sudden event could be one of the following
   a) Autonomic nervous system*
   b) Peripheral nervous system
   c) Cerebellum
4. If this man gets home and instead of celebrating with his wife he becomes sick with palpitations and sweating it is probably the function of one of the following.
   a) Accessory nerves
   b) Vagus nerves *
   c) c) Glossopharyngeal Nerves

Study Session 3

The Mind-Brain Relationship

Introduction

This Study Session teaches that most behaviour of animals and human beings are responses to neuronal changes and activities in the brain. In other words, what we do are practical reflections of the response of the brain to incoming stimulus.



Learning Outcomes

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

3.1 appraise the 3 discussed experiments in this session to propose the concept of "mind-brain relationship".

Many people use the term "mind" in a way that makes it un-observable and un-available to scientific study. Perhaps it is better to state that *the "mind" is just another way of saying "brain activities"*. The mind could be observed like a physical entity, separate from the body. This is why it is possible to observe the mind of other people. Although there is little scientific evidence to prove that the structure and organization of the brain give rise to mental experience, evidences abound that various kinds of brain damage lead to specific changes in behaviour and losses of sensory capacity. Brain damage may therefore relate to mind damage. Additionally, evidences arising from the study of the behavioural effects of electrical stimulation of the brain also support this viewpoint.

3.1 Control of Behaviour by Electrical Stimulation of the Brain

In 1870, Fritzch and Hitzig reported that mild, non destructive electrical stimulation of portions of the cerebral cortex of a dog could cause muscle movements. At low intensities, the electrical current stimulated discrete, limited movements-always on the side of the body opposite the stimulation. Depending on the exact point stimulated, the dog would move its neck, back, abdomen, tail, leg, or some other parts of its body. Repeated stimulation of the same point consistently elicited the same response. Later experiments yielded similar results for many species.

Electrical activity occurs naturally in the brain at all times. Ordinarily, this electrical activity is caused by nerves sending messages from the sense organs. Their impulses combine with electrical activity already present in the other areas of the brain to produce activity in other areas, which then activate still other areas. Later, some activity in the areas of the brain that control movement was observed. Fritsch and Hitzig had already stimulated the movement-controlling areas, bypassing all the preliminary stages.

Electrical Stimulation of the Brain can evoke not only simple muscle movements but also more complex sequences of behaviour, particularly if the animal is awake during the stimulation and free to move about. Working with chickens, Von Holst and Von St. Paul (1960) implanted electrodes on the skull to hold them in place. Later, they were able to attach wires to the exposed electrodes and pass a weak electrical current to the brain of an animal while it was awake and moving about.

Stimulation of various areas elicited such behaviours as feeding, drinking, grooming, turning the body to one side, sleeping, sitting, escape flight and aggressive attack. The behaviour elicited depended on the exact location of the electrode and the intensity of the stimulation (stronger current could stimulate more cells). The elicited behaviour also varied depending on the environmental stimuli. For instance, in later experiments with rats, stimulation of certain areas led to eating, if only food was present (Valenstein, Cox, Kakolewski, 1970). Similarly, Hess, (1944) found that electrical stimulation of certain areas could induce an animal to fall asleep suddenly.

ITQ

In study session 2, we discussed that messages and impulses from the brain to the rest of the body must pass through one of the following:

a) Pons
b) Spinal cord
c) Cerebellum

- Feedback for (a) Pons has some of its cells acting as relay stations but not all messages pass through them.
- Feedback for (b) Spinal cord is the nervous tissue link between the brain and the rest of the body, while its nerve endings spread round the body. This is the best choice.
- Feed back for (c) Cerebellum is responsible for voluntary muscle movement and not relaying of information.

Stimulation of more Complex Behaviours

Jose Delgado (1969) introduced some technological advances that permitted him to investigate the electrical stimulation of a wider variety of behaviours. He advanced the experiments of Von Holst and Von St. Paul (1960) by attaching permanent electrodes connected to a monkey's skull to an electrical stimulator. He found that stimulation of some points produced normal coordinated walking, walking in circles, running, falling asleep, cessation of spontaneous movement, or loss of appetite. Also, with five seconds stimulation, the monkey had a response lasting 10-14 seconds. The monkey changed its facial expression, turned its head to the right side, stood up on two feet, circled to the right, walked on two feet to a pole in the centre of the room, climbed the pole and then came down, growled, threatened and sometimes attacked another monkey, and finally approached the group in a friendly manner and then resumed normal behaviour.

ITQ

The sure way of knowing the mind-brain relationship is by

a) Behavior change in people with brain damage*
b) Scientific evidence that mind exists
□ Feedback for (a) Behavioral change; these activities are initiated below the level of the cerebrum and although the stimulation may not be known by the individual, but the effects are usually perceived. This is the best choice
□ Feedback for (b) Scientific evidence about the mind are debatable especially location and distinct features. Try again.

Hint

Electrical Stimulation of the Human Brain

If ethical guidelines are followed, there are a few medical purposes that permit the experimental observation of electrical stimulation of human brains. Electrical stimulation has most often been used with humans in an attempt to treat epilepsy, a syndrome caused by abnormal electrical discharge in the brain. The abnormal activity originates in a damaged or malfunctioning area of the brain called the focus of epilepsy. The focus is located in different places for different individuals. The abnormal discharge spreads outward from the focus until a large portion of the cerebral cortex is involved, possibly causing uncontrollable body jerks. Surgical excision may be required especially where drug treatment failed.

Only the part to be incised is anaesthetized, leaving the patient conscious in the process. The first step is to find the focus. The surgeon exposes part of the brain and then applies an electrode to stimulate a few areas in the cortex, one after the other. Eventually, as the surgeon stimulates a point, the patient says “that makes me feel the same way I feel when I’m about to have one my seizures”. This point can be identified as the focus of the epilepsy. The surgical procedure is then advanced and the focus removed surgically, leading to a cessation of epileptic seizures in the patient.

ITQ

Electrical stimulation experiment that most likely proves the mind-brain relationship is _____

a) Feeling simulation in the epileptic after electrical stimulation in brain*
b) Delgado’s brain stimulation in Monkey’s
c) Electrical stimulation in dog’s cortex showing change in its behavior.
□ Feedback for (a) Feeling simulation in the epileptic; when the epileptic is been prepped for surgery, they can have the same aura they observe before their epileptic seizures which proves the emotional changes attributed to the mind as a consequence of the brain’s activities. This is the best choice

- Feedback for (b) Delgado's brain stimulation as much as this experiment shows the effect of the brain on behavior it was on monkeys with permanent electrodes. Try again.
- Electrical stimulation on dogs; this shows gross motor activities which can be attributed to other effects rather than only to actual emotions and feelings of the mind. Try again

Study Session Summary

Summary

In this Study Session, you have learnt that the "mind" is just another way of saying "brain activities". Despite existing ambiguities, the mind could be observed like a physical entity, separate from the body.

Evidences abound that various kinds of brain damage lead to specific changes in behaviour and losses of sensory capacity. Brain damage may therefore relate to mind damage. Evidences arising from the study of the behavioural effects of electrical stimulation of the brain also support this viewpoint.

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Assessment

Assessments

SAQ 3.1(tests Learning Outcome 3.1)
Mr Akin was a Quarry man who was known to be quiet, conscientious and generally likeable. About a year ago while blasting a rock, the dynamite seem not exploding he when there to reset it- then the unexpected happened and it exploded in his hand causing serious concussion on his head . Fortunately, he survived but he became sloppy, unpredictable, talkative and generally trashy. On subsequent admission a CT scan showed lesion in various areas of the brain especial frontal cortex.

1. What would you adduce to this sudden behavior change after the head injury accident?
   a) A proof of the mind-brain relationship
   b) Loss of personal control
   c) A temporary lax anybody can have
2. An experiment close to this in real life is the
   a) Electrical stimulation of the human brain
   b) Control of behavior by electrical stimulation by Fritzch and Hitzig
   c) Delgado stimulation on complex behavior

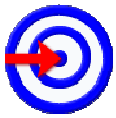
Study Session 4

The Endocrine System

Introduction

In this Study Session, we will focus on endocrine system. The endocrine system consists of glands widely separated from each other with no direct anatomical links. Endocrine glands consist of groups of secretory cells surrounded by an extensive network of capillaries which facilitates diffusion of hormones from the secretory cells in the blood stream. They are commonly referred to as the ductless glands because the hormones are secreted and diffused directly into the blood stream.

When you have studied this session, you should be able to:



Learning Outcomes

4.1 describe hormones.
4.2 highlight the functions of specific hormones in the human body.
4.3 distinguish between underproduction and overproduction of these hormones.

4.1 Hormones

A hormone is any of a large number of chemical substances secreted by an endocrine gland into the blood stream by an endocrine gland. This secretion is transported to another part of the body where it binds to a specific type of receptor. At the receptor site, the hormone exerts a particular effect. The effect enables the endocrine system to function as a communication system between cells, independently of the nervous system. Most hormones are produced from amino acids (proteins) and fats.

Keeping the internal environment of the body in a stable condition is maintained partly by the endocrine system and partly by the nervous system. While the autonomic nervous system is responsible for rapid changes, the hormones of the endocrine system are involved in slower and more precise adjustments.

The endocrine system consists of a number of distinct glands and some other tissues in other organs. Although the hypothalamus is classified as a part of the brain and not as an endocrine gland it controls the pituitary gland and has an indirect effect on many others.

Types of Endocrine Glands

The endocrine glands are:

1 pituitary gland

1 thyroid gland

4 parathyroid glands

2 adrenal (suprarenal) glands

The pancreatic islets (islets of Langerhans)

1 pineal gland or body

1 thymus gland

2 ovaries in the female

2 testes in the male

The level of a hormone in the blood is variable and self regulating within its normal range. A hormone is released in response to a specific stimulus and usually its action reverses or negates the stimulus through a negative feedback mechanism. This may be controlled either indirectly through the release of hormones by the hypothalamus and the anterior pituitary gland, e.g. steroid and thyroid hormones, or directly by blood levels of the stimulus e.g. insulin and glucagons.

The effect of a positive feedback mechanism is amplification of the stimulus and increasing release of the hormone until a particular process is complete and the stimulus ceases, e.g. release of oxytocin during labour.

4.2 Hormones and their Specific Characteristics

4.2.1 Pituitary Gland

The pituitary gland and the hypothalamus act as units, regulating the activity of most of the other endocrine glands.

The Anterior Pituitary Gland

The anterior pituitary gland produces the thyroid stimulating hormone (TSH), the luteinizing (LH), the follicle stimulating hormone (FSH), the adreno corticotropic hormone (ACTH) and prolactin. The functions of the anterior pituitary gland hormones are as follows:

1. As a growth hormone, it stimulates growth of body tissues especially the long bones and skeletal muscles.
2. The TSH stimulates the growth of the thyroid gland.
3. The LH is a gonadotrophic hormone necessary for increasing the production of progesterone in females and testosterone in males.
4. The FSH is a gonadotrophic hormone necessary for increasing the production of oestrogen and maturation of ovum in females, and production of sperm in males.
5. Prolactin-Stimulates Milk Production.
6. The ACTH increases the secretion of steroid hormones by adrenal gland. It helps in regulating sleep pattern.

Oversecretion of the hormones of the anterior pituitary gland causes gigantism (very tall people) and acromegaly (coarse facial features, enlarged tongues and large hands and feet). Undersecretion causes dwarfism, lack of sexual development, obesity and sterility.

The Posterior Pituitary Gland

This is the part of the pituitary gland that produces oxytocin and vasopressin. The oxytocin controls uterine contraction and breast milk expulsion while prolactin stimulates milk production. The anti diuretic hormone or vasopressin reduces urine output by increasing the permeability to water of the distal convoluted and collecting tubules of the nephrones of the kidneys. The vasopressin constricts blood vessels and raises blood pressure. Undersecretion of the hormones of the posterior pituitary causes diabetes insipidus.

4.2.2 Pineal Gland

It produces melatonin which contributes to regulation of circadian rhythm of the body including sleep activity cycles. It also hinders the growth and development of sex organs before puberty.

4.2.3 Thyroid Gland

It produces throxine and triiodothyronine which increases metabolic rate, growth and maturation. Oversecretion causes thyrotoxicosis, while undersecretion causes cretinism in children and myxoedema in adults.

4.2.4 Parathyroid Gland

It produces parathormone which increases blood calcium level if low. Oversecretion causes reabsorption of calcium from the bones, thereby raising blood calcium level. This could lead to formation of stones in the bladder, muscle weakness and general fatigue. Undersecretion causes tetany which is characterized by vitamin D and calcium deficiencies, as well as strong painful spasms of skeletal muscles.

4.2.5 Adrenal Cortex

It produces steroid hormones from cholesterol. The hormones that it produces are collectively called corticosteroids, which are gluco cortocoids, mineralocorticoids and sex hormones. Glucocorticoids are essential for life, regulating metabolism and responses to stress. Mineralocorticoids produce aldosterone which maintains the water and electrolytes of the body by stimulating sodium reabsorption and potassium excretion. The sex hormone produces androgen similar to the ones produced by the testis. It reduces secretion of salts by the kidney. It also stimulate the liver to elevate blood sugar as well as causing increases in the in the metabolism of proteins and fats. Oversecretion of glucocorticoids cause Cushing's syndrome characterized by painful deposit of fats on the face (moon face), muscle wasting as a result of excessive protein catabolism among others. Undersecretion of glucocorticoids cause reduced glucose uptake and muscle weakness. Oversecretion of mineralocorticoids leads to excessive production of aldosterone causing excessive re-absorption of sodium chloride and water. It also causes excessive excretion of potassium leading to syncope and muscle weakness.

4.2.6 Adrenal Medulla

It produces epinephrine and norepinephrine. The effects of these hormones are similar to the effects of the sympathetic nervous system. They increase the heart rate, increases the blood pressure, divert blood to essential organs, increase the metabolic rate and dilate the pupils. This prepares the body for emergencies. The effects of oversecretion epinephrine and nor-epinephrine include deposition of fats in the lumen of blood vessels, hypertension, excess blood sugar, nervousness, etc. Underscretion of hormones of the adrenal medulla causes a reversal of the above conditions. Hyposecretion of mineralocorticoids leads to low production of aldosterone these results in failure of the kidneys to regulate sodium and potassium and water excretion, leading to hyponatraemia and hyperkalaemia these are called Addison's disease.

4.2.7 Pancreas

It produces insulin and glucagon. Insulin is required for reducing the blood levels of stored nutrients, especially glucose after absorption. The hormone increases the entry of glucose into cells as well as increasing the storage of fats. Glucagon increases conversion of stored fats to glucose. Undersecretion of insulin causes diabetes mellitus.

4.2.8 Ovaries

They produce oestrogen and progesterone. Oestrogen is necessary for promoting ovulation and promoting the development of female sexual characteristics, while progesterone maintains pregnancy.

4.2.9 Testis

They produce androgens which enable sperm production, growth of pubic hair, and male sexual characteristics.

Study Session Summary

In this Study Session, we examined endocrine system. In the process, we described hormones, and highlighted the functions of specific hormones in the human body. In conclusion, we presented how to distinguish between underproduction and overproduction of these hormones.

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Assessment

Assessments

SAQ 4.1 (tests Learning Outcomes 4.1, 4.2 and 4.3)

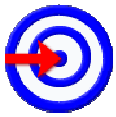
1. Describe hormones.
2. Highlight the functions of specific hormones in the human body.

Study Session 5

Consciousness

Introduction

Both lower and higher animals possess the characteristics of altered states of awareness at varying times. The degree of brain activity often affects the level of awakening of the organism which also influences the physical activity and mental alertness. This is largely a function of the neuro-chemical processes going on in the brain which affects perception of the internal and external environments. In this Study Session, we you will explore specific variations of consciousness, which include: sleep, dream, and hypnosis. This Study Session is therefore an effort to highlight the characteristic features of each of the states.



Learning Outcomes

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

5.1 determine the state of consciousness of an individual.
5.2 differentiate between types of sleep and stages of sleep.
5.3 relate the Freudian and activation-synthesis theories to the occurrence of dreams.

5.1 The State of Consciousness

Consciousness is the awareness of one's own mental processes. It can be thought as ranging along a continuum from total unconsciousness on one hand to high mental alertness on the other. The more we are of our thoughts, feelings, and reactions, the greater our level of consciousness.

States of consciousness means the noticeable variations in patterns and styles of awareness. If these patterns diverge from what we experience when wide awake and highly alert, we say that we are in an altered state of consciousness. Types of altered states of consciousness could be seen in terms of sleep, dream, and hypnosis.

5.2 Altered States of Consciousness

5.2.1 Sleep

It is possible for people to continue on a fairly regular sleep-wake cycle even though they could not tell what time of the day it was. The reason is that sleep wake cycle is an example of a circadian rhythm. This is a naturally occurring daily cycle in the body. But the internal clock that regulates your sleep wake cycle is set for 25 hours, not 24 hours (Moore-Ede & Czeisler, 1984). However, your sleep wake clock is reset daily, keeping you in tune with the 24-day on earth. Larger adjustments are fairly difficult to make; especially when one flies across different time

zones. One suffers a jet lag where, feeling tired is as a result of alteration of the normal circadian rhythm.

Stages of Sleep

During sleep, the body shows great changes in physiological arousal, and the brain undergoes a remarkable series of changes in electrical activity. These changes show that sleep occurs in several distinct stages. This could be observed on an electro encephalogram or EEG. To do this, small electrodes are placed on certain parts of a person's skull. The electrodes are connected to a machine that detects and magnifies the activity of nerve cells located in the cerebral cortex. These activities are recorded graphically as lines in different heights on a sheet of paper to represent the amplitude. The number of the ups and down lines per second is called the frequency. As you enter different planes during sleep, the amplitude and frequency of sleep change.

None Rapid Eye Sleep

Most of the stages of sleep we pass through fall under the category of Non Rapid Eye Movement (NREM) sleep. The eyes do not move rapidly during this stage of sleep. About 80% of an individual's sleeping time, especially during the first half of the night falls under the NREM sleep.

- **NREM Stage 1**

  Responsiveness to most stimuli is lost, thoughts begin to drift, if aroused; and the person still feels awake. It is characterized by lower amplitude and frequency in the brain and lasts between 1-7minutes.

- **NREM Stage 2**

  During this stage, the individual falls asleep. Thoughts will become short and fragmented. The brain shows fast frequency bursts of activity and giant amplitude waves.

- **NREM Delta Sleep**

  This stage is usually commenced within 30 to 45 minutes after falling into sleep. This is the period when one enters into the deepest sleep. The delta stage is the period when it is most difficult to awaken someone from sleep. The total amount of time spent in delta sleep varies according to age, the younger a person is the more time the person spends in delta sleep. There is a greater pituitary gland secretion of growth hormone during delta sleep.

Rapid Eye Movement Sleep

During the remaining 20% of sleeping time, the eyes move rapidly back and forth beneath the closed eyelid. This is called the Rapid Eye Movement (REM) sleep. It is during this stage that one experiences most vivid dreams.

During sleep, one passes into NREM quickly. After spending a few minutes to an hour in delta sleep, the individual returns to stage 2 sleep and from there may enter into REM period. This means that the average person has several periods of delta sleep during a night. There is a continuous alteration between the NREM and REM throughout the

course of a night sleep. About 95% of people sleep between six and a half to nine and a half hours per night.

Tip

REM occurs about 30-90 minutes through the night. It involves movement from NREM stage 2 into REM sleep, remaining there for a period between 15 minutes and one hour at a time. As the night progresses, the REM period often becomes longer especially in the second half of the night. The heart rate, breathing and oxygen consumption increases.

Sleep Disorders

Disorders of sleep include narcolepsy which is a condition characterized by unexpected periods of sleep during the day. Some other people could suffer night terrors, which are experiences of intense anxiety from which a person awakens screaming in terror. Other sleep disorders include sleep talking, sleep walking and insomnia.

Insomnia

For the vast majority of us, the sleep-wake cycle operates reliably day after day, without our giving it thought. However, there are a few others that suffer sleep disorders. One of the most common disorders of sleep is insomnia. Insomnia involves difficulty going to sleep or staying asleep for the night. Insomnia is more often caused by psychological problems than physical ones.

Causes of Insomnia

Insomnia is usually caused by one or combination of the following problems.

1. Unusual stress and anxiety arising from personal, financial, marital disharmony, school or work-related problems.
2. Intractable or chronic pain
3. Change in sleep schedule
4. Excessive or dependent use of drugs, e.g. tranquilisers, sedatives, or alcohol at bedtime
5. Sleep apnoea. This is a respiratory problem where a sleeping person literally stops breathing during sleep and then wakes up to start breathing again
6. Unknown (idiopathic) causes

Treatment of Insomnia

The two main treatment methods of treatment of insomnia include drug treatment called chemotherapy and the second method is called psychotherapy.

1. Drug Treatment of Insomnia

People with insomnia feel very sleepy during the daytime; many of them consider this the most serious aspect of the problem. In order to get the rest they need at night, many people with insomnia self medicate with tranquilisers. Even when physicians prescribe barbiturates to treat insomnia, there is the risk of addiction. Today, drugs called benzodiazepines and minor tranquilisers are used in treating insomnia.

The drugs should be used for a short time to prevent dependence, daytime drowsiness and mild depression.

2. Psychological Treatment of Insomnia

Insomnia is often caused by excessive worrying, thinking and restlessness; psychologists have thus, developed behavioural programmes to help people overcome these problems (Borkovec, 1982).

One of such programme is called progressive relaxation. It is designed to get insomniacs to relax all the muscles of the body and thus to eliminate the physical tension that often contributes to sleeplessness.

Another method is stimulus control. Although we do not like to think that our actions are controlled by environmental cues around us, however, this is in fact very often the case. If you suffer from insomnia, getting into bed may be a cue for beginning to worry that you are about to spend another sleepless night. This worry contributes to the worry that the person should overcome. In other words, "going into bed" is a stimulus for sleeping, not for worrying. Going to bed is never associated with thoughts and behaviours that can prevent sleep.

Visual imagery could also be used to control insomnia especially among people who likes to watch movies or television before going to bed. Under this technique, familiar objects such as colour drawings of six common objects like a candle, a blackboard, a kite, a lightbulb, a bowl of fruit etc. could be shown to the treatment participants. They would be asked to imagine each of them in a great deal for two minutes. The participants are then advised to practice this twice daily, once during the daytime and at bedtime. This technique is capable of relieving insomnia by helping the individual to stop worrisome thoughts.

5.2 Dream

This is an unconscious mental experience, which is usually in the form of a sequence of ideas, images, and imaged events, often accompanied by emotions during REM sleep. Most people dream in the night even though may not be able to recount this on waking up in the morning. Dreams often seem bizarre because they disregard physical laws and the way we normally behave. Experiences that we never had in real life such as jumping to the top of a building could be encountered in dreams.

Psychological Theories Related to Dreams

1. According to Freudian theory, we experience many unacceptable desires that we can not deal with because they cause us too much anxiety. Our defense is to repress these thought provoking wishes.- to push them back into the unconscious. Freud (1900) believed that dreams are full of symbols that represent the thoughts and desires that we have locked away in the unconscious, and interpreting these symbols is one way of discovering submerged ideas and feelings.
2. According to Hobson and McClarley's (1977) activation synthesis theory, dreaming is caused by nothing more than random activity in the brain. Their theory holds that certain neurons in the pons of the brain are activated during REM sleep. The pons then sends millions

of random nerve impulses up to the cortex. The cortex tries to make sense of these incoming signals, just as it would of the signals from the body and sense organs. The result is a series of often disjointed feelings, perceptions, imagined movements, and changing scenes that we define as dreams.

Most present day dream researchers argue that dreams are usually a continuation of our waking thoughts and concerns rather than symbols of unconscious desires (Cohen, 1979).

5.3 Hypnosis

A state of hypnosis involves being put into a trance state that is qualitatively different from any other conscious state. In a state of hypnosis, the person could perform suggested behaviours that are no longer under conscious or voluntary control. Others disagree with the above viewpoint (Spanos, 1986). They rather suggest that hypnosis involves nothing more than an attempt to create pressures so that a subject will conform and perform suggested behaviours. A hypnotized person may be in a unique state of divided consciousness.

Study Session Summary

Summary

In this Study session you learned that consciousness is the awareness of one's own mental processes. It can be thought as ranging along a continuum from total unconsciousness on one hand to high mental alertness on the other. Variations about states of consciousness, or types of altered states of consciousness could be seen in terms of sleep, insomnia, dream, and hypnosis.

During sleep, the body shows great changes in physiological arousal, and the brain undergoes a remarkable series of changes in electrical activity. These changes show that sleep occurs in several distinct stages which include NREM Stage 1, NREM Stage 2, NREM Delta Sleep and REM.

We also noted that insomnia involves difficulty going to sleep or staying asleep for the night. It could be caused by unusual stress and anxiety The two main treatment methods of treatment of insomnia include chemotherapy and the second method is called psychotherapy. We observed that a dream is an unconscious mental experience, which is usually in the form of a sequence of ideas, images, and imaged events, often accompanied by emotions during REM sleep; and a state of hypnosis involves being put into a trance state that is qualitatively different from any other conscious state.

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Assessment

Assessment

SAQ 5.1 (tests Learning Outcomes 5.1, 5.2 and 5.3)

1. Mary has been alseep for 3 hours. As she continues to sleep, we can expect that _____ sleep will diminish and that _____ sleep will increase in duration.
   A. stage 4, stage 3
   B. stage 3, stage 4
   C. stage 4, REM
   D. REM, stage 3

2. Steve has not slept for 72 hours. It is increasingly likely that she will be more susceptible to:
   A. viral infections
   B. sleep apnea
   C. insomnia
   D.dissociations

3. Which of the following sleep disorders would be the most incapacitiating for a commercial airline pilot?
   A. night terrors
   B. insomnia
   C. sleep walking
   D. narcolepsy

4. Those who study hypnosis agree that it is a state of:
   A. amnesia
   B. REM sleep
   C. heightened suggestibilty
   D. physiological arousal

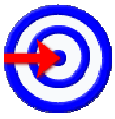
5. According to Freud, the personally threatening and censored meaning of a dream is its:
   A. manifest content
   B. dissociated content
   C. latent content
   D. hallucinatory content

Study Session 6

Drugs and Awareness

Introduction

This Study Session discusses the relationship between some drugs and brain functioning. Many millions of people use drugs to change their level of awareness, mood, and feelings. In many situations, these drugs are not prescribed by a qualified medical practitioner, i.e. self medicated, self procured, and self administered. This could be regarded as drug abuse, and it could lead to drug dependence and addiction.



Learning Outcomes

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

6.1 identify drugs that affect awareness.
6.2 highlight the effect of drugs on awareness.
6.3 explain the treatment of drug abuse.

6.1 Drug Abuse

Most of the drugs that are abused produce distortions of sensory experiences. The distortions resemble certain synaptic transmitters closely enough to attach to their receptors. Depressants such as alcohol, heroin, or morphine depress the activity of the central nervous system and result in feelings of relaxation, apathy, and decreased attention. Stimulants such as marijuana produce visions of imaginary perceptions by acting on chemicals in the brain. Hallucination is a condition where an individual perceives something which is not a true perception nor actually as a result of stimulation of a sense organ. High doses of marijuana sometimes produce hallucinations.

6.2 Related Terminologies to Drug Abuse

6.2.1 Psychotropic substances

These are drugs that affect mental experiences or behaviour. They are also called psychoactive substances.

6.2.2 Substance / Drug Abuse

This means non-medical use of substances or drugs, including both drugs that have and those that do not have generally accepted medical value. Drug abuse could also be defined as the consumption of a drug apart from medical need or in unnecessary quantities. Its nature and significance may be considered from two points of view: one relates to the interaction between the drug and the individual, the other to the interaction between drug abuser and society.

6.2.3 Tolerance

It means that the body builds up a resistance to the drug so that larger and larger doses are needed to produce the same behavioural effect.

6.2.4 Drug Addiction

This is a state of periodic or chronic intoxication produced by the repeated consumption of a drug (natural or synthetic).

Its characteristics include:

i. an overpowering desire or need (compulsion) to continue taking the drug and to obtain it by any means;
ii. a tendency to increase the dose;
iii. a psychic (psychological) and generally a physical dependence on the effects of the drug; and
iv. detrimental effects on the individual and on society.

6.2.5 Drug Habituation

This is a condition resulting from the repeated consumption of a drug. Its characteristics include:

i. a desire (but not a compulsion) to continue taking the drug for the sense of improved well-being which it engenders;
ii. little or no tendency to increase the dose;
iii. some degree of psychic dependence on the effect of the drug, but absence of physical dependence and hence of an abstinence syndrome (withdrawal), and
iv. detrimental effects, if any, primarily on the individual.

6.2.6 Withdrawal Symptom

This is the effect of stopping a drug that has produced addiction. A chronic smoker who stops smoking will probably suffer headaches and feel irritable. Depending on the drug, withdrawal symptoms may include nausea, body pains, and delusions.

6.2.7 Psychotropic Drugs and Neurotransmitters

Neurotransmitters are chemical substances in the nervous system of the body that carry messages between brain cells. Some stimulants such as amphetamines and cocaine increase the amount of neurotransmitters. This increase results in more messages, more stimulation, and feelings of arousal and alertness. Some depressants such as heroin and morphine, replace the naturally occurring neurotransmitters with an enormous amount of similar acting chemicals. The result of this dramatic chemical replacement is to inhibit functioning of the brain cells that produce relaxation and apathy. One of the primary ways that drugs produce physiological and behavioural changes is by affecting the neurotransmitters that control the number of messages flowing between brain cells.

6.2.8 Depressants

Depressants are ... An example of depressants is alcohol. Alcohol is broken down by the liver at the rate of one per hour. A person with a

blood alcohol level (BAL) of 0.1% is considered legally drunk, but may not misbehave. Once the BAL rises to about 0.4%, the individual will become less inhibited, more relaxed and talkative. If the BAL continues to rise, coordination will be lost, the person will begin to talk loudly, and feel intoxicated.

Alcohol is thought to affect various chemicals that regulate the functioning of the brain (Loomis, 1982). The net result is that alcohol is a depressant; it acts to depress the central nervous system. People have the feeling of being more relaxed, talkative or social after several drinks because alcohol is inhibiting brain cells, not stimulating them. Prolonged and heavy drinking may destroy brain cells.

6.2.9 Stimulants

Stimulants are ... The major reason for the popularity of cocaine, which is often snorted through the nose, is the ability to produce bursts of energy, arousal, and alertness. Users tend to feel euphoric, self confident, and certain that they are thinking more clearly. People that use cocaine often over-estimate their potentials or the quality of their work. The main difference between cocaine and amphetamine is that cocaine is short acting (10-30minutes) while the effect of amphetamine may last for several hours.

Caffeine is far less powerful than cocaine. It is a stimulant that affects the autonomic nervous system and produces symptoms as increased heart rate and a mild feeling of alertness and arousal. Drinking 5-6 cups of caffeine a day may cause sleeplessness, depression and heart problems.

Nicotine which is present in tobacco is a mild stimulant. It increases heart rate to be 8-10 times faster than non smokers'. It improves concentration, short term memory, and other cognitive skills (Edwards, 1986). However, the regular use of nicotine results in addiction and this makes stopping smoking very difficult.

6.3 Treatment of Drug Abuse

How to Treat Drug Abuse

1. Reassure the patient that it is possible to stop abusing substances.
2. Link the patient up with alcohol / narcotic anonymous groups.
3. It may be necessary to enter an inpatient treatment center.
4. Encourage patient detoxification for about two weeks.
5. Identify and deal with psychosocial problems encouraging drug use.

Study Session Summary

Summary

In this Study Session we noted that many people use drugs to change their level of awareness, mood, and feelings. In many situations, these drugs are not prescribed by a qualified medical practitioner, i.e. self procured and self administered. This could be regarded as drug abuse which could lead to drug dependence and addiction. The Study Session went further to discuss related terms to drug abuse, which includes: psychotropic substances, substance abuse, tolerance, drug addiction, drug habituation and stimulants amidst others.

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Assessment

Assignment

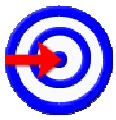
1. Mention 3 drugs that influence awareness in people.
2. Describe how any of the drugs identified affect awareness.
3. Highlight the methods by which drug abuse could be reduced in the society.

Study Session 7

Perception and Sensation

Introduction

In this Study Session, you will explore theories related to sensation and perception. Although intimately related, sensation and perception play two complimentary but different roles in how we interpret our world. Sensation refers to the process of sensing our environment through touch, taste, sight, sound, and smell. This information is sent to our brains in raw form where perception comes into play. Perception is the way we interpret these sensations and therefore make sense of everything around us. Through this session, you will construct ideas of how our senses work and how this information is organized and interpreted.



Learning Outcomes

When you have studied this session, you should be able to:

7.1 Define and use correctly the terms in bold:

- **perception**
- **sensation**
- **perceptual constancy**
- **form perception**
- **motion perception**
- **absolute threshold**
- **difference threshold**
- **sensory adaptation**

7.2 point out the organs of perception.

7.1 The Meaning of Perception

The Oxford Dictionary of Psychology defines perceive as "to become aware of something through the senses, or to comprehend or grasp a stimulus." A sense is any of the faculties by which one experiences the external world or the internal state organ. **Perception** could therefore be defined as the process, act, or faculty of perceiving. It involves the neurological processes by which such recognition and interpretation are effected. In sum, perception means insight, intuition, or knowledge gained by perceiving, as well as the capacity for such insight.

7.1.1 Relationship between Perception and Nervous System

Perception arises from the subjective experiences of objects or events that ordinarily result from stimulation of the receptor organs of the body. This stimulation is transformed or encoded into neural activity (by specialized receptor mechanisms). The stimulus is relayed to more central regions of the nervous system where further neural processing occurs. Most likely, it

is the final neural processing in the brain that underlies or causes perceptual experience, and so perception like experiences can sometimes occur without external stimulation of the receptor organs, as in dreams.

7.1.2 Perception and Psychology

In contemporary psychology, interest generally focuses on perception or the apprehension of objects or events, rather than simply on sensation or sensory process. While no sharp line of demarcation between these concepts exists, it is fair to say that sensory qualities are generally explicable on the basis of mechanisms within the receptor organ, whereas object and event perception entails higher-level activity of the brain.

7.1.3 Terms related to Perception and Sensation

Perceptual Constancy

This means that the perceptual properties of objects remain remarkably constant despite variations in distance, slant, and retinal locus caused by movements of the observer. Examples of perceptual constancy are: size (except at very great distances, an object appears the same size whether seen nearby or far away, although the size of its image on the retina can be very different); shape (a circle seen from the side is perceived as a circle, although it appears as an ellipse on the retina); orientation (objects appear to keep the same orientation in space, independently of the orientation of the observer's head); and position (a fixed object remains perceived as stationary even when its image on the retina moves because of eye or head movements)

Form Perception

This means the experience/ recognition of a shaped region in the field. Recognition means the experience that the shape is familiar. Identification means that the function or meaning or category of the shape is known. For those who have never seen the shape before, it will be perceived but not recognized or identified. For those who have, it will be perceived as a certain familiar shape and also identified. Recognition and identification obviously must be based on past experience, which means that through certain unknown processes, memory contributes to the immediate experience that one has, giving the qualities of familiarity and meaning.

Motion Perception

Perceived movement cannot simply be explained by the motion of an object's retinal image since image motion caused by observer or eye movement does not lead to perceived object movement. Moreover, an object tracked by smooth-pursuit eye movements will appear to move, although in that case there is essentially no motion of the object's image over the retina. Similarly, an afterimage will appear to move during eye movement even in a completely darkened room. Where ordinarily the movement of the retinal image caused by the moving eye is computed to signify “no object motion,” thus yielding position constancy (since the image motion and eye motion are equal in magnitude), the same

computational rule must signify "object motion" in the case of the afterimage.

Absolute Threshold

The absolute threshold is the point where something becomes noticeable to our senses. It is the softest sound we can hear or the slightest touch we can feel. Anything less than this goes unnoticed. The absolute threshold is therefore the point at which a stimulus goes from undetectable to detectable to our senses.

Difference Threshold

Once a stimulus becomes detectable to us, how do we recognize if this stimulus changes? When we notice the sound of the radio in the other room, how do we notice when it becomes louder. It's conceivable that someone could be turning it up so slightly that the difference is undetectable. The difference threshold is the amount of change needed for us to recognize that a change has occurred. This change is referred to as the Just Noticeable Difference.

Signal Detection Theory

Have you ever been in a crowded room with lots of people talking? Situations like that can make it difficult to focus on any particular stimulus, like the conversation we are having with a friend. We are often faced with the daunting task of focusing our attention on certain things while at the same time attempting to ignore the flood of information entering our senses. When we do this, we are making a determination as to what is important to sense and what is background noise. This concept is referred to as signal detection because we attempt detect what we want to focus on and ignore or minimize everything else.

Sensory Adaptation

The last concept refers to stimuli which has become redundant or remains unchanged for an extended period of time. Ever wonder why we notice certain smells or sounds right away and then after a while they fade into the background? Once we adapt to the perfume or the ticking of the clock, we stop recognizing it. This process of becoming less sensitive to unchanging stimulus is referred to as sensory adaptation, after all, if it doesn't change, why do we need to constantly sense it?

7.2 Organs of Perception

Since objects or events are not experienced only through vision, the term perception obviously applies to other sense modalities as well. Certainly objects and their movement may be experienced through the sense of touch. Such experiences derive from receptors in the skin (tactile perception), but more importantly, from the positioning of the fingers with respect to one another when an object is grasped, the latter information arising from receptors in the muscles and joints (haptic or tactual perception). The position of the parts of the body are also perceived with respect to one another whether they are stationary (proprioception) or in motion (kinesthesis). Furthermore, the position of the body is experienced with respect to the environment through

receptors sensitive to gravity, such as those in the vestibular apparatus in the inner ear. Auditory perception yields recognition of the location of sound sources and of structures such as melodies and speech. Other sense modalities such as taste (gustation), smell (olfaction), pain, and temperature provide sensory qualities but not perceptual structures as do vision, audition, and touch, and thus are usually dealt with as sensory processes.

Study Session Summary

Summary

In this Study Session, you explored the concept of sensation. Sensation refers to the process of sensing our environment through touch, taste, sight, sound, and smell. Perception is the way we interpret these sensations and therefore make sense of everything around us. The organs of perception include the eyes, ears, skin, nose, and tongue. In contemporary psychology, interest generally focuses on perception or the apprehension of objects or events, rather than simply on sensation or sensory process.

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Assessment

Assignment

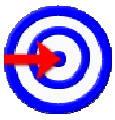
1. Anaylze the relationship between perception and the nervous system.
2. Identify the organs of perception.
3. Explain seven terms related to perception and sensation.

Study Session 8

The Eyes and Vision

Introduction

The sense of vision is one of the five classical senses which assume greater importance than any other sensory system. This Study Session will therefore expose you to how we obtain more information about our environment via what we see than what we hear or smell. The brain is also involved in vision-related activities than other activities of sensory perception.



Learning Outcomes

When you have studied this session, you should be able to:

8.1 describe the human eye.
8.2 point out the functions of at least three specific areas in the eye.

8.1 The Eye and Sight

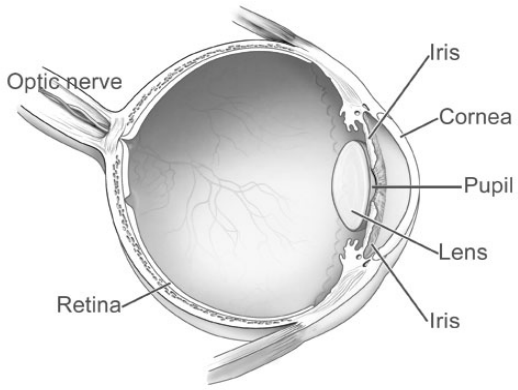
The eye is the organ of the sense of sight situated in the orbital cavity. It is supplied by the optic nerve. It is almost spherical in shape and is about 2.5cm in diameter. The space between the eyes and the orbital cavity is occupied by the adipose/fatty tissue. The bony wall of the orbit and the surrounding fat protect the eye from injury.

Structurally, the two eyes are separate but unlike the ears some of their activities are coordinated so that they function as a pair. It is possible to see with only one eye but three dimensional vision is impaired when only one eye is used, especially in relation to distance.

8.2 Layers of the Eye

There are three layers of tissue of the eye: The outer fibrous layer is made of sclera and the cornea. The middle vascular layer or uveal tract is made of the choroid, ciliary body and iris. The inner nervous tissue is made up of retina. The structures inside the eyeball are the lens, aqueous fluid/ humor and vitreous fluid / humor.

Fig 8.1 Human Eye *showing the functional areas*



Tip

The human eye captures electro-magnetic changes in form of light waves but, it cannot detect waves like X-ray, ultraviolet radiation and infra red rays. The human eye can see a source of light that is as faint as a candle from a distance of about 17 miles.

8.2.1 The Outer layer

The sclera

This is the white of the eye forms the outermost layer of tissue of the posterior and lateral aspects of the eyeball and is continuous anteriorly with the transparent cornea. The tough fibrous tissue preserves the shape of the eyeball and also protects the delicate inner layers.

Cornea

The cornea is transparent and in front. It is allows the passage of light rays to focus on the retina. The extrinsic muscles attached to the sclera permits and limits movements of the eyeball within the orbit.

8.2.2 The Inner Layer

The Choroid

The choroid lines the posterior 5/6th of the inner surface of the sclera. It is very rich in blood vessels and it is deep chocolate brown in colour. Light enters the eye the pupil, stimulates the nerve endings in the retina and is then absorbed by the choroids.

The Ciliary Body

It is the anterior continuation of the choroids. It consists of ciliary muscles and secretory epithelial cells. It gives attachment to the suspensory ligament, which at its other end is attached to the capsule enclosing the lens. Contraction and relaxation of the ciliary muscle changes the thickness of the lens which bends or refracts light rays entering the eye to focus them on the retina. The epithelial cells secret aqueous fluid into the anterior chamber of the eye.

The Iris

This is the visible coloured part of the eye which extends anteriorly from the ciliary body, lying behind the cornea in front of the lens. It divides the anterior segment into the anterior and posterior chambers which contain aqueous fluid secreted by the ciliary body. It is a circular body composed of pigment cells and two layers of smooth muscle fibers. At the center of the iris is the pupil. Parasympathetic stimulation constricts the pupil and sympathetic stimulation dilates it. The amount of pigment cells in the iris is genetically determined. This determines the colour of the iris. Albinos have no pigment cells, and people with blue eyes have fewer pigment cells than people with brown eyes.

8.2.3 The Inner Layer

The Lens

This is a highly elastic, circular bi convex body lying immediately behind the pupil. It consists of fibers enclosed within a capsule. It is suspended from the ciliary muscle by the suspensory ligament. Its thickness is controlled by the ciliary muscle through the suspensory ligament.

The lens bends (refracts) light rays reflected by the objects in front of the eyes. The nearer the object to be viewed is, the thicker the lens becomes to allow focusing.

Retina

The retina is the innermost layer of the wall of the eye. It is an extremely delicate structure which adapts by stimulation with light rays. The area that is highly sensitive to light is the layer of sensory receptor cells, the rods and cones. The retina lines about ¾ of the eyeball and is thickest at the back and thins out anteriorly to end just behind the ciliary body. Near the center of the posterior part is the macula lutea, or yellow spot. In the center of the area there is a little depression called the fovea centralis, consisting of only cone shaped cells. The rods and cone contain photosensitive pigments that convert light rays into nerve impulses. The optic disc is the place where the optic nerve leaves the retina.

Note

The anterior segment of the eye, i.e. the space between the cornea and the lens, is incompletely divided into anterior and posterior chambers by the iris. Both chambers contain a clear queous fluid secreted into the posterior chambers by ciliary glands.

8.3 Physiology of Sight

Light is reflected into the eyes by objects within the field of vision. Light is a combination of all the rainbow colours which is reflected from objects within the visual field, and is focused on the retina of each eye. The process involves refraction of light rays, changing the size of the pupils and accommodation of the eyes.

8.3.1 Refraction of Light Rays

Refraction means to make a ray of light change direction when it enters at an angle. For example, in the eye the biconvex lens bends and focuses light rays on the retina. Before reaching the retina, light rays pass successively through the conjuctiva, cornea, aqueous fluid, lens and vitreous body. To increase the refractory power, the ciliary muscle contracts, releasing its pull on the suspensory ligament and the anterior surface of the lens bulges forward, increasing its convexity this focuses light rays on the retina. When the ciliary muscle relaxes it slips backwards, increasing its pull on the suspensory ligament, making the lens thinner. This focuses light rays from distant objects on the retina.

8.3.2 Changing the Size of the Pupils

Pupil size influences accommodation by controlling the amount of light entering the eye. In a bright light, the pupils are constricted. In a dim light they are dilated.

If the pupils are dilated in a bright light, too much light would enter the eye and damage the sensitive retina. In a dim light, if the pupils were constricted, insufficient light would enter the eye to activate the photosensitive pigments in the rods and cones which stimulate the nerve endings in the retina. Contraction of the circular muscles of the iris constricts the pupil, and contraction of the radiating muscles of the iris dilates it. Sympathetic stimulation dilates the pupils and the parasympathetic stimulation causes constriction.

8.3.3 Accommodation

Accommodation of the eyes to light in close vision (i.e. about 6 meters) involves constriction of the pupils, convergence of the eyeballs and changing the power of the lens. Constriction of the pupils assists accommodation by reducing the width of the beam of light entering the eye so that it passes through the central curved part of the lens. In order for the eyes to converge, extraocular muscles move the eyes. To obtain a clear image they rotate the eyes so that they converge on the object viewed. This coordinated muscle activity is under autonomic control. When there is voluntary movement of the eyes, both eyes move and convergence is maintained. The nearer an object is to the eyes the greater the eye rotation needed to achieve convergence, e.g. an individual focusing near the tip of his nose appears to be cross-eyed. Additionally, the lens is thick for near vision and is thinnest when focusing on an object that is at 6 meters distance. For objects farther than 6 meters from the eyes, such objects are focused directly on the retina without adjustment.

Dark Adaptation

When exposed to bright light, the rhodopsin within the sensitive rods is completely degraded. This is not significant until the individual moves into a darkened area where the light intensity is insufficient to stimulate the cones, and temporary visual impairment results whilst the rhodopsin is being regenerated within the rods. The cones are sensitive to bright light and colour.

Study Session Summary

Summary

We have explored the sense of vision in this Study Session. We obtain more information about our environment in what we see than what we hear or smell. The brain is involved in vision related activities than other sensory perception activities. The eye is the organ of the sense of sight situated in the orbital cavity. There are three layers of tissue of the eye: the outer fibrous layer which is made of sclera and the cornea; the middle vascular layer or uveal tract that is made of the choroid, ciliary body and iris; and the inner nervous tissue which composes of retina. The structures inside the eyeball are the lens, aqueous fluid/ humor and vitreous fluid / humor.

We also discussed that light is a combination of all the rainbow colours, and it is reflected into the eyes by objects within the field of vision. Light is reflected from objects within the visual field, and is focused on the retina of each eye.

Assessment

Assessment

You can assess how well you have achieved the Learning Outcomes of this Study Session by answering the questions that follows. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You may check your answers with the Notes on the Self-Assessment Questions at the end of this Manual.

SAQ 8.1 (tests Learning Outcome 8.1)

Assuming that you have been asked to compare the human eye to a photographic camera,

A. identify the organ of the eye that corresponds to the camera's lens.
B. spot the eye's organ that corresponds to the camera's aperture.
C. identify the eye's organ that corresponds to the camera's film paper.

SAQ 8.2A (tests Learning Outcome 8.2)

As a scientist, you discover on examination of the eyes of two individuals, A and B; that A had significantly greater ratio of rods to cones than B. Which of the following options would be the likely conclusion of your finding?

a) A had better night vision than B.
b) B had better night vision than A.
c) A had better day vision than B.
d) None of the above.

SAQ 8.2B (tests Learning Outcome 8.2)

If the scientist however finds that Mr. A can perceive near objects better than far objects, what might be would have been the initial conclusion?

a) the cones have been damaged
b) the ciliary muscles may be weak
c) the cornea is dirty
d) the lens is too small.

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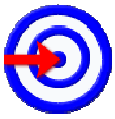
Study Session 9

The Ears and Hearing

Introduction

One of the stimuli that the nervous system is sensitive to is sound. The perception and response of people to sound waves is a cardinal function of human beings. We will therefore focus on the organ of hearing and the physiology of hearing in this Study Session.



Learning Outcomes

When you have studied this session, you should be able to:

9.1 outline the process of sound.
9.2 describe the parts of the human ear.
9.3 discuss the physiology of hearing.

9.1 Sound

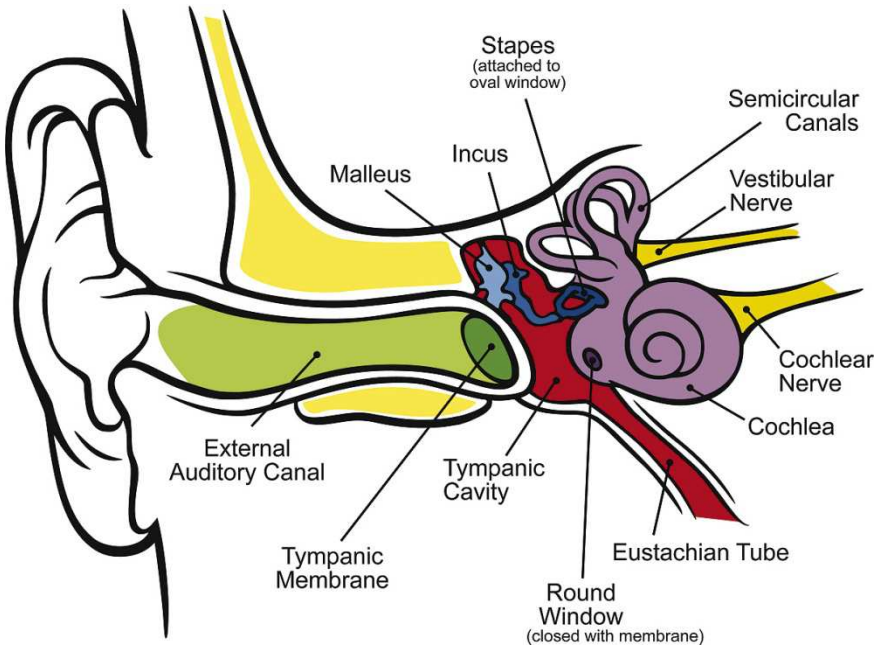
If you snap your fingers, you will hear a crack. This sound comes from waves of air that were compressed and expanded by the quick movement of your fingers. If you could see sound waves, you might compare them to the ripples on a lake. Each ripple that made is each time air is compressed and expanded is called a cycle. You can tell the difference between low and high sounds by their pitch. The pitch is determined by the number of cycles that occur per second. The low pitched sound of a bass has fewer cycles per second than the high pitch of a door bell. The term frequency is used to express the number of cycles per second. The average person hears frequencies from 20 to 20,000 cycles per second.

With normal aging, we lose the ability to detect the very highest of these frequencies, such that by age seventy, many people have trouble hearing sounds above 6,000 cycles. The loudness of a sound is determined by the height or amplitude of the sound wave and is measured in units called decibels. A whisper is about 30 decibels whereas the usual live band blasts about 110 decibels. The higher the decibel level, the more intense the sound and the greater the danger of damaging the organs of hearing. This is why people that work near noisy equipment are always advised to wear ear protecting equipment.

9.2 Structure of the Ear

The ear is divided into 3 distinct parts: outer ear, middle ear (tympanic cavity), and the inner ear.

Fig 9.1 Human Ear



9.2.1 The Outer Ear

It consists of the auricle (pinna) and the external acoustic meatus. The auricle is the expanded portion projecting from the side of the head. The external acoustic meatus (auditory canal) is a slightly s-shaped tube of about 2.5 cm long extending from the auricle to the ear drum. There are numerous sebaceous and ceruminous glands in the skin of the lateral third. The ceruninous glands produce a sticky material (cerumen) which traps dust, insects etc. The tympanic membrane (ear drum) completely separates the external acoustic meatus from the middle ear.

9.2.2 The Middle Ear

When sound waves strike the ear drum, it causes it to vibrate. This sets in motion three tiny bones, the malleus (hammer), incus (anvil) and the stapes (stirrups) so named because of their shapes. Each of these act as a lever increasing the pressure on the next, until the pressure exerted by the stirrup is many times greater than what the hammer exerts. The stirrups press against a membrane called the oval window, which lies at the end of the middle ear. Because the oval window is much smaller than the ear drum, and because of the lever effects that the three tiny bones create, the oval window receives much more pressure per square millimeter than the ear drum does. This increased pressure is needed to move the fluid in the next chamber of the ear.

9.2.3 The Inner Ear

The inner ear or labyrinth contains the organ of hearing and balance. It is generally described in two parts, the bony labyrinth and the membranous labyrinth. The bony labyrinth is larger than, and encloses the membranous labyrinth of the same shape which fits into it, like a tube within a tube. Between the bony and membranous labyrinths there is a

layer of watery fluid called the perilymph and within the membranous labyrinth, there is the endolymph.

- The bony labyrinth consists of: 1 vestibule, 1 cochlear and 3 semi circular canals. The vestibule contains the oval and round windows in its lateral wall. The cochlear resembles a snail's shell. The semi circular canals are three tubes arranged so that one is situated in each of the three planes of space. They are continuous with the vestibule.
- The membranous labyrinth lies in the bony labyrinth. It contains endolymph and comprises of the vestibule, cochlear and the three semi circular canals. A cross section of the cochlear contains three compartments: the scala vestibule, the scala media and the scala tympani.
  On the base of this triangle called the basilar membrane, there are supporting cells and specialized cochelar hair cells containing auditory receptors. These cells form the spiral organ of corti, which is the sensory organ that responds to vibration by initiating nerve impulses that are then perceived as hearing by the brain. The auditory receptors are dendrites of efferent nerves that combine forming the cochlear (auditory) part of the vestibulocochlear nerve, to the hearing area in the cerebrum where the sound is perceived and to various nuclei in the pons and in the midbrain.

9.3 Physiology of Hearing

Sound waves generated e.g. by playing a record are changed into nerve impulses by the nerve cells in the inner ear. Nerve cells leave the cochlear via the auditory nerve. From there they travel to the thalamus and then to the primary auditory area located in the temporal bone of the cortex. If the nerve impulse of the music stops at the primary auditory area, tones of different pitches and degrees of loudness would be heard, but not the melody.

Sound waves have properties of pitch and volume, or intensity. Pitch is determined by the frequency of the sound waves and is measured in hertz (Hz). The volume depends on the amplitude of the sound waves and is measured in decibels (dB). Very loud noise is damaging to the ear because it damages the sensitive hair cells of the spiral organ.

Because of the structure of the inner ear, sounds of different frequencies stimulate the basilar membrane at different places along its length allowing discrimination of pitch. Additionally, the greater the amplitude of the wave created in the endolymph, the greater the stimulation of the auditory receptors.

Study Session Summary

Summary

The ears and sense of hearing were our focus in this Study session. The ear is divided into 3 distinct parts: outer ear, middle ear (tympanic cavity), and the inner ear. The Outer ear consists of the auricle (pinna) and the external acoustic meatus. The middle ear contains the oval window, round window and the auditory ossicles.

When sound waves strike the ear drum, it causes it to vibrate. Sound waves generated are changed into nerve impulses by the nerve cells in the inner ear. Nerve cells leave the cochlear via the auditory nerve. From there they travel to the thalamus and then to the primary auditory area located in the temporal bone of the cortex.

Assessment

Assessment

When sound waves strike the ear drum, it causes it to vibrate. Sound waves generated are changed into nerve impulses by the nerve cells in the inner ear. Nerve cells leave the cochlear via the auditory nerve. From there they travel to the thalamus and then to the primary auditory area located in the temporal bone of the cortex.

Sound waves have properties of pitch and volume, or intensity. Pitch is determined by the frequency of the sound waves and is measured in hertz (Hz). The volume depends on the amplitude of the sound waves and is measured in decibels (dB).

You can assess how well you have achieved the Learning Outcomes of this Study Session by answering the questions that follows. You may check your answers with the Notes on the Self-Assessment Questions at the end of this Manual for feedback.

SAQ 9.1 (tests Learning Outcome 9.1)

One of the following statements describing the outer part of the human ear appears wrong. Detect the wrong one.

a) The Outer Ear consists of the auricle (pinna) and the external acoustic meatus.
b) The auricle is the slightly s-shaped tube extending from the outside to the ear drum.
c) The ceruninous glands in the outer ear produce a sticky material (cerumen) which traps dust, insects etc.

SAQ 9.2A (tests Learning Outcome 9.2)

Assuming that as a psychologist, you notice that an individual has partial hearing impairment, such that s/he can hear sounds of higher than lower loudness, that is, sounds of certain amplitudes. On examination of the ears, you find that the inner ears are intact, but not the organs of the

middle ear. You then decide to refer her/him to an ear specialist for hearing aids. What might be your best assumption?

a) structures in the inner, as well as the middle ears are impaired.
b) the structures of the inner ear might be impaired.
c) the structures of the middle ear are not functioning to conduct sounds properly.
d) the structures of the outer ear are the likely impaired.

SAQ 9.2B (tests Learning Outcome 9.2)

Given the above scenario, what would you intend the hearing aid to help achieve?

a) help the structures of the outer ears to better catch sounds and transmit them to the middle ears.
b) enable the middle ear structures beat harder.
c) enable structures of the inner ears to better conduct stimuli coming from the middle ears.
d) amplify sundry sounds so that the middle ears can better reach their thresholds.

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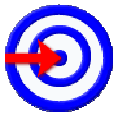
Study Session 10

Perception of Smell and Taste

Introduction

The smell or olfactory system can distinguish thousands of odours. Scientists have identified a large gene family that they believe codes for odour binding sites, or receptors, in the olfactory lining of the nose. In the olfactory bulb information from these receptors is organized into patterns that the brain may interpret as different odours. These and other discoveries are leading to important insights about human behaviour and providing hope for treating those with a diminished or lost sense of smell. Scents evoke many images and sensations so common we don't give them much thought. The olfactory system, which senses and processes odours, is one of the oldest and most vital parts of the brain. For most animals, it is the primary mode of communication and influences many important functions, including reproduction and taste.



Learning Outcomes

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

10.1 describe the nose as an organ of smell.
10.2 describe the tongue as an organ of taste.
10.3 highlight the labelled-line theory to olfaction and gaustation/taste.

10.1 The Nose and Perception of Smell

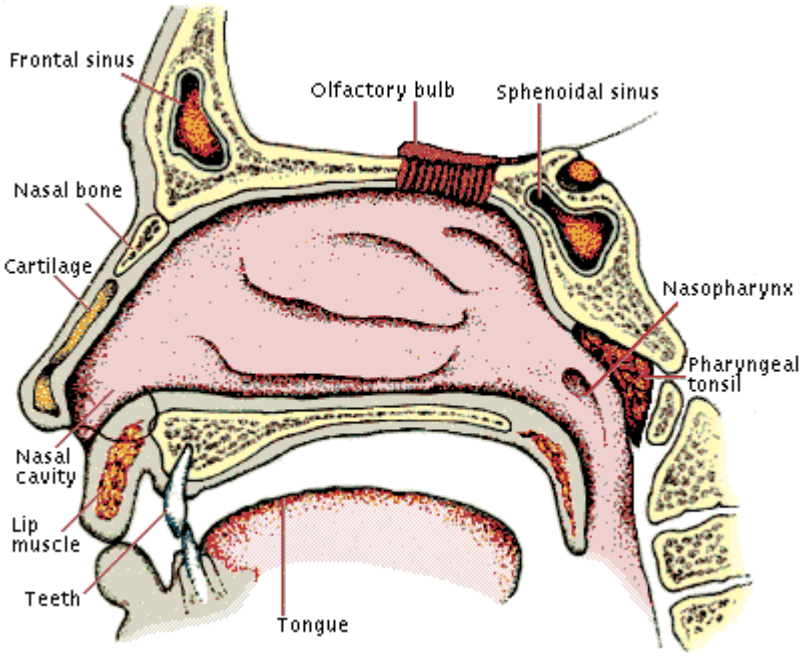
10.1.1 Olfactory Information

According to the labelled-line theory of olfaction, olfactory receptors fall into a few distinct types. According to this theory, each odorous chemical fits into one and probably only one receptor site, in a lock–and–key fashion (Amoore, 1963). Once a receptor is excited, it sends a message that represents a specific odour. In other words, olfaction is a response to a few primary odours.

10.1.2 The Structure of the Nose

The nose contains specialized sensory nerve cells, or neurons, with hair like fibres called cilia on one end. Each neurone sends a nerve fibre called an axon to the olfactory bulb which is a brain structure just above the nose as shown in Fig 10.1.

The Nose



Most animals can distinguish thousands of odours. Early studies showed that different olfactory neurons respond to different odours, and that odours stimulate specific patterns of activity in the olfactory bulb. Scientists also found that the olfactory cilia in fish contain binding sites, or receptors for odour molecules (Society for Neurosurgeons, 1995).

Recently, researchers identified a surprisingly large family of genes in rats that appears to code for odour receptors. This gene family is one of the largest ever discovered - programming 500 to 1,000 different types of receptors. Scientists think this large and diverse group of genes is what helps animals detect such a huge variety of odours. (Society for Neurosurgeons, 1995).

In rats and mice, the olfactory lining is divided into four zones, each containing neurons with different odour receptors. Neurons expressing the same receptor genes within each zone appear to be randomly arranged. In the olfactory bulb, however, fibers from neurons with the same receptor converge on just one or a few glomeruli - specialized structures in which olfactory neurons connect with other types of neurons. As reported by the Society for Neurosurgeons (1975), research suggests that an individual odour molecule stimulates several types of receptors, each of which responds to a part of the molecule's structure. Brain mapping techniques have shown that the pattern of glomeruli activated by each odour forms a map or code that the brain may recognize as a unique scent.

Genes much like those for odour receptors appear to control other types of chemical sensing, such as the ability of sperm to locate an egg. Similar receptors also may function in a special structure in the nose called the vomeronasal organ, which is thought to help detect special chemical signals called pheromones. These signals appear to regulate hormone release, mating, and social functions in animals, and possibly also in humans.

Olfactory information travels not only to the limbic system - primitive brain structures that govern emotions, behaviour, and memory storage - but also to the brain's cortex, or outer layer, where conscious thought occurs. In addition, it combines with taste information in the brain to create the sensation of flavour. Learning more about these links will help explain how odours affect our thoughts, emotions and behaviour.

10.1.3 Physiology of Smell

The sense of smell in human beings is generally less acute than in other animals. Many animals are known to secret odorous chemicals called phrenomones that play an important part in chemical communication in situations such as territorial behaviour, mating and the bonding of mothers and their newborns. However, the role of phrenomones in human beings is unknown. All odorous materials give off volatile molecules, which are carried into the nose with the inhaled air and stimulate the olfactory chemoreceptors when dissolved in mucus.

The air entering the nose is warmed and convection currents carries eddies of inspired air to the roof of the nasal cavity. Sniffing concentrates volatile molecules in the roof of the nose. This increases the number of olfactory receptors stimulated and thus the perception of the smell. The sense of smell may affect the appetite. If the odours are pleasant the appetite may improve and vice versa. When accompanied by the sight of food, an appetizing smell increases salivation and stimulates the digestive system. The sense of smell may create long lasting memories, especially to distinctive odours, e.g. hospital smells, favourite or least liked foods.

When an individual is continuously exposed to an odour, perception of the odour decreases and ceases within a few minutes. This condition called adaptation occurs at the level of the cerebrum and in the nasal sensory receptors.

10.2 The Tongue and Perception of Taste

Taste drives appetite and protects us from poisons. So, we like the taste of sugar because we have an absolute requirement for carbohydrates (sugars etc.). We get cravings for salt because we must have sodium chloride (common salt) in our diet. Bitter and sour cause aversive, avoidance reactions because most poisons are bitter (most bitter substances are bad for you - certainly in excess) and off food goes sour (acidic). Why do medicines all taste bitter? Because they are, in fact, poisons and if you take too much they will harm you. We have an absolute need for protein, and amino acids are the building blocks for proteins, so the "new" taste quality of some umami (pronounced: oo-marmi) which is the meaty, savoury taste drives our appetite for amino acids. This taste has been known to the Japanese for a long time - but has only recently been recognised by the West. Bacon really hits our umami receptors because it is a rich source of amino acids.

10.2.1 The Structure of the Human Tongue

In human beings, taste buds are groups of 30-100 individual elongated neuroepithelial cells, which are often embedded in special structure in the

surrounding epithelium, termed papillae. At the apex of the taste bud, microvillar processes protrude through a small opening, the taste pore, into the mouth. Just below the taste bud apex, taste cells are joined by tight junctional complexes that prevent gaps between cells. Food molecules cannot therefore squeeze between taste cells and get into the taste bud.

Taste buds and taste papillae

Taste papillae can be seen on the tongue as little red dots, or raised bumps, particularly at the front of the tongue. These ones are actually called "fungiform" papillae, because they look like little button mushrooms. There are three other kinds of papillae, foliate, circumvallate and the non-gustatory filiform. Taste buds, on the other hand, are collections of cells on these papillae and cannot be seen by the naked eye. To illustrate the point, the taste buds are collections of cells situated on top of, or on the sides of, the different papillae. At the base of the taste bud, afferent taste nerve axons invade the bud and ramify extensively, each fibre typically synapsing with multiple receptor cells within the taste bud.

In mammals taste buds are located throughout the mouth, in the pharynx, the laryngeal epiglottis and at the entrance of the eosophagus. There are about 4,600 taste buds per tongue. A greater number of these are located on the rear side of the tongue. Taste buds are contained within four major classes of papillae.

1. The *Fungiform papillae* are located on the most anterior part of the tongue and generally contain one to several taste buds per papilla. They appear as red spots on the tongue. The total number of fungiform papillae per human tongue is around 200. There are 1120 fungiform taste buds per tongue.
2. The *Foliate papillae* are situated on the edge of the tongue. They are predominantly sensitive to sour tastes.
3. The *Circumvallate papillae* are sunken papillae and confer a sour/bitter sensitivity to the posterior 2/3 of the tongue.
4. *Filiform papillae* are mechanical and non-gustatory. The number of taste buds declines with age.

Cells in Taste Papillae

1. *Supporting cells* - contain microvilli, appear to secrete substances into lumen of taste bud.
2. *Sensory receptor cell* - has peg-like extensions projecting into lumen. These contain the sites of sensory transduction.
3. *Basal cells* - these differentiate into new receptor cells. They are derived from surrounding epithelium. The cells are continuously renewed every 10 days or so.

Taste and the Labeled-Line Theory

The labeled-line theory of taste states that each type of receptor has its own route to the brain, That is, each axon carries information about just one of the primary sites, and each neurone anywhere in the brain's taste

system is also coded to respond to just one of the primary tastes (Kalat, 1988).

Basic Types of Taste

There are five basic tastes: salt, sour, sweet, bitter and umami. Umami is the taste of certain amino acids (e.g. glutamate, aspartate and related compounds). It was first identified by Kikunae Ikeda at the Imperial University of Tokyo in 1909 (Nelson, 2002).

10.2.3 Physiology of Taste

Taste buds contain sensory receptors (chemoreceptors) that are found in the papillae of the tongue and widely distributed in the in the epithelia of the tongue, soft palate, pharynx and epiglottis. They consist of small sensory nerve endings of the glossopharyngeal facial, and vagus nerves. Some of the cells have hairlike micro villi on their free border, projecting through tiny pores in the epithelium. The sensory receptors are stimulated by chemicals that enter the pores dissolved in saliva. Nerve impulses are generated and conducted along the glossopharyngeal, facial and vagus nerves before synapsing in the medulla. The final destination is the taste area in the parietal lobe of the cerebral cortex where taste is perceived.

Some tastes can consistently stimulate taste buds in specific parts of the tongue. The tip of the tongue is responsible for sweet taste, the sides of the tongue is for sour taste, and the back of the tongue for bitter taste. The sense of taste functions only when the substance is in solution.

This belief that some tastes can consistently stimulate taste buds in specific parts of the tongue could be seen in specific contexts. The tip of the tongue is responsible for sweet taste, the sides of the tongue is for sour taste, and the back of the tongue for bitter taste. The sense of taste functions only when the substance is in solution. The various taste areas of the brain contribute to behaviour in different ways. The hypothalamus apparently related taste to hunger and satiety. Hypothalamic cells respond more vigorously to a taste when the animal is hungry. Their response to the taste of a particular food declines especially after the animal has just eaten a fair amount of that food (Rolls, Murzi, Yasley, Thorpe, & Simpson, 1986). The decline may be responsible for sensory specific satiety-the tendency to get satiated on a food one has just eaten and to prefer to switch to something else.

Study Session Summary

Summary

This Study Session explored the olfactory system and perception of taste. The olfactory system senses and processes odours. For most animals, it is the primary mode of communication and influences many important functions, including reproduction and taste.

We also noted that taste drives appetite and protects us from poisons. In human beings, taste buds are groups of 30-100 individual elongated "neuroepithelial" cells, which are often embedded in special structure in the surrounding epithelium, termed papillae. Taste buds are collections of cells on papillae and cannot be seen by the naked eye. Taste papillae can be seen on the tongue as little red dots, or raised bumps, particularly at the front of the tongue. They include the fungiform, foliate, circumvallate, filiform. There are five basic tastes: salt, sour, sweet, bitter and umami.

Assessment

Assessment

You can assess how well you have achieved the Learning Outcomes of this Study Session by answering the questions that follows. You may check your answers with the Notes on the Self-Assessment Questions at the end of this Manual for feedback.

SAQ 10.1 (tests Learning Outcome 10.1)
Odour receptors are randomly arranged in which part of the diagram?

a) olfactory lining
b) olfactory bulb
c) genes
d) cilia

SAQ 10.2 (tests Learning Outcome 10.1)
The structure in the nose that writes the code of each distinct smell for the brain to interpret is _____.

a) vomeronasal organ
b) glomeruli
c) cilia
d) limbic system

SAQ 10.3 (tests Learning Outcome 10.1)
Which of the following structures represent the final destination of olfactory signals that originate in the cilia?

a) olfactory bulb
b) limbic system
c) brain cortex
d) glomeruli

SAQ 10.4 (tests Learning Outcome 10.2)

Assuming that after reading all night, you are tired, hungry, and thirsty. You then decide to take a big cup of beverage instead of eating a bowl of yam. How might you explain your behaviour?

SAQ 10.5 (tests Learning Outcome 10.2)
A scientist testing for the function and efficacy of taste buds, mistakenly placed a sour-tasting liquid on the fungi papillae of an individual's tongue, and noticed that the individual showed no response, indicating that the individual did not taste anything. Why did the individual not taste anything?

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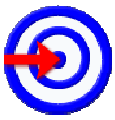
Study Session 11

Somatosensation

Introduction

In this Study Session, we will examine one of the means by which human beings respond to changes in the environment - the sense of touch. If you slightly press one of your fingers to a hot tea cup, you will feel pressure and warmth. If you touch a hot iron, you will feel pain. If you press your hand against an ice cube, you will feel cold. What you have discovered is that the sense of touch is a mixture of a number of different skin senses, namely, warmth, cold, pain, and pressure. On many other occasions, perception of pain is in response to pathological or psychological assaults going on in the body.



Learning Outcomes

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

11.1 present the senses of touch.
11.2 outline the mechanism for perceiving touch.
11.3 highlight types of pain.
11.4 describe the physiology of pain perception.

11.1 Somatosensation

The sense of touch is not really one sense but a combination of at least four senses namely touch, pain, warm, and cold. There are four respective surfaces on the skin through which these senses could be perceived. These physiological processes are embedded in what is known as somatosensation.

Somatosensation refers to a combination of processes related to perception of sensation as well as movement of the body. Mammalian skin has series of sensory receptors located peripherally in various parts of the body with the ability to respond to a variety of sensory stimulus. The sensory receptors which are unevenly distributed could be explored with devices such as fine hairs, needle points, warmed or cooled pointed hammers. Similarly, the separate sensitive spots differ in frequency and location or anatomical distribution.

A touch receptor may consist of a simple bared ending, an elaborated neurone ending, or a bare ending surrounded by non- neural cells that modify its function (Kalat, 1988). Areas with greater sensitivity of the skin such as the fingertips have as many as 700 touch cells in 2 square millimetres surface. Different receptors are associated with different types of sensations. On receiving a stimulus, each of the information received takes specific pathways to communicate with specific areas in the brain. With this unique distinction, any localized tissue damage of a skin surface for instance could destroy the local tissue without destroying the perception of stimulus related to the area damaged, or vice versa. On

the other hand, because pain and temperature sensations are perceived along the same path, any injury that affects one path will automatically hinder the other path (Kalat, 1988).

Any information that passes through different paths in the spinal cord also reaches different parts of the thalamus and cerebral cortex. For example, a specific area of the thalamus responds to the activity of the Pacinian corpuscles which respond to the stimulus of touch on the skin. Within the area, different parts respond to different receptors or combination of receptors (Dykes, Sur, Merzenich, Kaas & Nelson, 1981).

11.1.1 Somatosensory Areas and their Functions

The various areas of somatosensory thalamus send their impulses to different areas of the somatosensory cortex, located in the parietal lobe. The somatosensory cortex includes four major parallel strips, each of which has its own representation of the entire body. Kaas (1983) identified these areas to include the following;

i. Hair follicle receptors located in hair covered skin, rapidly respond to movement of hairs
ii. Meissner's corpuscles located in hairless areas of sudden displacement of skin respond to low–frequency vibration
iii. Pacinian corpuscles located in both hairy and hairless skin respond slowly to indentation of skin
iv. Ruffini endings located in both hairy and hairless skin respond slowly to stretch of skin.

These areas of somatosensation remain at least partly separate from one another at all levels, from the receptors to somatosensory areas of the cerebral cortex.

11.2 Pain Sensation

Pain is an unpleasant sensation occurring in varying degrees of severity as a consequence of injury, disease, or emotional disorder. Pain is an unpleasant yet important function for survival similar to a warning system (but not all pain is needed for survival). It is a universal human experience that is best described by the sufferer. Pain is a sensation with strong emotional properties. It could be of various types; mechanically induced, chemically induced, intense heat, and intense cold (LaMotte & Collins, 1982).

11.2.1 Description of the Intensity of Pain

Pain may range in intensity from slight through severe to agonizing. It is experienced as having qualities such as sharp, throbbing, dull, nauseating, burning and shooting. It often has both an emotional quality and a sensed bodily location. Medical professionals will sometimes ask patients to rate their pain on a scale of zero through ten, where ten is consistent with screaming and thrashing about.

11.2.2 Description of the Intensity of Localization

This subjective reality of the localization of pain to an area of the body is the basis for speaking of pain receptor, neck pain, referred pain, cutaneous pain, as well as pain in my foot, kidney pain, or the painful uterine contractions occurring during childbirth. This common usage of pain is not entirely consistent with the scientists' model of pain being a subjective experience.

11.3 Types of Pain

Pain can be classified as *acute* or *chronic*. The distinction between acute and chronic pain is based on the nature of the pain itself, and not on its duration of sensation.

11.3.1 Acute Pain

Physicians are more comfortable treating acute pain, which has as its source in soft tissue damage, infection and/or inflammation. Such pains can be modulated and removed by treating its cause and through combined strategies using analgesics to treat the pain and antibiotics to treat the infection. It is not the pain itself that is short in duration: it is the diagnosis of "acute pain" and the expectation that it will be short in nature that continues to confuse both the medical establishment and those who experience pain. The primary distinction is this: acute pain serves to protect one after an injury. Chronic pain does not serve this or any other purpose. Acute pain is the symptom of pain.

11.3.2 Chronic Pain

Chronic pain was originally defined as pain that has lasted 6 months or longer. It is now defined as "the disease of pain." Its origin, duration, intensity, and specific symptoms vary. The one consistent fact of chronic pain is that, as a disease, it cannot be understood in the same terms as acute pain, and the failure to make this distinction (particularly in those who suffer chronic pain) has been and continues to be the cause of multi-dimensional suffering, depression, social isolation, and helplessness. The failure to recognize chronic pain as substantially different from acute pain cannot be blamed on the medical profession: it is a societal lapse.

Causes of Chronic Pain

The most common causes of chronic pain include:

i. low-back pain
ii. headache
iii. recurrent facial pain
iv. cancer pain
v. arthritic pain
vi. psychosomatic or psychogenic cause

Chronic pain, no matter how debilitating it is in one's life, continues to be considered by most insurance carriers as a 3-17% disability. American pain associations estimate that 40-80 million Americans live with chronic

pain. At the same time, there are only 8,000 qualified pain management specialists.

Chronic pain has no time limit, often has no apparent cause and serves no apparent biological purpose. Chronic pain can trigger multiple psychological problems that confound both patient and health care provider, leading to feelings of helplessness and hopelessness.

11.4 Types of Physiological Pain

Nociceptors Pain detecting neurons

This can be grouped according to the source and related **nociceptors**.

11.4.1 Cutaneous Pain

This type of pain is caused by injury to the skin or superficial tissues. Cutaneous nociceptors terminate just below the skin, and due to the high concentration of nerve endings, produce a well-defined, localized pain of short duration. Examples of injuries that produce cutaneous pain include, minor cuts, minor (first degree) burns and lacerations.

11.4.2 Somatic Pain

Such pains originate from ligaments, tendons, bones, blood vessels, and even nerves themselves. It is detected with somatic nociceptors. The scarcity of pain receptors in these areas produces a dull, poorly-localized pain of longer duration than cutaneous pain; examples include sprains and broken bones. Myofascial pain is usually caused by trigger points in muscles, tendons and fascia, and may be local or referred.

11.4.3 Visceral Pain

The pain originates from body's viscera, or organs. Visceral nociceptors are located within body organs and internal cavities. Nociceptors in these areas are more scarce and also produces pain that is usually more aching and of a longer duration than somatic pain. Visceral pain is extremely difficult to localize, and several injuries to visceral tissue exhibit "referred" pain, where the sensation is localized to an area completely unrelated to the site of injury. Myocardial ischaemia (the loss of blood flow to a part of the heart muscle tissue) is possibly the best known example of referred pain; the sensation can occur in the upper chest as a restricted feeling, or as an ache in the left shoulder, arm or even hand. "The brain freeze" is another example of referred pain, in which the vagus nerve is cooled by cold inside the throat. Referred pain can be explained by the findings that pain receptors in the viscera also excite spinal cord neurons that are excited by cutaneous tissue. Since the brain normally associates firing of these spinal cord neurons with stimulation of somatic tissues in skin or muscle, pain signals arising from the viscera are interpreted by the brain as originating from the skin. The theory that visceral and somatic pain receptors converge and form synapses on the same spinal cord pain-transmitting neurons is called "Ruch's Hypothesis".

11.4.4 Phantom Limb Pain

This is a type of referred pain. It is the sensation of pain from a limb that has been lost or from which a person no longer receives physical signals.

It is an experience almost universally reported by amputees and quadriplegics.

11.4.5 Neuropathic Pain

This type of pain can occur as a result of injury or disease to the nerve tissue itself. This can disrupt the ability of the sensory nerves to transmit correct information to the thalamus, and hence the brain interprets painful stimuli even though there is no obvious or known physiologic cause for the pain. Neuropathic pain is the disease of pain. It is not the sole definition for chronic pain, but does meet its criteria.

Consequences of Nociception

When the nociceptors are stimulated they transmit signals through sensory neurons in the spinal cord. These neurons release glutamate, a major excitatory neurotransmitter that relays signals from one neuron to another. If the signals are sent to the reticular formation of brain stem, thalamus, then pain enters consciousness, but in a dull poorly localised manner. From the thalamus, the signal can travel to the somatosensory cortex in the cerebrum, when the pain is experienced as localised and having more specific qualities. Feinstein and colleagues found that nociception could also, "activate generalized autonomic responses independently of the relay of pain to conscious levels" causing "pallor, sweating, bradycardia, a drop in blood pressure, subjective "faintness," nausea and syncope" (Feinstein, Langton & Schiller,1954).

Study Session Summary

Summary

From the foregoing, the sense of touch consists of four senses namely touch, pain, warm, and cold. Somatosensation is a physiological process by which the skin perceives sensations as movement of the body. The various areas of somatosensory thalamus send their impulses to different areas of the somatosensory cortex, located in the parietal lobe.

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Assessment

Assignment

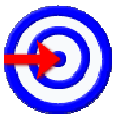
1. Define somatosensation
2. Mention means through which human beings perceive touch
3. Describe the physiological process by which pain is perceived

Study Session 12

Human Motivation

Introduction

Although there are times when organisms are in a state of hibernation, for example when asleep, it is generally characteristic of them to be active. In order to understand why an active organism does what it does, we would need to understand the motives behind their actions. Motives incite a living organism to put up an action or behaviour; it also gives direction to behaviour once it has commenced.



Learning Outcomes

When you have studied this session, you should be able to:

12.1 highlight the difference between motivation and emotion.
12.2 identify at least five sources of motivation.
12.3 discuss at least four theories of motivation

12.1 Motivation, Motivational Disposition and Emotion

Motivation is an internal state or condition (sometimes described as a need, desire, or want) that serves to activate or energize behavior and give it direction. It could also be defined as a driving force or forces responsible for the initiation, persistence, direction, and vigour of goal directed behaviour. It includes the biological drives such as hunger, thirst, sex and sex preservation, and also social forms of motivation such as "need for achievement" and "need for affiliation". (Kleinginna & Kleinginna, 1981). Succinctly, motivation involves the internal state or condition that activates behavior and gives it direction; desire or want that energizes and directs goal-oriented behavior; influence of needs and desires on the intensity and direction of behavior. Most motivation theorists assume that motivation is involved in the performance of all learned responses; that is, a learned behavior will not occur unless it is energized.

The major question among psychologists, in general, is whether motivation is a primary or secondary influence on behaviour. That is, are changes in behaviour better explained by principles of environmental/ecological influences, perception, memory, cognitive development, emotion, explanatory style, or personality or are concepts unique to motivation more pertinent

Not all motives which can incite an organism to action are likely to be operative at the same time. An individual may be determined to make good grades in an oncoming examination, thereby studying so hard during the week. The same person may be engrossed with religious roles on Sunday, leaving out the serious attention to reading in the process. The tendency to have a variety of motives at a time without expressing all of

them at the same time is called motivational disposition. Motivational dispositions reflect the organism's past; aroused motives are a consequence of present interactions among internal and external circumstances. Individuals differ in their motivational dispositions because of their developmental and acquired characteristics.

Emotion (an indefinite subjective sensation experienced as a state of arousal) is different from motivation in that there is not necessarily a goal orientation affiliated with it. Emotions occur as a result of an interaction between perception of environmental stimuli, neural/hormonal responses to these perceptions (often labeled feelings), and subjective cognitive labeling of these feelings (Kleinginna and Kleinginna, 1981b). Evidence suggests there is a small core of core emotions (perhaps 6 or 8) that are uniquely associated with a specific facial expression (Izard, 1990). This implies that there are a small number of unique biological responses that are genetically hard-wired to specific facial expressions. A further implication is that the process works in reverse: if you want to change your feelings (i.e., your physiological functioning), you can do so by changing your facial expression. That is, if you are motivated to change how you feel and your feeling is associated with a specific facial expression, you can change that feeling by purposively changing your facial expression. Since most of us would rather feel happy than otherwise, the most appropriate facial expression would be a smile.

12.2 Classification of Motives

Both human and animal motives may be based on the need for satisfying thirst, hunger, sex and pain. Other classifications consider motivational dispositions. Maslow (1954) related motivational dispositions to five basic needs which he identified as physiological needs, safety needs, love and belonginess' needs, need for self esteem, and need for self actualization.

12.3 Sources of Motivation

In general, explanations regarding the source(s) of motivation can be categorized as either extrinsic (outside the person) or intrinsic (internal to the person). Intrinsic sources and corresponding theories can be further subcategorized as either body/physical, mind/mental (i.e., cognitive, affective, conative) or transpersonal/spiritual. This could be broken down as shown in Fig 12.1.

Fig 12.1

Sources of Motivational Needs	
Behavioural/external	• elicited by stimulus associated/connected to innately connected stimulus • obtain desired, pleasant consequences (rewards) or escape/avoid undesired, unpleasant consequences
Social	• imitate positive models be a part of a group or a valued member
Biological	• increase/decrease stimulation (arousal) • activate senses (taste, touch, smell, etc • decrease hunger, thirst, discomfort, etc maintain homeostasis, balance)
Cognitive	• maintain attention to something interesting or threatening • develop meaning or understanding • increase/decrease cognitive disequilibrium; • solve a problem or make a decision figure something out • eliminate threat or risk
Affective	• increase/decrease affective dissonance • increase feeling good decrease feeling bad • increase security of or decrease threats to self-esteem • maintain levels of optimism and enthusiasm
Conative	• meet individually developed/selected goal • obtain personal dream develop or maintain self-efficacy • take control of one's life eliminate threats to meeting goal, obtaining dream reduce others' control of one's life
Spiritual	• understand purpose of one's life • connect self to ultimate unknowns

12.4 Theories of Motivation

Theories of motivation could be broadly classified as behavioural, cognitive, psychoanalytic theory, humanistic / Maslowian theory, sdocial learning and social social cognition.

12.4.1 Behavioural Theories

These include Classical conditioning and Operant conditioning. Classical conditioning states that biological responses to associated stimuli energize and direct behavior. Operant learning states the primary factor is consequences: consequences in this context means that the application of reinforcers provides incentives to increase behavior; the application of punishers provides disincentives that result in decrease of behaviour.

12.4.2 Cognitive Theories

There are several motivational theories that trace their roots to the information processing approach to learning. These approaches focus on the categories and labels people use help to identify thoughts, emotions, dispositions and behaviours. These theories include the cognitive dissonance theory, attribution theory, expectancy theory.

Cognitive Dissonance

This is a cognitive theory was developed by Leon Festinger (1957) and states that when there is a discrepancy between two beliefs, two actions, or between a belief and an action, we will act to resolve conflict and discrepancies. The implication is that if we can create the appropriate amount of disequilibrium, this will in turn lead to the individual changing his or her behavior which in turn will lead to a change in thought patterns which in turn leads to more change in behavior.

The Attribution Theory

is a cognitive theory developed by Heider, 1958; Weiner, 1974). This theory proposes that every individual tries to explain success or failure of self and others by offering certain "attributions." These attributions are either internal or external and are either under control or not under control.

The Expectancy Theory

This theory was propounded by Vroom (1964). It states that three factors of expectancy, instrumentality, and Valance or Value are to be multiplied by each other and must be present for an individual's motivation to engage in a behaviour. A low value in one will result in a low value of motivation. If one does not believe he or she can be successful at a task or the individual does not see a connection between his or her activity and success, or the individual does not value the results of success, then the probability is lowered that the individual will engage in the required learning activity.

12.4.3 The Psychoanalytic Theory

According to Freud (1990), all actions or behaviour is a result of internal, biological instincts that are classified into two categories: life (sexual) and death (aggression). Many of Freud's students broke with him over this concept. For example, Erikson (1993) and Sullivan (1968) proposed that interpersonal and social relationships are fundamental, Adler (1989) proposed power, while Jung (1953, 1997) proposed temperament and search for soul or personal meaningfulness.

12.4.4 The Social Learning/Observational Theory

This suggests that modelling (imitating others) and vicarious learning (watching others have consequences applied to their behaviour) are important motivators of behaviour.

12.4.5 The Social Cognition Theory

This theory explains that the environment, an individual's behaviour, and the individual's characteristics (e.g., knowledge, emotions, cognitive development) both influence and are influenced by each other two components. Bandura (1986, 1997) highlights self-efficacy (the belief that a particular action is possible and that the individual can accomplish it) and self-regulation (the establishment of goals, the development of a plan to attain those goals, the commitment to implement that plan, the actual implementation of the plan, and subsequent actions of reflection and modification or redirection. Two other sub-themes of the social cognition theory exist. First, the spiritual / transpersonal theory which deals with the meaningfulness of our lives or ultimate meanings. Second, the achievement motivation theory which states that individuals are motivated to either avoid failure (more often associated with performance goals) or achieve success (more often associated with mastery goals).

Study Session Summary

Summary

This study session took you through motivation, which is a driving force that is responsible for the initiation, persistence, direction, and vigour of goal directed behaviour. It includes the biological drives such as hunger, thirst, sex and sex preservation. It also includes social forms of motivation such as “need for achievement” and “need for affiliation”. Yet, not all motives which can incite an organism to action are likely to be operative at the same time.

Motivation can be categorized as either extrinsic (outside the person) or intrinsic (internal to the person). Intrinsic sources and corresponding theories can be further subcategorized as either body/physical, mind/mental (i.e., cognitive, affective, conative) or transpersonal/spiritual. Lastly, we highlighted various theories of motivation, such as behavioural, cognitive, psychoanalytic, social learning and social cognition theories.

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Assessment

Assignment

1. Define motivation.
2. Mention the sources of motivation.
3. Analyse the relationship between human motivation and behaviour.
4. Explain five theories of motivation.

Feedbacks to Self Assessment Questions (SAQs)

SAQ 1.1

1. B - nervous system carrying out its functions effectively
2. B - motor or efferent neurons
3. C - Action potential by sending of neural impulses
4. A - All or none principle
5.
   a. repolarisation
   b. refractory*
   c. depolarization*

SAQ 2.1

1. B - basal Nuclei
2. B - trigeminal nerves
3. A - Autonomic nervous system
4. B - Vagus nerves

SAQ 3.1

1. A - A proof of the mind-brain relationship
2. C – Delgado stimulation on complex behavior

SAQ 4.1

1. Hormones are chemical messengers that are secreted directly into the blood, which carries them to organs and tissues of the body to exert their functions. There are many types of hormones that act on different aspects of bodily functions and processes. These bodily functions and processes include:
   - Development and growth
   - Metabolism of food items
   - Sexual function and reproductive growth and health
   - Cognitive function and mood
   - Maintenance of body temperature and thirst

2. Here is a summary of hormones, their locations and functions:

1. Pituitary, known as the "Master Gland", is a part of the brain that consists of three lobes called "anterior", "interior" and "posterior".

Lobes	Hormone	Function
Posterior	• Oxytocin	• Stimulates utrine contraction and brest contraction for milk release.
	• Anti-Diuretic Hormone (ADH), also known as "vasopressin"	• Stimulates re-absorption of water from kidney tubules. • Hypo- causes Diabetes Insipidus (large amounts of urine produced).
Anterior	• Prolactin (PRL)	• Production of breast milk (works in men too).
	• Human Growth Hormone (HGH)	• Growth • Hypo- Dwarfism • Hyper- Gigantism
	• Thyroid Stimulating Hormone (TSH)	• Stimulates the thyroid to release thyroxin.
	• Adrenocorticotrophic Hormone (ACTH)	• Stimulates the adrenal cortex to produce Corticosteriods
	• Luteinizing Hormone (LH)	• Brings about ovulation and maintains the corpus luteum.
	• Follicle Stimulating Hormone (FSH)	• Stimulates growth/development of Graafin follicles
	• Gonadotrophins	• Secondary sexual characteristics
	• Interstitial Cell Stimulating Hormone (ICSH)	• Works on the seminiferous tubules in the testes – to produce sperm – which take 21 days to mature.
Intermediate	• Intermedin	• Control of melanocyte production.

2. Pineal is a pea-sized mass of nerve tissue attached by a stalk to the posterior wall of the third ventricle of the brain, deep between the cerebral hemispheres at the back of the skull. (It functions as a gland, secreting the hormone melatonin, a hormone produced by the pineal gland in darkness but not in bright light.

Hormone	Function

• **Melatonin**	• Melatonin receptors in the brain react to this hormone and synchronize the body to the 24 hour day/night rhythm, thus informing the brain when it is day and when it is night. • Melatonin is derived from seratonin, with which it works to regulate the sleep cycle.
3a. Thyroid Gland: Part of the Thyroid/Parathyroid Gland, which is in the neck.	
Hormone	**Function**
• **Thyroxin**	• Concerned with the Basal Metabolic Rate (BMR), which is the amount of energy the body uses, just to 'tick over' o **Hyper-Thyroidism** = 'over-active thyroid' = Thyrotoxicosis Symptoms: increase in BMR; increase in heart-rate; loss of weight; hyper-activity; insomniac; develops bulging eyes due to accumulation of fluid behind the eye; may develop Goitre; possible link with Attention Deficit Disorder. o **Hypo-Thyroidism** Symptoms; decrease in BMR; weight gain; lethargy; skin becomes dry and puffy; hair becomes thin and brittle. Causes: Derbyshire Neck (originally due to insufficient iodine in the soil in Derbyshire), Graves Disease, and Cretinism (= metal and sexual development imapaired, if occurs in children).
• **Calcitonin**	• Uptake of calcium to bone.
3b. Parathyroid Gland: Part of the Thyroid/Parathyroid Gland, which is in the neck.	
• **Parathormone**	• Associated with the growth of muscle and bone.

	• Distribution of calcium and phosphate in the body. o **Hyper-** Causes transfer of calcium from the bones to the blood; bones become fragile & easily broken; osteoporosis. (Parathormone activity is inhibited by oestrogen.) o **Hypo-** Lowers blood calcium levels, causing tetany (which may be treated by injections of the hormone); low calcium levels in skeletal muscle (which may cause cramps).

4. Thymus gland is located straddled across the trachea & bronchi in the upper thorax. The thymus (a gland associated with the immune system), is enclosed in a capsule and divided internally by cross-walls into many lobules (full of T-lymphocytes). In infancy the thymus controls the development of lymphoid tissue and the immune response to microbes and foreign proteins (accounting for allergic response, antoimmunity, and the rejection of organ transplants). T-lymphocytes migrate from the bone marrow to the thymus, where they mature and differentiate until activated by antigen.	
• **Thymosin**	• Activates the immune system by activating the T-Cells (T-Killer Cells; T-Helper Cells; T-Memory Cells).
• **T-Lymphocytes**	• The thymus consists of lobules full of T-lymphocytes (white blood cells associated with antibody production). • T-lymphocytes migrate from the bone marrow to the thymus, where they mature and differentiate until activated by antigens.

5. Paancreas lies behind the stomach. It is both exocrine (ducted) and endocrine (ductless).
   a) As an <u>exocrine gland</u> it secrets enzymes (organic catalysts) into the small intestine.
   b) Islets of Langerhans: Located within the pancreas. Contains groups of both Alpha- and Beta- cells.

Location	Hormone	Function
Beta Cells	• Insulin	• Conversion of glucose to glycogen. • Cellular up-take of glucose. • Conversion of excess glucose to fat.
Alpha Cells	• Glucagon	• Conversion of glycogen to glucose.

6. Adrenal Glands		
Location	**Hormone**	**Function**
Adrenal Medulla	• Adrenalin	Prepares the body for "fright, fight or flight" and has many effects: • Action of heart increased. • Rate and depth of breathing increased. • Metabolic rate increased. • Force of muscular contraction improves. • Onset of muscular fatigue delayed. • Blood supply to the bladder and intestines reduced, their muscular walls relax, the sphincters contract.
	• Noradrenalin	Similar effects to adrenalin: • Constriction of small blood vessels leading to increase in blood pressure. • Increased blood flow through the coronary arteries and slowing of heart rate. • Increase in rate and depth of breathing. • Relaxation of the smooth muscle in the intestinal walls.
Adrenal Cortex	• Corticosteroids	Glucocorticoids (e.g. cortisol, cortisone, corticosterone) • Utilization of carbohydrate, fat and protein by the body.

		• Normal response to stress. • Anti-inflammatory effects. • Hypersecretion of cortisol results in Cushings Syndrom. Mineralocorticoids (e.g. aldosterone) • Regulation of salt and water balance. • Hypersecretion of Alderosterone decreases the potassium in the body (affecting nerve impulse transmission and leading to muscular paralysis).

7. Ovaries: Produce mature ova.

Hormone	Function
• Oestrogen	• Break-down of the utrine wall.
• Progesterone	• Builds up and maintains the uterus wall for embedding of fertilized egg. • Associated with secondary sexual characteristics, e.g. body hair, breast enlargement, changes in physical body.

8. Testes: Located outside the pelvic cavity.

Hormone	Function
• Testosterone	• Development and function of male sex organs. • Secondary sexual characteristics. e.g. body hair, muscle development, voice change.

SAQ 5.1

1. C. stage 4, REM
2. A. viral infections
3. D. narcolepsy
4. C. heightened suggestibilty
5. C. latent content

SAQ 8.1 A. Cornea.

B Iris.

C. Retina.

SAQ 8.2A Option A is correct. Individual A is likely to have better night vision than individual B because the rods are more useful for faint light processing.

8.2B The ciliary muscles, which control the thickening and thinning of the lens, are weak. Thus, option B is the most likely correct conclusion.

SAQ 9.1 If you choose option B, you are correct. Indeed, the auricle is rather, the expanded portion projecting from the side of the head, while the slightly s-shaped tube extending from the auricle to the ear drum is the acoustic meatus.

SAQ 9.2 The correct option is D. As a matter of fact, the anvil is actually found in the middle ear.

9.3A Option C is correct. If you have chosen options A, B, or D, you are wrong. Since the impairment refers to amplitude, the likely areas not to be functioning are either the middle ear or inner. On examination however, you have observed that the inner ear is intact, but not the inner ear.

9.3B We do not know the reason for your option, but the best rationale behind option C is for the hearing aid "to amplify sundry sounds so that the middle ears can better reach thresholds".

SAQ 10.1

SAQ 10.2 The correct option is B, that is glomeruli. Vomeronasal organs on the other hand help to detect special odours called pheromones, which regulate hormone release, mating, and social functions in animals. Note the emphasis on special odours.

SAQ 10.3 Brain cortex - where they are interpreted

SAQ 10.4 Perhaps unknown to you, your brain is depleted of glucose, and in order to replenish your energy, you did not only go for just food, but decide for the one that could provide you with more readily available sugar.

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