

Kingdom of Saudi Arabia  
Ministry of Higher Education  
Majmaah University  
College of Medicine



المملكة العربية السعودية  
وزارة التعليم العالي  
جامعة المجمعة  
كلية الطب



# Nervous System AND Special Senses Module MED-226

STUDY GUIDE

Phase-2, Third Year, Second Semester

Academic Year: 1433-1434 H (2012-2013 G)

### Approval for the Module

- Approval of this module from Pathology Department was made on 16/03/2013
- Approval of this module from Basic Medical Sciences Department was made on 17/03/2013
- Approval of this module from Department of Community Medicine was made on 18/03/2013
- Approval of this module from Department of Medicine was made on 18/03/2013
- Approval of this module from Medical Education Department was made in the 5<sup>th</sup> meeting on 18/03/2013

## Message Of The Module Committee

Dear students, this is the second module of your fourth semester. We hope by now all of you are quite mature with a substantial experience of medical school. We promise that you will find this module of *Nervous System and Special Senses* to be very interesting.

This module covers integrated medical study of the brain, spinal cord, special senses and all the associated structures. The module has been designed to cover all the relevant details of the structures included in this. There has been made a sincere effort to integrate the knowledge of basic sciences and the clinical aspect.

We suggest you to not to be swayed by any apprehensions about the complexity of the subject because this module is made and will be delivered in a way that it is simple, easy, interesting and at the same time not compromising the content. In order to completely enjoy the module, all you need is to be regular in classes and your self-study as well. You are always welcome for your academic queries with the faculty.

So, best wishes for your bright future. Just have faith in yourself, your resources: work hard and say each day

“IT’S SIMPLE, EASY AND INTERESTING”

Regards

Module Coordinator

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## General Module Information

<b>Module Title</b>	<b>Nervous System and Special Senses</b>
<b>Module Code and Number</b>	<b>: MED-226</b>
<b>Credit Hour</b>	<b>7 hours</b>
<b>Module Duration</b>	<b>9 Weeks</b>
<b>Module Starting Dates</b>	<b>20/5/1434 H (01/04/2013)</b>
<b>Module Coordinator</b>	<b>Dr Khwaja M. Amir (Physiology)</b>
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<b>Module Committee Members</b>	<b>Dr Khalid Abdulwahab (Ophthalmology) Dr Abdulrahmn Alharbi (Medicine) Dr Mohammed Yunus (Pathology) Dr Sajid Hussain (Pharmacology) Dr Vaseem (Biochemistry)</b>



## Module Description

This module broadly consists of two themes the neurosciences and the special senses along with other associated structures. The theme of neurosciences covers the brain and spinal cord while the theme on special senses and associated structures covers all the organs of special senses and associated anatomical structures. These themes cover the study of structure, functions, pathologies and their management .This module also tries to focus on major clinical problems of nervous system and special senses. Special emphasis is given on the neurological diseases prevalent locally in Saudi Arabia with due emphasis on the social impact.

Many types of teaching and learning strategies have been applied to impart the knowledge in comprehensive, simple and interesting way.

## Module Objectives

At the end of the course, students are expected to

- a) Develop a firm understanding of structures and functions of nervous system.(A)
- b) Apply the knowledge of structure and function of the nervous system to localize a lesion within the nervous system. (A,B,C)
- c) Explain the physiological and anatomical basis of common investigations such as neurophysiologic studies, CT scan and MRI. (A,E)
- d) Explain the pathophysiology of common nervous system disorders and describe the principles of management. (A,B)
- e) Explain the mechanism of actions and side effects of common drugs used in the treatment of neurological disorders.(A,B)
- f) Identify the structures of head and neck region including special senses and explain their functional basis.(A,B)
- g) Identify, explain and recognize common pathological conditions of special senses.(A,B,C)
- h) Recognize that many nervous system disorders are chronic conditions that require multidisciplinary approach to care and rehabilitation.(B,D)
- i) Describe the psychological, social and economic impacts of neurological disorders on the individual, family and the community.(C,D,E)

**This course will contribute to the achievement of all learning outcomes of College of Medicine, Majmaah University undergraduate curriculum. The Overall learning outcomes of the course are:**

**The graduate should be**

- A. Scientific in their approach to practice.
- B. Proficient in clinical care.
- C. Professional.
- D. Community conscious.
- E. A Scholar.



## MODULE CONTENTS

### A. LECTURES

#### THEME 1- NEUROSCIENCES

1. Introduction to the Module
2. Fundamentals of Nervous System
3. Development of Nervous System
4. Gross Anatomy of Cerebral Cortex-Motor And Sensory-I
5. Gross Anatomy of Cerebral Cortex-Motor And Sensory-II
6. Anatomy of Spinal Cord
7. Sensory System and Ascending Tracts
8. Brainstem
9. Pain
10. Opioids
11. Motor Functions of Spinal Cord
12. Motor Cortex and Descending Tracts
13. Meninges of Brain and Spinal Cord
14. Meninges and Prion Disease
15. Meningitis
16. Cranial Nerves -I
17. Blood Supply of Brain and Spinal Cord
18. Cerebrovascular Diseases
19. Ventricular System and Cerebrospinal Fluid
20. Cerebrospinal Fluid -Formation and Flow
21. Cranial Nerves-II
22. Brain Lipids
23. Cerebral Edema, Hydrocephalous and Herniation
24. Stroke
25. Upper Motor Neuron and Lower Motor Neuron Lesions
26. Physiology of Autonomic Nervous System
27. Pathology of Peripheral Nervous System
28. Anatomy of Cerebellum and its Connections
29. Cerebellum
30. Cerebellar Dysfunctions
31. Diencephalon and Pituitary Gland
32. Thalamus, Hypothalamus and Limbic System
33. Basal Ganglia
34. Maintenance of Posture and Balance
35. Vestibular Apparatus and Equilibrium
36. Intellectual Functions- Memory and Speech
37. Sleep
38. Neurophysiological Investigations

39. Imaging of Brain and Spinal Cord
40. Anesthetics
41. Degenerative Diseases of Brain
42. Drugs Used in Neurodegenerative Diseases
43. Alzheimer's Disease and Parkinson's Disease
44. Epilepsy
45. Tetanus
46. Common CNS Tumors-I
47. Common CNS Tumors-II
48. Encephalitis and Meningoencephalitis
49. Antiepileptics
50. Impact of Neurological Disorders and Rehabilitation
51. Anxiolytics, Hypnotics and CNS Stimulants
52. Energy Metabolism and Metabolic Encephalopathies
53. Antipsychotics
54. Polio and Prion Disease
55. Congenital Malformations of CNS and Perinatal Brain Injury
56. Antidepressants
57. Cerebral Palsy
58. Headache Syndromes

## **THEME 2- SPECIAL SENSES AND ASSOCIATED STRUCTURES**

59. Pharyngeal Apparatus: Development and Derivatives of Pharyngeal Pouches
60. Organization of Neck
61. Anatomy of Neck-I
62. Anatomy of Neck-II
63. Structure of Orbit and Eye
64. Mechanism of Vision
65. Visual Pathway
66. Pharynx and Larynx-I
67. Pharynx and Larynx-II
68. Structure of Ear
69. Hearing Pathway and Mechanism of Hearing
70. Tongue
71. Face
72. Temporal and Infratemporal Fossa
73. Mechanism of Taste and Olfaction
74. Acute and Chronic Otitis Media

### **B.PRACTICAL SESSIONS**

1. Anatomy of Spinal Cord
2. Physiological Examination of Sensations
3. Anatomy of Skull And Meninges
4. Infections of CNS and Pathology of Meninges
5. Anatomy of Cerebral Cortex And Brainstem
6. Biochemistry of Cerebrospinal Fluid
7. Blood Supply and Microanatomy of Central Nervous System
8. Microbiological Examination of Cerebrospinal Fluid
9. Physiology of Human Reflexes
10. Pathology of Neurodegenerative Diseases
11. Anatomy of Cerebellum
12. Pathology of CNS Tumours
13. Anatomy of Neck Region-1
14. Anatomy of Neck Region-2
15. Physiology of Vision
16. Anatomy of Pharynx and Larynx
17. Physiology of Hearing
18. Anatomy of Ear and Eye
19. Microanatomy of Larynx, Pharynx and Tongue
20. Anatomy of Face and Tongue
21. Anatomy of Temporal and Infratemporal Fossa

### **C.CLINICAL SKILLS SESSIONS**

1. Examination of Sensory System
2. Examination of Motor System
3. Examination of Cranial Nerves
4. Lumbar Puncture

### **D. FIELD VISIT**

1. Visit to King Khalid hospital, Majmaah
2. Visit to Rehabilitation centre, Majmaah

### **E.SEMINAR**

1. Development of nervous system
2. Brainstem
3. Stroke
4. Coma

**F.CASE DISCUSSION**

1. Alzheimer's disease
2. Parkinson's disease
3. Neuropathic pain
4. Bell's palsy

**G.PROBLEM BASEDLEARNING**

1. A patient with fever, headache and altered sensorium
2. A patient with abnormal movement and unconsciousness
3. A case of head injury
4. A 10 year old boy with hearing loss

## DETAILED OBJECTIVES OF LECTURES

### LECTURE 1-INTRODUCTION TO THE MODULE

At the end of the lecture, the students should be able to

- a) Understand the objectives of the modules
- b) Know the contents of the module
- c) Identify the teaching and learning methods in the module
- d) Enlist the assessment system of the module
- e) Recognize the references of the module
- f) Recall the components of central and peripheral system

### LECTURE 2- FUNDAMENTALS OF NERVOUS SYSTEM

At the end of the lecture, the students should be able to

- a) Name different classification of nerve fibers and classify nerves according to them
- b) Express the functional anatomy of synapse
- c) Describe the electrical events occurring at the synapse
- d) Express the properties of synapse
- e) Classify and recall the function of neurotransmitters

References-Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition: page 543-55

Ganong's Review of Medical Physiology 23<sup>rd</sup> edition: page 79-82,115-123,129-

### LECTURE 3- DEVELOPMENT OF NERVOUS SYSTEM

At the end of the lecture, the students should be able to

- a) Discuss stages of neurulation
- b) Explain formation of forebrain, mid brain and hind brain
- c) Describe development of spinal cord
- d) Enumerate histological differentiation of nerve cells, glial cells, neural crest cells and spinal nerves
- e) Identify derivatives of neural crest
- f) Identify clinical application i.e. congenital anomalies.

Reference-Langman's Medical Embryology, 11<sup>th</sup> edition. Chapter 17, page 294-315.



## LECTURE 4- GROSS ANATOMY OF CEREBRAL CORTEX: MOTOR AND SENSORY- I

At the end of the lecture, the students should be able to

- a) Identify subdivisions of cerebrum i.e., telencephalon and diencephalon
- b) Discuss surfaces, lobes, sulci and gyri of cerebral hemisphere
- c) Describe internal structures i.e., basal ganglia

Reference- Clinical Neuroanatomy by Richard S. Snell's, 7<sup>th</sup> edition. Chapter 7 page 258-269.

## LECTURE 5- GROSS ANATOMY OF CEREBRAL CORTEX: MOTOR AND SENSORY- II

At the end of the lecture, the students should be able to

- a) Identify three groups of connecting nerve fibers of cerebral hemisphere.
- b) Identify blood supply of cerebrum
- c) Identify clinical application i.e. lesion of internal capsule.

Reference- Clinical Neuroanatomy by Richard S. Snell's, 7<sup>th</sup> edition. Chapter 7 page 258-269.

## LECTURE 6- ANATOMY OF SPINAL CORD

At the end of the lecture, the students should be able to

- a) Recall general anatomy of vertebral column.
- b) Discuss gross features of spinal cord
- c) Describe microanatomy of spinal cord
- d) Enumerate nerve cell groups in anterior, posterior and lateral gray column
- e) Enumerate and identify functions of anterior, posterior and lateral white columns

Reference- Clinical Neuroanatomy by Richard S. Snell's, 7<sup>th</sup> edition. Chapter 4, 134-160.

## LECTURE 7- SENSORY SYSTEM AND ASCENDING TRACTS

At the end of the lecture, the students should be able to

- a) Classify receptors
- b) Explain the mechanism of generation of receptor potential

- c) Discuss the classification of somatic sensations
- d) Locate the different ascending sensory tracts
- e) Analyze and interpret the functions of ascending sensory tracts
- f) Define and locate the dermatomes
- g) Describe the organization of somatosensory cortex

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition,  
Page 559-564,571-581

- Ganong's Review of Medical Physiology 23<sup>rd</sup> edition, page 149-155,173-179

## LECTURE 8- BRAIN STEM

At the end of the lecture, the students should be able to

- a) Discuss gross features of medulla
- b) Describe internal structure of medulla oblongata at decussation of pyramids, Medial lemniscus and olives.
- c) Identify the structures of central gray matter.
- d) Discuss gross features of pons

Reference- Clinical Neuroanatomy by Richard S. Snell's, 7<sup>th</sup> edition, Chapter 5, page 187-222

## LECTURE 9-PAIN

At the end of the lecture the student should be able to

- a) Explain different types of pain
- b) Describe the pain pathways in the body
- c) Mention the different analgesia systems of the body
- d) Explain the gate control theory of pain
- e) Explain surgical, pharmacological and non pharmacological management of pain

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition: page 583-593

- Ganong's Review of Medical Physiology 23<sup>rd</sup> edition, page: 167-171

## LECTURE 10- OPIOIDS

At the end of the lecture the student should be able to

- a) Explain pharmacology of opioids
- b) Comment on opioid antagonist
- c) Discuss pain management

Reference- Lippincott's Illustrated Reviews: Pharmacology, 5th edition page 169-179

## LECTURE 11- MOTOR FUNCTIONS OF SPINAL CORD

At the end of the lecture the student should be able to

- a) Recall the organization of nerve fibers in the spinal cord for motor functions
- b) Describe the structure of muscle spindle and Golgi tendons
- c) Explain the mechanism of stretch reflex
- d) Explain the mechanism of withdrawal reflex
- e) Distinguish between monosynaptic and polysynaptic reflexes
- f) Analyze the significance of these spinal cord reflexes in maintaining posture and locomotion of body

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition:  
page 665-675

-Ganong's Review of Medical Physiology 23<sup>rd</sup> edition: page 157

## LECTURE 12- MOTOR CORTEX AND DESCENDING TRACTS

At the end of the lecture the student should be able to

- a) Locate the various motor areas of cerebral cortex
- b) Describe the pathway of the pyramidal tract
- c) Describe the pathways and functions of major extrapyramidal tracts
- d) Express the function of brainstem in controlling motor functions of the body

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition,  
page: 667-674

Ganong's Review of Medical Physiology 23<sup>rd</sup> edition, page: 157-164

## LECTURE 13- MENINGES OF BRAIN AND SPINAL CORD

At the end of the lecture the student should be able to

- a) Discuss dura mater of brain with its modifications
- b) Describe dural venous sinuses
- c) Enumerate veins of brain draining in cranial venous sinuses
- d) Describe arachnoid mater and pia mater of brain with arachnoid villi and sub arachnoid space
- e) Enumerate meninges of spinal cord with its modifications

Reference- Gray's Anatomy for students, 2<sup>nd</sup> edition. Meninges and brain and its blood supply, chapter 8 Page 830-834, 842-846

Identify clinical application i.e. intracranial hemorrhages, meningeal headaches

## LECTURE 14- MENINGES AND PRION DISEASE

At the end of the lecture the student should be able to

- a) Define meningitis
- b) Enlist the types of meningitis
- c) Describe the pathophysiology of bacterial and tuberculous meningitis
- d) Enlist the various prion diseases
- e) Describe the pathophysiology of CJD (Creutzfeldt-Jakob disease)

Reference- Robbin's Basic Pathology 8<sup>th</sup> edition-pages 874-876, 880-881

## LECTURE 15- MENINGITIS

At the end of the lecture the student should be able to

- a) List causes of acute and chronic meningitis
- b) Discuss pathogenesis of acute and chronic meningitis
- c) Discuss mechanism of transmission of pathogens causing acute and chronic meningitis
- d) Discuss pathogenesis of Tuberculous, Cryptococcal and Viral Meningitis
- e) Explain the role of immunization in prevention of acute and chronic meningitis

Reference- Schaechter's Mechanisms of Microbial Disease 4<sup>th</sup> edition, page 594-599

-Jawetz, Melnick & Adelberg's Medical Microbiology 25th page 269-270, 405-406, 649-651

-Medical Microbiology and Infection at a Glance, Fourth Edition 2012, Chap 49,

- f) Discuss laboratory diagnosis of acute and chronic meningitis

## LECTURE 16- CRANIAL NERVES AND THEIR NUCLEI-I

At the end of the lecture the student should be able to

- a) Identify cranial nerves emerging from the base of the brain
- b) Explain olfactory and optic pathways.
- c) Identify course and nuclei of III and IV cranial nerves.
- d) Enlist nuclei, components and course of V and VI cranial nerves.
- e) Enlist nuclei and course of VII cranial nerve
- f) Enlist nuclei, components and course of vestibulocochlear nerves.

Reference- Gray's Anatomy for students, 2<sup>nd</sup> edition. Chapter 8 Cranial Nerves- page 848-855

## LECTURE 17- BLOOD SUPPLY OF BRAIN AND SPINAL CORD

At the end of the lecture the student should be able to

- a) Enumerate arterial supply of brain
- b) Explain division of arterial system in carotid and vertebral systems
- c) Enumerate branches of carotid and intervertebral arteries
- d) Explain circle of Willis and identify arterial supply of specific brain areas
- e) Enumerate veins of brain and spinal cord
- f) Identify clinical application

Reference- Clinical Neuroanatomy by Richard S. Snell's, 7<sup>th</sup> edition. Chapter 17, pages 485-497,

## LECTURE 18- CEREBROVASCULAR DISEASES

At the end of the lecture the student should be able to



- a) Define hypoxia, ischemia, and infarction
- b) Describe the pathophysiology of these conditions
- c) Explain morphological features of above conditions in nervous system
- d) Understand the consequences of these conditions

Reference- Robbin's Basic Pathology 8<sup>th</sup> edition-pages 863-869

#### LECTURE 19-VENTRICULAR SYSTEM AND CEREBROSPINAL FLUID (CSF)

At the end of the lecture the student should be able to

- a) Enlist ventricles of brain along with their location.
- b) Explain the structure and location of lateral ventricle
- c) Explain the structure and location of third and fourth ventricle
- d) Discuss choroid plexus and cerebral aqueduct
- e) Define the Blood brain barrier
- f) Identify clinical application of ventricles and CSF flow

Reference- Clinical anatomy by regions, 8<sup>th</sup> edition Chapter 11: Page 683-84, 690

#### LECTURE 20- CEREBROSPINAL FLUID-FORMATION (CSF) AND FLOW

At the end of the lecture the student should be able to

- a) Enumerate the functions of CSF
- b) Describe the composition of CSF
- c) Explain the process of formation of CSF
- d) Describe the circulation and absorption of CSF
- e) Analyze the effects of change in CSF composition and pressure

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition: Page: 746-749

-Ganong's Review of Medical Physiology 23<sup>rd</sup> edition: page 79-82,115-123,129-146

#### LECTURE 21- CRANIAL NERVES AND THEIR NUCLEI-II

At the end of the lecture the student should be able to

- a) Enlist nuclei, components and course of glossopharyngeal nerve
- b) Enlist nuclei, components and course of vagus nerve
- c) Enlist nuclei, components and course of spinal accessory and hypoglossal nerve.
- d) Identify and describe parasympathetic ganglia of head.
- e) Identify clinical application.

Reference- Gray's Anatomy for students, 2<sup>nd</sup> edition. Chapter 8 Cranial Nerves Page 848-855

## LECTURE 22- BRAIN LIPIDS

At the end of the lecture the student should be able to

- a) Understand the complex lipids in the brain
- b) Discuss the lipids in the cellular milieu
- c) Describe the composition of myelin
- d) Explain the overview of related disorders

Reference- Harper's Illustrated Biochemistry 27<sup>th</sup> edition Pg 124 – 128

- Basic Neurochemistry – molecular, cellular and medical aspects 7<sup>th</sup> edition Pg 33 – 49

## LECTURE 23- CEREBRAL EDEMA, HYDROCEPHALOUS AND HERNIATION

At the end of the lecture the student should be able to

- a) Define and differentiate the terms cerebral edema, hydrocephalous and herniation
- b) Identify the causes of cerebral edema, hydrocephalous and herniation
- c) Explain the pathophysiology of cerebral edema, hydrocephalous and herniation
- d) Discuss the morphologic features of cerebral edema

Reference- Robbin's Basic Pathology 8<sup>th</sup> edition-pages 861-863

## LECTURE 24-STROKE

At the end of the lecture the student should be able to

- a) Define stroke and TIA (Transient Ischemic Attack)
- b) Enumerate types of stroke
- c) Discuss Localization Signs
- d) Describe mechanism of Stroke
- e) Enlist the risk factor of Stroke
- f) Identify the causes Of Stroke

- g) Discuss Management of stroke

Reference- Goldman's Cecil Medicine 24<sup>th</sup> Edition

#### LECTURE 25-UPPER MOTOR NEURON AND LOWER MOTOR NEURON LESIONS

At the end of the lecture the student should be able to

- Identify upper motor and lower motor neuron lesion.
- Enumerate the causes of upper motor and lower motor lesions
- Recognize localization sign
- Choose neuroinvestigation for upper motor and lower motor lesions
- Interpret clinical correlation

Reference- Clinical Medicine- Kumar and Clark 5<sup>th</sup> Edition

#### LECTURE 26-PHYSIOLOGY OF AUTONOMIC NERVOUS SYSTEM(ANS)

At the end of the lecture the student should be able to

- Recall the organization of ANS
- Describe the different types of receptors in ANS
- Express the characteristics and distribution of sympathetic and parasympathetic nervous system
- Analyze the role of renal medulla in ANS
- Identify the clinical correlation of ANS

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition: page - 729-739

#### LECTURE 27- PATHOLOGY OF PERIPHERAL NERVOUS SYSTEM (PNS)

At the end of the lecture the student should be able to

- Enlist the important PNS lesions
- Describe the pathophysiology of Guillain-Barre Syndrome, Schwannoma, and Neurofibroma

Reference- Robbin's Basic Pathology 8<sup>th</sup> edition-pages 861-863

#### LECTURE 28- ANATOMY OF CEREBELLUM AND ITS CONNECTIONS

At the end of the lecture the student should be able to

- a) Identify external features of cerebellum
- b) Enumerate neurons, fibers, nuclei and layers of cerebellum
- c) Identify connections of cerebellum
- d) Identify clinical application

Reference- Clinical Neuroanatomy by Richard S. Snell's, 7<sup>th</sup> edition. Chapter 6, 231-244

#### LECTURE 29-CEREBELLUM

At the end of the lecture the student should be able to

- a) Name and locate functional areas of cerebellum
- b) Explain the connections of cerebellum
- c) Enlist the functions of cerebellum
- d) Describe the clinical features in patients with cerebellar dysfunction
- e) Recognize cerebellar signs

Reference Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition: page.681-689

-Ganong's Review of Medical Physiology 23<sup>rd</sup> edition. page 254-258

#### LECTURE 30- CEREBELLAR DYSFUNCTIONS

At the end of the lecture the student should be able to

- a) Recall cerebellar functions
- b) Identify cerebellar dysfunction
- c) Identify the causes of cerebellar dysfunction
- d) Review clinical cases related to cerebellar dysfunction

Reference- Clinical Medicine- Kumar and Clark 5<sup>th</sup> Edition

#### LECTURE 31- DIENCEPHALON AND PITUITARY GLAND

At the end of the lecture the student should be able to

- a) Identify the structure and divisions of diencephalon
- b) Describe the boundaries of diencephalon
- c) Discuss external and internal features of thalamus
- d) Discuss sub thalamus, epithalamus, Habenular nucleus and pineal body
- e) Identify relations of hypothalamus
- f) Discuss hypothalamic nuclei in lateral and medial zones

- g) Identify afferent and efferent connections of hypothalamus
- h) Describe hypothalamic connections of pituitary gland
- i) Identify hypophyseal portal system.

Reference- Gray's Anatomy: The anatomical basis for clinical practice, 39<sup>th</sup> edition.  
Section 2, Chapter 21

## LECTURE 32- THALLAMUS, HYPOTHAMUS AND LIMBIC SYSTEM

At the end of the lecture the student should be able to

- a) Discuss the functions of thalamus
- b) Discuss the functions of limbic system
- c) Explain the hypothalamic regulation of
  - i. Endocrine secretion
  - ii. Appetite behavior
  - iii. Body temperature regulation
- d) Understand the hypothalamic control of limbic system

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition:  
page:714-720

## LECTURE 33 BASAL GANGLIA

At the end of the lecture, the students should be able to,

- a) Enumerate the constituents of basal ganglia
- b) Locate the connections of basal ganglia and the neurotransmitters involved
- c) Explain the functions of basal ganglia
- d) Explain the pathophysiology of common disorders of basal ganglia

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition: page:  
689-694

## LECTURE 34- MAINTENANCE OF POSTURE AND BALANCE

At the end of the lecture the student should be able to

- a) Explain the levels of control in body posture
- b) Define and explain postural reflexes
- c) Describe the body posture in spinal, decerebrate and decorticate conditions



- d) Explain the mechanisms of standing and walking

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition: page: 667-678,663-664

-Ganong's Review of Medical Physiology 23<sup>rd</sup> edition: Page: 241-249

### LECTURE 35- VESTIBULAR APPARATUS AND EQUILIBRIUM

At the end of the lecture the student should be able to

- Discuss the structures of the vestibular apparatus
- Explain the neural pathway controlling equilibrium of the body
- Describe the response of the body to linear and rotational acceleration
- Enumerate and explain the other structures of body involved in equilibrium apart from the vestibular apparatus
- Explain the pathophysiology of vestibular disorders

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition: page.674-678

-Junquera's Basic Histology- Chapter 23

### LECTURE 36- INTELLECTUAL FUNCTIONS- MEMORY AND SPEECH

At the end of the lecture the student should be able to

- Explain sensory and motor mechanism of speech
- Classify and define types of memory
- Explain physiological basis of memory
- Differentiate the different types of memory deficits
- Describe the mechanism of speech
- Differentiate between different type of speech disorders

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition: page.705-709

### LECTURE 37-SLEEP

At the end of the lecture the student should be able to

- Enumerate different types of sleep and differentiate between them
- Explain the sleep cycle

- c) Describe the mechanism of sleep generation
- d) Understand the physiological effects of sleep
- e) Apply his knowledge to understand sleep disorders

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition: Page: 721-725

-Ganong's Review of Medical Physiology 23<sup>rd</sup> edition: Page: 233-239

#### LECTURE 38- NEUROPHYSIOLOGICAL INVESTIGATION

At the end of the lecture the student should be able to

- a) Define EEG( Electroencephalogram)
- b) Explain pattern and uses of EEG
- c) Explain the process of Nerve conduction study
- d) Define Electromyography and mention its uses
- e) Define Visual evoked potential mention its uses
- f) Explain the brain stem reflex

Reference- Clinical Medicine- Kumar and Clark 5<sup>th</sup> Edition

#### LECTURE 39- IMAGING OF BRAIN AND SPINAL CORD

At the end of the lecture the student should be able to

- a) Identify normal brain CT ( Computer Tomography) scan
- b) Understand the basis of MRI brain and sequence
- c) Identify anatomical brain structure in neuroimaging
- d) Identify abnormal finding in CT scan with clinical correlation

Reference- Clinical Medicine- Kumar and Clark 5<sup>th</sup> Edition

#### LECTURE 40 - ANAESTHETICS

At the end of the lecture the student should be able to

- a) Discuss pharmacology of intravenous and inhalational anesthetics
- b) Describe the pharmacology of local anesthetics
- c) Explain the rationale of drugs used in pre-anesthetic medication

Reference- Lippincott's Illustrated Reviews: Pharmacology, 5th Edition 133-149

#### LECTURE 41- DEGENERATIVE DISEASES OF BRAIN

At the end of the lecture the student should be able to

- a) Enlist the degenerative diseases of brain
- b) Describe the pathophysiology of Huntington disease, Spinocerebellar degenerations, Diseases of Motor neurons
- c) Describe the pathophysiology of multiple sclerosis

Reference- Robbin's Basic Pathology 8<sup>th</sup> edition-pages 891-897

#### LECTURE 42- DRUGS USED IN NEURODEGENERATIVE DISEASES

At the end of the lecture the student should be able to

- a) Describe the pharmacology of drugs used in Parkinson's disease
- b) Treatment of Parkinson's disease
- c) Discuss drugs used in Alzheimer's disease
- d) Enumerate drugs used in multiple sclerosis and amyotrophic lateral sclerosis

Reference- Lippincott's Illustrated Reviews: Pharmacology, 5th Edition 99-110

#### LECTURE 43-ALZHEIMER'S DISEASE AND PARKINSON'S DISEASE

At the end of the lecture the student should be able to

- a) Identify Alzheimer's disease
- b) Explain pathophysiology and morphological features of Alzheimer's disease
- c) Describe the consequences of Alzheimer's disease
- d) Identify Parkinson's disease
- e) Explain pathophysiology and morphological features of Parkinson's disease
- f) Describe the consequences of Parkinson's disease

Reference- Robbin's Basic Pathology 8<sup>th</sup> edition-pages 891-895

#### LECTURE 44- EPILEPSY

At the end of the lecture the student should be able to

- a) Classify epilepsy and describe the epidemiology of epilepsy
- b) Enlist the risk factors of epilepsy
- c) Identify provoked and unprovoked seizure
- d) Enlist the causes of epilepsy
- e) Define status epilepticus

- f) Explain the management protocol of epilepsy

Reference- Goldman's Cecil Medicine 24<sup>th</sup> Edition

#### LECTURE 45- TETANUS

At the end of the lecture the student should be able to

- a) Explain etiology, pathogenesis and mechanism of transmission
- b) Discuss the mechanism of action of tetanus toxin
- c) Discuss the role of immunization in primary and secondary prevention of tetanus

Reference- Jawetz, Melnick & Adelberg's Medical Microbiology 25th Edition  
Chapter 11, Clostridium tetani Page 170-171

#### LECTURE 46 & 47- COMMON CENTRAL NERVOUS SYSTEM TUMORS

At the end of the lecture the student should be able to

- a) Enumerate the common CNS tumours
- b) Explain the pathophysiology of CNS tumours
- c) Describe the morphology of common CNS tumours
- d) Enlist the consequences of major CNS tumours

Reference- Robbin's Basic Pathology 8<sup>th</sup> edition-pages 882-887, 899-901

#### LECTURE 48- ENCEPHALITIS & MENINGOENCEPHALITIS

At the end of the lecture the student should be able to

- a) List the causes of encephalitis and meningo-encephalitis
- b) Discuss pathogenesis of HSV encephalitis, rabies encephalitis and Primary Amoebic meningo-encephalitis
- c) Explain mechanism of transmission of HSV, rabies and Primary Amoebic meningo-encephalitis
- d) Discuss laboratory diagnosis of rabies encephalitis and meningo-encephalitis
- e) Explain the role of immunization in primary and secondary prevention in rabies encephalitis

Reference- Schaechter's Mechanisms of Microbial Disease 4<sup>th</sup> Edn, page 599-600, 358-362, 502-503

-Jawetz, Melnick & Adelberg's Medical Microbiology 25th Edition Chap 42, Rabies Page 579-585, Chap 33, Herpes virus, Page437-440

## LECTURE 49-ANTIPILEPTICS

At the end of the lecture the student should be able to

- a) Classify antiepileptic drugs
- b) Describe the pharmacology of antiepileptic drugs
- c) Explain management of epilepsy

Reference- Lippincott's Illustrated Reviews: Pharmacology, 5th Edition 180-191

## LECTURE 50- IMPACT OF NEUROLOGICAL DISORDERS AND REHABILITATION

At the end of the lecture the student should be able to

- a) Enlist various neurological disease
- b) Describe the principles of neuro-rehabilitation and its applications in neurological diseases
- c) Discuss various types of rehabilitation useful in management in neurological diseases
- d) Explain how rehabilitation improves in the quality of life in neurological diseases

Reference- Harrison's Principles of Internal Medicine, 16<sup>th</sup> Edition

## LECTURE 51- ANXIOLYTICS, HYPNOTICS AND CNS STIMULANTS

At the end of the lecture the student should be able to

- a) Describe the pharmacology of benzodiazepines
- b) Treatment of benzodiazepine poisoning
- c) Discuss pharmacology of barbiturates
- d) Explain treatment of barbiturate poisoning
- e) Describe pharmacology of psychomotor stimulants

Reference- Lippincott's Illustrated Reviews: Pharmacology, 5th Edition 111-132

## LECTURE 52- ENERGY METABOLISM AND METABOLIC ENCEPHALOPATHIES

At the end of the lecture the student should be able to

- a) Integrate the various metabolic pathways in the context of brain cells
- b) Describe the relation of energy metabolism to pathological conditions in the brain
- c) Classify and overview of metabolic encephalopathies

Reference- Basic Neurochemistry – molecular, cellular and medical aspects 7<sup>th</sup> edition. Pg 531 - 600



### LECTURE 53- ANTIPSYCHOTICS

At the end of the lecture the student should be able to

- a) Classify antipsychotic drugs
- b) Explain therapeutic uses and adverse effects of antipsychotic drugs
- c) Describe the management of schizophrenia

Reference- Lippincott's Illustrated Reviews: Pharmacology, 5th Edition 161-167

### LECTURE 54-POLIO AND PRION DISEASE

At the end of the lecture the student should be able to

- a) Discuss etiology, pathogenesis and epidemiology of poliomyelitis
- b) Explain the role of immunization on epidemiology of poliomyelitis
- c) List various prion diseases
- d) Discuss etiology, pathogenesis and transmission of Prion disease
- e) Discuss the role of sterilization & disinfection in transmission of prion disease

Reference- Jawetz, Melnick & Adelberg's Medical Microbiology 25th Edition Chap 36, Poliovirus, Page 494-497, Chap 42, Prion and slow virus disease Page 585-587

### LECTURE 55- CONGENITAL MALFORMATIONS OF CNS (CENTRAL NERVOUS SYSTEM) AND PERINATAL BRAIN INJURY

At the end of the lecture the student should be able to

- a) Enlist the CNS congenital malformation.
- b) Describe the pathophysiology of major CNS congenital malformations in detail.
- c) Define perinatal brain injuries
- d) Enlist the perinatal brain injuries
- e) Explain the pathophysiology of cerebral palsy

Reference- Robbin's Basic Pathology 8<sup>th</sup> edition-pages 871-873

### LECTURE 56- ANTIDEPRESSANTS

At the end of the lecture the student should be able to

- a) Describe pharmacology of Selective serotonin reuptake inhibitors (SSRI) & serotonin/norepinephrine reuptake inhibitors
- b) Discuss pharmacology of atypical antidepressants

- c) Explain pharmacology of tricyclic antidepressant
- d) Illustrate pharmacology of mono amino oxidase inhibitors
- e) Describe the management of mania & bipolar disorders

Reference- Lippincott's Illustrated Reviews: Pharmacology, 5th Edition 151-159

#### LECTURE 57- CEREBRAL PALSY

At the end of the lecture the student should be able to

- a) Define the term cerebral palsy
- b) Mention the prevalence of cerebral palsy
- c) Enumerate the causes and risk factors of Cerebral Palsy
- d) Classify the types of Cerebral Palsy

Reference-Nelson's textbook of Pediatrics

#### LECTURE 58-HEADACHE SYNDROMES

At the end of the lecture the student should be able to

- a) Take history for headache patient and examination
- b) Identify headache syndrome including migraine with /without aura ,tension type,mixed type ,chronic type ,medication overuse headache ,trigeminal autonomic cephalgia
- c) Identify different types of headache
- d) Enumerate the causes of headache
- e) Discuss management of headache
- f)

Reference-Clinical Medicine, Kumar and Clark 5<sup>th</sup> Edition: Pages 1124-1125, 1203-1204

- Reference- Goldman's Cecil Medicine 24<sup>th</sup> Edition

#### LECTURE 59- PHARYNGEAL APPARATUS: DEVELOPMENT AND DERIVATIVES OF PHARYNGEAL POUCHES

At the end of the lecture the student should be able to

- a) Explain the formation of pharyngeal arches
- b) Enlist the derivatives of pharyngeal arches with their innervations

- c) Define pharyngeal pouches and identify their derivatives
- d) Discuss development of face
- e) Explain the formation of intermaxillary segment and secondary palate
- f) Identify congenital anomalies

Reference- Langman's Medical Embryology, 11<sup>th</sup> edition. Chapter 16 Page 267-275,

## LECTURE 60- ORGANIZATION OF NECK

At the end of the lecture the student should be able to

- a) Describe the osteology of typical and atypical cervical vertebrae
- b) Discuss superficial fascia of neck region with platysma, cutaneous nerves, superficial veins and superficial lymph nodes.
- c) Discuss modifications of deep fascia of neck
- d) Enumerate muscles of neck region
- e) Discuss lymphatic drainage of neck region.
- f) Identify clinical application e.g. External jugular vein and internal jugular vein catheterization, Platysma Innervations, Mouth Distortion, Neck Incisions, Torticollis, clinical significance of deep fascia and cervical lymph nodes.

Reference- Clinical anatomy by regions, 9<sup>th</sup> edition, Richard S. Snell's Chapter 11 page 582-605.

## LECTURE 61- ANATOMY OF THE NECK REGION: I

At the end of the lecture the student should be able to

- a) Enumerate triangles of neck with its boundaries and contents
- b) Describe suprahyoid and infrahyoid muscles
- c) Discuss the formation of cervical plexus with its branches
- d) Enumerate arteries and veins of neck
- e) Discuss common carotid, external carotid, internal carotid arteries with its major branches
- f) Discuss internal jugular vein with its tributaries
- g) Clinical application e.g. carotid sinus hypersensitivity, phrenic nerve injury.

Reference- Clinical anatomy by regions, 9<sup>th</sup> edition, Richard S. Snell's Chapter 11 page 589-602,616-618

## LECTURE 62- ANATOMY OF THE NECK REGION: II

At the end of the lecture the student should be able to

- a) Discuss anterior vertebral muscles of neck region with its innervations, vascular supply and action.
- b) Discuss lateral vertebral/scalene group of muscles with its innervations, vascular supply and action.
- c) Enumerate the boundaries and contents of root of neck.
- d) Describe components of cervical part of sympathetic trunk.
- e) Identify clinical application e.g. Sympathectomy for Arterial Insufficiency of the Upper Limb, Horner's Syndrome, cervical rib and compression syndromes of brachial plexus.

Reference- Clinical anatomy by regions, 9<sup>th</sup> edition, Richard S. Snell's Chapter 11 page 589-602,616-618

## LECTURE 63- STRUCTURE OF ORBIT AND EYE

At the end of the lecture the student should be able to

- a) Describe development of optic cup and lens vesicle
- b) Discuss development of retina, iris and ciliary body
- c) Describe development of lens, choroid, sclera, cornea, vitreous body and optic nerve
- d) Identify the developmental anomalies of eye
- e) Describe boundaries of bony orbit
- f) Enlist structures of eyelids
- g) Identify components of lacrimal apparatus
- h) Enumerate extrinsic muscles of eyeball with its innervations, blood supply and movement
- i) Enumerate components of eye ball with fibrous layer, vascular layer , inner layer of eye ball with innervations and blood supply
- j) Identify clinical application.

Reference- Gray's Anatomy for students, 2<sup>nd</sup> edition. Chapter 8 orbit Page 878-902,  
- Langman's Medical Embryology, 11<sup>th</sup> edition. Chapter 19 Page 335-342,

## LECTURE 64- MECHANISM OF VISION

At the end of the lecture the student should be able to

- a) Describe the structure of eye including the layers of retina
- b) Explain the principles of optics
- c) Describe the photochemistry of vision with reference to rods and cones
- d) Explain the electrophysiology of vision

Reference- Guyton and Hall- textbook of physiology 12<sup>th</sup> edition: Page: 609-622

## LECTURE 65- VISUAL PATHWAY

At the end of the lecture the student should be able to

- a) Locate the whole visual pathway from eyes to the cortex
- b) Define visual field
- c) Interpret the clinical features due to lesions in the visual pathway

Reference- Guyton and Hall- textbook of physiology 12<sup>th</sup> edition: page.623-627, 631-632

## LECTURE 66 - PHARYNX AND LARYNX-I

At the end of the lecture the student should be able to

- a) Discuss development of pharynx
- b) Describe parts of pharynx.
- c) Enumerate muscles of pharynx.
- d) Identify nerve supply and action of muscles of pharynx
- e) Discuss nerve supply, blood supply and lymphatic drainage of pharynx.
- f) Identify clinical correlation e.g. Tonsillitis, foreign bodies and piriform fossa.

Reference- Clinical anatomy by regions, 9<sup>th</sup> edition, Richard S. Snell's Chapter 11, page no. 634-640, 644-650

## LECTURE 67- PHARYNX AND LARYNX-II

At the end of the lecture the student should be able to



- a) Discuss development of larynx
- b) Describe framework of larynx i.e. cartilage, ligaments and membranes
- c) Describe inlet, folds, recess and muscles of larynx
- d) Enumerate blood supply, nerve supply and lymphatic drainage.
- e) Identify clinical application i.e. laryngeal nerve lesions, laryngeal oedema, laryngoscope and laryngeal mirror.

Reference- Clinical anatomy by regions, 9<sup>th</sup> edition, Richard S. Snell's Chapter 11, page no. 634-640, 644-650

## LECTURE 68- STRUCTURE OF EAR

At the end of the lecture the student should be able to

- a) Describe development of external, middle and inner ear
- b) Describe components of external ear
- c) Describe components of middle ear
- d) Discuss components of inner ear
- e) Identify clinical application, i.e. tympanic membrane perforation, mastoiditis, hearing loss and congenital anomalies.

Reference- Gray's Anatomy for students, 2<sup>nd</sup> edition. Ear, chapter 8, page 902-919

-Langman's Medical Embryology, 11<sup>th</sup> edition. Chapter 18, Page 327-333

## LECTURE 69- HEARING PATHWAY AND MECHANISM OF HEARING

At the end of the lecture the student should be able to

- a) Recall the pathway of sound wave from ear pinna to cochlea
- b) Understand the transmission of sound waves from cochlea to the cerebral cortex
- c) Identify the role of external and middle ear in sound conductance
- d) Understand the mechanism of sound conductance in cochlea
- e) Explain the mechanism of generation of endocochlear potential
- f) Describe the role of central auditory pathway in hearing mechanism
- g) Distinguish the difference between conductive and sensorineural deafness.

Reference- Guyton and Hall- textbook of physiology 12<sup>th</sup> edition: page 633-642

## LECTURE 70- TONGUE

At the end of the lecture the student should be able to

- a) Discuss development of tongue
- b) Describe mucous membrane of tongue
- c) Enlist extrinsic and intrinsic muscles of tongue with its action and nerve supply
- d) Identify blood supply, nerve supply and lymphatic drainage of tongue.
- e) Identify congenital anomalies of the tongue

Reference- Langman's Medical Embryology, 11<sup>th</sup> edition. Chapter 16, Page no. 277-278,

-Clinical anatomy by regions, 9<sup>th</sup> edition, Richard S. Snell's Chapter 11, Page no. 623-625

## LECTURE 71-FACE

At the end of the lecture the student should be able to

- a) Describe sensory nerves of face
- b) Discuss arterial supply, venous and lymphatic drainage of face
- c) Discuss muscles of facial expression
- d) Identify clinical application i.e., trigeminal neuralgia, facial infections and cavernous sinus thrombosis, facial muscle paralysis.

Reference- Gray's Anatomy for students, 2<sup>nd</sup> edition. Skull, Chapter 8, Page 812; Face, chapter 8, Page 856-859,

## LECTURE 72- TEMPORAL & INFRATEMPORAL FOSSA

At the end of the lecture the student should be able to

- a) Discuss bones forming boundaries of temporal and infratemporal fossa
- b) Describe temporomandibular joint with its movements
- c) Enlist muscles of mastication with its innervations and functions
- d) Discuss boundaries of temporal and infratemporal fossa with its contents
- e) Identify clinical application of the temporal and infratemporal fossa

Reference- Gray's Anatomy for students, 2<sup>nd</sup> edition temporal and infratemporal fossa, chapter 8, page 921-939

## LECTURE 73- MECHANISM OF TASTE AND OLFACTION

At the end of the lecture the student should be able to

- a) Recall the primary taste sensations
- b) Explain the structure and mechanism of stimulation of taste buds
- c) Recall the taste pathway
- d) Explain the structure of olfactory mucosa
- e) Describe the mechanism of stimulation of olfactory cells
- f) Recall the olfactory pathway
- g) Explain the role of central nervous system in olfaction
- h) Explain abnormal smell sensations
- i) Explain the clinical correlation of taste sensations and olfaction

Reference- Guyton and Hall- Textbook of Medical Physiology 12<sup>th</sup> edition: page 645-651

## LECTURE 74- ACUTE AND CRONIC OTITIS MEDIA

At the end of the lecture the student should be able to

- a) Discuss etiology, pathogenesis & epidemiology of Acute & Chronic Otitis Media
- b) Discuss lab diagnosis of Acute & Chronic Otitis Media

Reference- Greenwood Medical Microbiology, 17<sup>th</sup> Edition, Page 186, 188, 191, 658

Schaechter's Mechanisms of Microbial Disease 4<sup>th</sup> Edition, page 660-661

## DETAILED OBJECTIVES OF THE PRACTICAL SESSIONS

### PRACTICAL 1- ANATOMY OF SPINAL CORD

At the end of the session the students should be able to

- a) Identify the coverings and the supporting structures of the spinal cord.
- b) Identify the point of the termination of the spinal cord and the dural sac by using models and cadaver.
- c) Identify the terminal specialties of the cord, their relation to lumbar puncture, the nerve rootlets, and blood supply.
- d) Describe the anatomy of spinal cord
- e) Identify clinical application e.g. possible cord injury

Reference- Clinical Neuroanatomy by Richard S. Snell's, 7<sup>th</sup> edition. Chapter 4, 134-160.

### PRACTICAL 2- PHYSIOLOGICAL EXAMINATION OF SENSATIONS

At the end of the session the students should be able to

- a) Define sensory axis and list its components.
- b) Diagram the main sensory pathways.
- c) Describe the components of sensory axis for fine touch, crude touch, pain and vibration sense.
- d) Describe the methods for examinations of the main sensory pathways.
- e) Relate the sensory examination to sensory disturbances.

Reference- Textbook of Practical Physiology, C. L., M.D. Ghai, Jaypee Brothers Medical Pub; 8 edition (October 2012)-Pages: 220-224

### PRACTICAL 3- ANATOMY OF SKULL AND MENINGES

At the end of the session the students should be able to

- a) Identify scalp, its structural layers, muscles, nerves, and vessels by using dissected cadaver and models.
- b) Demonstrate the bones of the vault of the skull and the sutures uniting them.
- c) Demonstrate base of skull by using models and video's.
- d) Identify important foramina in base of skull by using models.
- e) Identify the prominent landmarks on the internal surface of the skull base.
- f) Identify specializations of cranial meninges, and cranial dural modifications.
- g) Identify anterior, middle and posterior cranial fossa.
- h) Identify radiological anatomy of skull and meninges.

Reference- Gray's Anatomy for students, 2<sup>nd</sup> edition. Meninges and brain and its blood supply, chapter 8 Page 830-834, 842-846

#### PRACTICAL 4- INFECTIONS OF CNS AND PATHOLOGY OF MENINGES

At the end of the session the students should be able to

Understand gross and microscopic features of the lesions

#### PRACTICAL 5-ANATOMY OF CEREBRUM AND BRAINSTEM

At the end of the session the students should be able to

- a) Identify lobes and sub divisions of cerebrum by using models and dissected cadaver.
- b) Identify major sulci and gyri and important associated functional areas in cerebral cortex.
- c) Locate infolding's of duramater and their relationship with cerebral hemisphere.
- d) Identify subdivisions of brain stem by using models and dissected specimens.
- e) Identify location of lateral and third ventricle by using plastinated models and video's.
- f) Identify radiological anatomy of cerebrum and brain by using video's and radiological films.
- g) Identify structures, divisions and boundaries of diencephalon

Reference- Clinical Neuroanatomy by Richard S. Snell's, 7<sup>th</sup> edition. Chapter 7 page 258-269.

- Clinical Neuroanatomy by Richard S. Snell's, 7<sup>th</sup> edition. Chapter 5, 187-222

#### PRACTICAL 6- BIOCHEMICAL ANALYSIS OF CEREBROSPINAL FLUID (CSF)

At the end of the session the students should be able to

- a) Commonly measured analytes in the CSF
- b) Pre-analytical considerations for the analytes
- c) Differential diagnosis of meningitis
- d) Special analytes measured in the CSF

Reference- Biochemistry of body fluids (ACBI) Page 1-10

Interpretation of diagnostic tests-Jacques Wallach 8<sup>th</sup> edition Page 316-340

#### PRACTICAL 7-BLOOD SUPPLY AND MICROANATOMY OF CENTRAL NERVOUS SYSTEM

At the end of the session the students should be able to



- a) Identify the arteries that contribute to the formation of the circle of Willis by using models, video's and cadaver.
- b) Identify the distribution of the cerebral arteries by using video's and plastinated models.
- c) Identify the arterial supply of spinal cord by using video's and plastinated models.
- d) Identify the entry route of internal carotid and vertebral arteries in cranial cavity.
- e) Identify radiological anatomy by using video's and radiological films.
- f) Identify microanatomy anatomy of cerebral cortex, cerebellum and spinal cord by using histological slides.

Reference- - Clinical Neuroanatomy by Richard S. Snell's, 7<sup>th</sup> edition. Chapter 17, 485-497

#### PRACTICAL 8- MICROBIOLOGICAL EXAMINATION OF CEREBROSPINAL FLUID

At the end of the session the students should be able to

- a) Perform Gram & ZN stain of deposit of CSF
- b) Identify the Gram Stain Reaction of the causative organism
- c) Differentiate between polymorphic/ lymphocytic pleocytosis
- d) Interpret a CSF report and give opinion about most likely etiology

Reference- Jawetz, Melnick & Adelberg's Medical Microbiology 25th Edition Chap 48, Central nervous system (Meningitis) Page 735-737.

-Jawetz, Melnick & Adelberg's Medical Microbiology 25th Edition Chap 47, Cerebrospinal Fluid Page 719

#### PRACTICAL 9- PHYSIOLOGY OF HUMAN REFLEXES

At the end of the session the students should be able to

- a) Outline the main components of reflex arc.
- b) Classify the human reflexes and give example for each type.
- c) Discuss the physiological basis of tendon jerk.
- d) List the different types and practice its examination.
- e) Discuss the clinical significance of tendon jerks.

Reference- Textbook of Practical Physiology, C. L., M.D. Ghai, Jaypee Brothers Medical Pub; 8 edition (October 2012) pages 342-344

#### PRACTICAL 10- PATHOLOGY OF NEURODEGENERATIVE DISEASES

At the end of the session the students should be able to  
Understand gross and microscopic features of the lesions

Reference- Robbin's Basic Pathology 8<sup>th</sup> edition-pages 891-897

#### PRACTICAL 11- ANATOMY OF CEREBELLUM

At the end of the session the students should be able to

- a) Identify lobes and sub divisions of cerebrum by using models and dissected cadaver.
- b) Locate infolding's of duramater and their relationship with cerebral hemisphere.
- c) Identify location of fourth ventricle by using plastinated models.
- d) Identify radiological anatomy of cerebrum and brain by using video's and radiological films.

Reference- Clinical Neuroanatomy by Richard S. Snell's, 7<sup>th</sup> edition. Chapter 6, 231-244

#### PRACTICAL 12- PATHOLOGY OF CNS TUMOURS

At the end of the session the students should be able to  
Understand gross and microscopic features of the CNS tumours

Reference- Robbin's Basic Pathology 8<sup>th</sup> edition-pages 882-887, 899-901

#### PRACTICAL 13-ANATOMY OF NECK REGION-I

At the end of the session the students should be able to

- a) Identify the boundaries of the anterior cervical triangle and their subdivisions in dissected cadaver and plastinated models.
- b) Identify area of distribution of cervical plexus.
- c) Identify the deep cervical fascia, its layers and modification in dissected cadaver and models.
- d) Identify sternocleidomastoid, digastric and infrahyoid (strap) muscles by using plastinated models and dissected cadaver.
- e) Recognize and describe the contents of the carotid sheath and their relationships with surrounding structures.
- f) Locate the vagus nerve and give its relationships to the fascia, vessels and viscera of the region.
- g) Identify radiological and surface anatomy of neck region by using models, radiographs and videos.

Reference- Clinical anatomy by regions, 9<sup>th</sup> edition, Richard S. Snell's Chapter 11  
page 589-602,616-618

## PRACTICAL 14 –ANATOMY OF NECK REGION II

At the end of the session the students should be able to

- a) Identify the boundaries of the posterior cervical triangle and its subdivisions.
- b) Recall general osteological features of cervical vertebrae.
- c) Identify the scalene muscles and the first rib.
- d) Identify the parts and branches of the subclavian artery and vein by using plastinated models and dissected cadaver.
- e) Identify the neurovascular entities that have different relationships to structures on the right and left sides of the root of the neck.
- f) Identify the deep cervical lymph nodes by using dissected cadaver.

Reference- Clinical anatomy by regions, 9<sup>th</sup> edition, Richard S. Snell's Chapter 11  
page 589-602,616-618

## PRACTICAL 15-PHYSIOLOGY OF VISION

At the end of the session the students should be able to

- a) Describe the different methods for measurement of visual acuity and discuss its physiological basis.
- b) Discuss the theories of colour vision and describe the different methods for its evaluation.
- c) Practice the pupillary light reflex, describe its components and discuss its clinical significance.
- d) Practice the corneal reflex, describe its components and discuss its clinical significance.

Reference- Textbook of Practical Physiology, C. L., M.D. Ghai, Jaypee Brothers  
Medical Pub; 8 edition (October 2012)-Pages: 204-213

## PRACTICAL 16-ANATOMY OF PHARYNX AND LARYNX

At the end of the session the students should be able to

- a) Identify, and trace the cranial nerves IX (glossopharyngeal), X (vagus), XI (spinal accessory), XII (hypoglossal).
- b) Identify pharynx, its anatomical structures and action of its musculature during swallowing by using plastinated models, video's and dissected cadaver.
- c) Identify the anatomy of the interior of the larynx by using models and videos.

- d) Identify the main cartilages and membranes that form the internal framework (skeleton) of the larynx.
- e) Describe the innervation and vascular supply of the larynx by using models and video's.
- f) Identify radiological and surface anatomy of pharynx and larynx.

Reference- Clinical anatomy by regions, 9<sup>th</sup> edition, Richard S. Snell's Chapter 11, page no. 634-640, 644-650

#### PRACTICAL 17- PHYSIOLOGY OF HEARING

At the end of the session the students should be able to

- a) Define deafness and mention its types.
- b) List the causes of different types of deafness.
- c) Describe the methods for measurement of hearing acuity (hearing tests)
- d) Practice the various hearing tests using tuning forks.
- e) Relate hearing tests to various types of hearing tests.

Reference- Textbook of Practical Physiology, C. L., M.D. Ghai, Jaypee Brothers Medical Pub; 8 edition (October 2012)-Pages: 213-218

#### PRACTICAL 18- ANATOMY OF EAR AND EYE

At the end of the session the students should be able to

- a) Describe the boundaries of orbit by using models and video's.
- b) Identify the course of optic nerve through optic canal to eye ball using models and videos.
- c) Identify extraocular muscles by using plastinated models and video's.
- d) Enlist fissures and foramen of orbits and structures passing through it
- e) Identify structure of external, middle and internal ear by using plastinated models and video's.

Reference- Gray's Anatomy for students, 2<sup>nd</sup> edition. Chapter 8 orbit Page 878-902  
- Gray's Anatomy for students, 2<sup>nd</sup> edition. ear, chapter 8, page 902-919

#### PRACTICAL 19- MICROANATOMY OF LARYNX, PHARYNX AND TONGUE

At the end of the session the students should be able to

- a) Identify microanatomy of larynx by using slides and videos.

- b) Identify microanatomy of pharynx by using slides and videos.
- c) Identify microanatomy of tongue by using slides and videos.

Reference- Junqueira's, Basic Histology, 12<sup>th</sup> Edition, Pages: 252-254,303

## PRACTICAL 20- ANATOMY OF FACE AND TONGUE

At the end of the session the students should be able to

- a) Describe the bones of skull forming the face
- b) Identify the branches of the facial nerve in the face by using plastinated models and videos.
- c) Identify some exemplary muscles of facial expression acting on the oral opening.
- d) Trace the course of the facial artery and facial vein in the face on models and dissected cadaver.
- e) List the muscles of the tongue and describe their origins.

Reference- Clinical anatomy by regions, 9<sup>th</sup> edition, Richard S. Snell's Chapter 11, Page no. 623-625

-Gray's Anatomy for students, 2<sup>nd</sup> edition. Skull, Chapter 8, Page 812; Face, chapter 8, Page 856-859

## PRACTICAL 21- ANATOMY OF TEMPORAL AND INFRATEMPORAL FOSSA

At the end of the session the students should be able to

- a) Identify osteology of temporal and infratemporal fossa.
- b) Identify the masticatory muscles.
- c) Identify boundaries and contents of the infratemporal fossa.
- d) Identify the branches of the trigeminal nerve and their functions related to mastication and sensation from the face.
- e) Identify the chorda tympani nerve and give its function.
- f) Identify parts of temporomandibular joint.
- g) Identify the major nerves and vessels of these spaces.
- h) Identify radiological and surface anatomy of temporal and infratemporal region.

Reference- Gray's Anatomy for students, 2<sup>nd</sup> edition temporal and infratemporal fossa, chapter 8, page 921-939



## DETAILED OBJECTIVES OF THE CLINICAL SKILL SESSIONS

### SESSION 1- EXAMINATION OF THE SENSORY SYSTEM

At the end of clinical skills sessions the student should be able to:

- a) Identify & learn clinically important sensory modalities
- b) Test sensory modalities like light touch, joint position sense, pin prick, vibration, temperature and two-point discrimination
- c) Identify common abnormalities of sensory modalities

### SESSION 2- EXAMINATION OF MOTOR SYSTEM

At the end of clinical skills sessions the student should be able to:

- a) Perform inspection & palpation of muscle groups to identify wasting, hypertrophy & fasciculation
- b) Assess the tone of muscles
- c) Test the power of muscles
- d) Elicit the deep tendon reflexes & plantar responses
- e) Test coordination of muscles

### SESSION 3- EXAMINATION OF CRANIAL NERVES

At the end of clinical skills sessions the student should be able to

- a) To name and number of each pair of cranial nerves
- b) To identify the region of the brain to which each pair is attached.
- c) To perform simple tests of function for each pair of cranial nerves.
- d) To identify common abnormalities of Cranial Nerves

### SESSION 4- LUMBAR PUNCTURE

At the end of clinical skills sessions the student should be able to:

- a) Describe the indications for LP
- b) Discuss the contraindications for an LP.
- c) Identify the correct anatomical location of lumbar puncture
- d) Reinforce the location of lumbar puncture in children and in adults with embryological development
- e) Demonstrate the correct technique for performing an LP using sterile technique.
- f) Correlate the structures that get the needle goes through during LP
- g) Interpret the CSF analysis and identify common abnormalities.

Reference- **Macleod's clinical examination 10<sup>th</sup> ed.**

## FIELD VISITS

### 1. Guidelines for field visits:

- A. Students should follow instruction given to them prior to the visit.
- B. A handout is given to students before every visit illustrating program, objectives and other details concerning the visit. Students are required to read handouts carefully.
- C. Students are encouraged to go to hospital utilizing transportation which is secured by the College Administration. Transportation will be available half an hour prior to visit. Students are expected to behave as future doctors. However, any misconduct by any student will be reported to the College Administration for appropriate measures according to University rules.
- D. At the end of each field visit, students are required to give their feedback regarding fulfillment of the objectives of the visit and clarify any comments and suggestions they may have. Feedback will be discussed in a scheduled session that will be held after the visit in the College.

### 1. Objectives of field visits:

#### 1. Visit to King Khalid Hospital



*At the end of the visit the student should be able to:*

- a. Identify the common types of neurological patients both admitted and outpatient visiting King Khalid Hospital.
- b. Understand the protocol of management of neurological patients in the hospital.
- c. Know the common investigations including radiology, performed on these patients in the hospital.
- d. Interpret the role of physiotherapy in treatment and follow up of the neurological patients in the hospital.

## 2. Visit to Rehabilitation Centre



*At the end of the visit, the student should be able to:*

- a) Define rehabilitation and explain its role in the treatment of neurological patients
- b) Identify the services available at the rehabilitation centre
- c) Identify the spectrum of patients at the rehabilitation centre
- d) Interpret the integration of services of the rehabilitation centre with that of the hospital
- e) Analyze the role of rehabilitation centre in the society
- f) Design ideas for any improvement in the services of the rehabilitation center

## SEMINARS

### I. GUIDELINES FOR SEMINAR SESSIONS:

1. Three seminars are scheduled during the module. Duration of each seminar is 2 hours.
2. The whole batch of students of the College of Medicine are divided into four groups, A, B, C and D ( around 10 students in each group)
3. Groups are recommended to assign a group leader chosen by students. Each group leader will be in charge for contacting the Module Coordinator, Dr. Khwaja Amir
4. A staff member will be assigned as a Seminar Supervisor for each group  
The Seminar Supervisor will be taking care of his group regarding:
  - a. Assigning students for giving presentations in coordination with the group leader.
  - b. Assigning of topics of seminars in coordination with group leader.
  - c. Direct helping and advising students during preparation of the presentations.
  - d. Leading and supervising of seminars regarding securing convenient venue, managing timing for each presentation and keeping order during seminars sessions.
  - e. Facilitating group discussion after each presentation.
  - f. Assessing students.
5. Three to four students are assigned for giving presentations in each seminar.
6. Each of the assigned students has to prepare a presentation for his assigned topic.
  - a. The presentation should be formatted by Microsoft office and PowerPoint program.
  - b. Only five to eight slides are required for each presentation.
  - c. Presentation should last for seven to ten minutes only. Five minutes will be allowed for whole group discussion.
  - d. Five to ten minutes are devoted for the tutor for giving feedback and comments.
7. Other students (not giving presentations) have to properly prepare themselves for active collaboration and discussion by reading topics related to seminars prior to attending (not just passive listening).



## II. DETAIL OBJECTIVES OF THE TOPICS OF EACH SEMINAR SESSION

### 1. DEVELOPMENT OF NERVOUS SYSTEM

At the end of the session the students should be able to

- a) Describe formation of basal, alar and floor plates in spinal cord development.
- b) Discuss congenital anomalies of spinal cord development.
- c) Recall formation of forebrain, mid brain and hind brain.
- d) Discuss congenital anomalies of brain development.

### 2. BRAINSTEM

At the end of the session the students should be able to

- a) Describe internal structure of pons at caudal and cranial levels.
- b) Discuss gross features of mid brain.
- c) Describe internal structures of mid brain at the level of superior and inferior colliculus.
- d) Identify clinical application i.e. Arnold-Chiari phenomenon, Wallenburg syndrome, medial medullary syndrome, Pontine hemorrhage, lesions of mid brain.

### 3. STROKE

At the end of the session the students should be able to

- a) Define stroke and discuss its epidemiology.
- b) Enumerate the major risk factors of stroke and mention its common clinical presentation.
- c) Differentiate between different types of stroke (thrombotic, hemorrhagic and embolic).
- d) Outline briefly of management of stroke and enumerate important protective mechanisms.

### 4. COMA

At the end of the session the students should be able to

- a) Describe briefly the physiological basis of consciousness.
- b) Define coma and list its causes.
- c) Explain the method to approach and evaluate the severity of a comatose patient.
- d) Outline the management of a comatose patient & Explain the term brain death

Reference-Langman's Medical Embryology, 11<sup>th</sup> edition

- Clinical Neuroanatomy by Richard S. Snell's, 7<sup>th</sup> edition

-- Clinical Medicine- Kumar and Clark 5<sup>th</sup> Edition



## CASE DISCUSSION (CD)

### 1. Guidelines of CD Sessions:

**a. Two scheduled CD sessions will be held during the module.**

**b. Instructional method:**

Small group learning

**c. Students preparation for the CD sessions:**

One week before each scheduled CD session, students will be given the full scenario of the case to be discussed. All students are asked and highly encouraged to read the scenario carefully and try to prepare themselves for the team-based learning discussion by trying to answer questions provided. Utilizing textbooks in the medical library and useful websites are of profound help in achieving convenient preparation in advance.

**d. CD Sessions:**

On the day of every CD session, the students will be dividing in four groups and for each group a faculty member will help them as a facilitator. During each session, the case will be presented and discussed by the students of each group in collaboration with the facilitator. They should bring their learning resources to the learning session to actively search and verify information that will be discussed. The facilitator will be in charge for facilitating discussions and clarifying points issued by students. The facilitator may also pose some critical questions related to the topic during the discussion. Active collaboration of all the students in the discussion will be necessary.

**e. Assessment of students for CD sessions:**

Topics discussed during CD sessions can be examined as a quiz at the end of the session and as well as in the module written exams in the form of scenario based questions and/or SEQs.

**CASE DISCUSSION 1 (CD 1)****Alzheimer's disease**

Mr. Abdurrahman 72years old male has been coming as follow up to the Psychiatric OPD of the King Khalid Hospital since 7 years with the complaints of forgetfulness. Initially his complaints were trivial like forgetting where he kept his keys or spectacles quite often daily. For the last couple of years the complaints are severe like often forgetting verses of Quran in salah, difficulty in tracing street while coming from mosque. Earlier he used to come alone to the hospital but these days his son accompanies him.

The patient was employed as gatekeeper in Post Office for several years and he retired 10 years back, thereafter he stays at home and is not involved in any active work. His wife passed away 2years back; he has four sons who have their own families. He lives with the eldest son who accompanied him to the hospital. The patient complains to the treating doctors that the behavior of the family members with him is not appropriate.

**Learning issues**

1. How do you classify memory?
2. What are the regions of brain responsible for memory consolidation?
3. What can be the causes of such a complaint in an individual?
4. How can you clinically asses the memory loss?
5. What are the causes of memory loss in advanced age?
6. What is the pathophysiology of the above mentioned disease?
7. What are the measures to prevent/delay the onset of the given disease?
8. According to you what is the reason of his annoyance with the family members.
9. Describe the management of the given case
10. What is the prevalence of this disease in Saudi Arabia and worldwide?

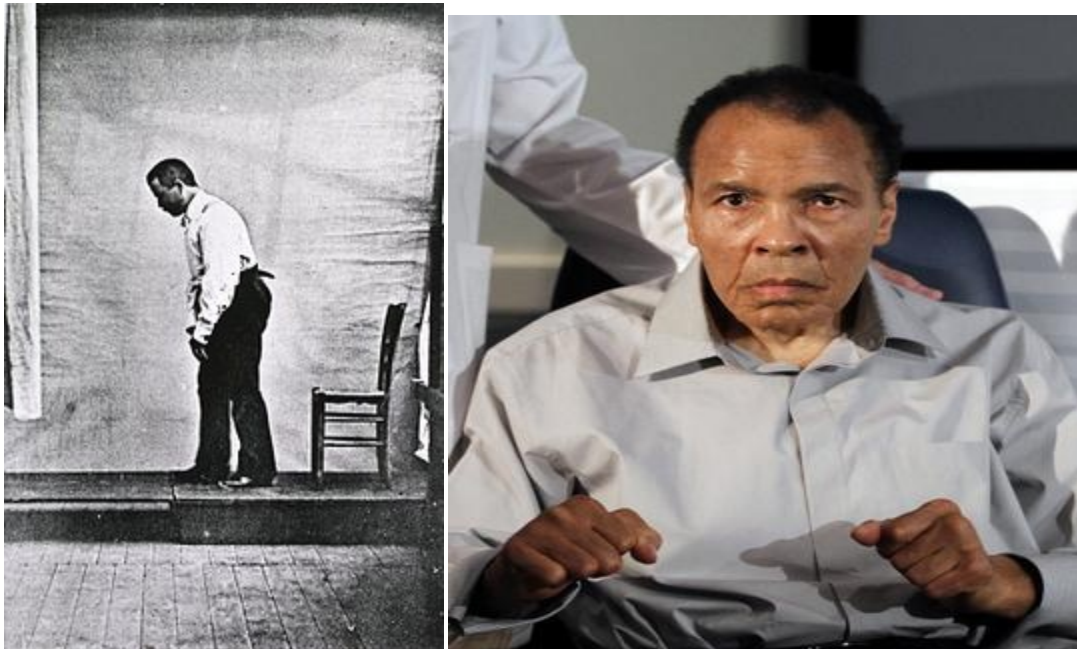
## CASE DISCUSSION 2 (CD 2)

### Parkinson's disease

Mr. Ismail a 65years old came to the outpatient department of King Khalid hospital accompanied by his son, experiencing abnormal movement in fingers in the form of tremors initially in the left hand and later on in the right hand for the past 2 months. Interestingly these tremors were present only when his hands were at rest and disappeared when he performed some work with the hands voluntarily. Patient also complained of slight stiffening of body and change in gait. The son identified that over these two months his father's face has become expressionless and tends to forget things frequently.

The doctor examined him thoroughly and made the diagnosis of Parkinson's disease.

The doctor counseled them and prescribed him drugs Levadopa and Carbidopa in low doses.



### Learning objectives

1. What is Parkinson's disease?
2. What do you understand by pyramidal and extrapyramidal disorders?
3. Why is there stiffness of body and change in gait?
4. Explain the pathophysiology of tremors in the given patient.
5. Why has the face of the patient become expressionless?
6. What is the physiological and biochemical abnormality in the neurological system of this patient?
7. Why the drug Levadopa is combined with another drug Carbidopa?
8. Why Levadopa is given in low doses and what are the adverse effects of long term treatment with Levadopa.

9. What are the pharmacological and nonpharmacological management for this disease?
10. What is the Epidemiology of Parkinson's Disease?
11. How will you follow up such a patient?

### CASE DISCUSSION 3 (CD 3)

#### Neuropathic Pain.

A 68 year old man, known case of type 2 diabetes mellitus on treatment since 15 years presented with a history of burning sensation in the foot which was associated with decreased vibration sense and occasional spontaneous severe lancinating pain. The doctor advised him Nerve Conduction Study which revealed peripheral neuropathy, RBS-276mg/dl. Further he was investigated for Deep Vein Thrombosis.

He was managed with

Inj. mixtard SC BD 8units BBF/ 6units before dinner

To be reviewed with endocrinologist after one week.

After extensive neurologic treatment strategies patient was stabilized on the following treatment

Tab. Amitryptaline

Tab. Multivitamin

#### Questions:

1. What is pain?
2. Locate the pain pathway and describe its physiological mechanism of pain?
3. What do you understand by endogenous analgesia system?
4. What is neuropathic pain?
5. What are the causes of neuropathic pain?
6. What is the pathophysiology of neuropathy in diabetes mellitus?
7. What are the further complications of diabetic neuropathy?
8. Describe management strategies in neuropathic pain.
9. What are the drugs used in the treatment of neuropathic pain with emphasis on mechanism of action and adverse effects
10. What are the investigations for Deep Vein Thrombosis?
11. What is epidemiology of the given disease?



**CASE DISCUSSION 4 (CD 4)****Bell's palsy**

A 26-years-young male reported to the emergency room with complains of asymmetry of his face when he looked into the mirror in the morning. He also complains of altered taste sensation and pain behind right ear .His family members tell that his face deviates when he smiles. There is no history of trauma to face, unconsciousness, fever, recent infection etc

On examination, he appeared anxious, otherwise alert. His vital signs showed pulse 75/min regular, BP. 110/75 mm of Hg, temperature 98.2°F, respiratory rate 15/min. Examination of central nervous system revealed asymmetry of face with loss of naso-labial fold right side, drooling of saliva from right angle of mouth, deviation of angle of mouth towards left side, inability to brow on right half of forehead. Patient was also unable to close his right eyelid. Rest of systemic examination was unremarkable.

His Blood Complete picture showed Hb 14.5 g/dl, TLC  $8.5 \times 10^9/L$ , Platelets  $210 \times 10^9/L$ . His C-reactive protein is  $\leq 5\text{mg/L}$ .

The doctor diagnosed this condition as Bell's palsy. Patient was prescribed analgesics, oral prednisolone and topical ophthalmic ointment with special advice for eye protection. After few weeks of treatment, he was found to have resolution of symptoms and no sequel at follow up.

**Learning Objectives**

1. What is the anatomical course and branches of Facial Nerve?
2. How to explain the of altered taste sensation in anterior half of tongue?
3. Explain why patient hear loud noise in his right ear?
4. Differentiate between upper motor neuron lesions from lower motor neuron lesion of facial nerve in this case?
5. What is the etiology of this condition?
6. What would have been concern of the physician had this patient presented with weakness of face on both sides of face?
7. Why did the physician advise the patient to protect his right eye? What complications can arise due to improper care of the eye?
8. How will you investigate such a case?
9. What is the management of such a case?
10. What is the epidemiology of this disease in KSA and worldwide?



## PROBLEM BASED LEARNING (PBL)

1. PBL 1- A patient with fever, headache and altered sensorium
2. PBL 2- A patient with abnormal movement and unconsciousness
3. PBL 3- A case of head injury
4. PBL 4- A 10 year old boy with hearing loss

## Quality Assurance and Evaluation Process

The teaching and learning process needs constant reviewing and monitoring to ensure that it meets the demands placed on it by the overall curriculum. Hence, there will be a number of evaluation strategies employed by the module.

They are as follows:

1. Student feedback at the end of the module, seeking student comments on both teaching and learning, and assessment, along with views on the general course organization and implementation
2. Student feedback of a sample of teaching and learning activities
3. Tutor feedback
4. Examiner feedback
5. Peer evaluation, where a staff member may visit a particular teaching and learning activity and provide formative feedback about its conduct
6. Analysis of the student's examination results
7. External review

## Teaching and Learning Methods

This section provides an elaboration of the teaching and learning methods that will be used to deliver this block. Thus, a detailed description and a step-wise guide to how these methods should be conducted will be given below.

- A. Interactive lectures**
- B. Small group learning sessions (PBL)**
- C. Seminars**
- D. Practical sessions**
- E. Skills lab sessions**
- F. Clinical teaching and learning sessions**
- G. Tutorials.**

### **A. Interactive lectures:**

#### ***Introduction:***

Interactive lectures are similar to the lectures used in all other parts of the curriculum, or anywhere else. They are, however, not the didactic lectures used in the past.

#### ***Process:***

The lecturer will involve the students in active discussion, and may provide brief learning activities during the lecture to achieve the learning objectives stated under each topic. Occasionally, there will be more than one lecture/lecturer to achieve all the learning objectives given under one topic. As much as possible, where applicable, the lectures will highlight clinical application of the content material. Students could take notes during a lecture, but the lecture slides will be available on Blackboard (i.e., the learning management system of the university).

### **B. Problem-Bases Learning (PBL):**

#### ***Introduction:***

These are activities where students are divided in a small group of about 10 under the supervision of a tutor/facilitator. One of the important methods of small group learning is PBL, where the students first will be trained how to work in a PBL.

#### ***Process:***

A detailed guide as to how a PBL is conducted provided separately. Please go through this guide, carefully before taking on PBL learning.

### **C. Seminars**

#### ***Introduction:***

In this method students will prepare for a relevant topic on a given 'curriculum facet'. The curriculum facet for discussion will be selected by the tutor. The topics related to a given curriculum facet could be either selected by the tutor or by the student, but pre-agreed with the tutor. The student will prepare for a 10-minute presentation on the topic and deliver it to the whole batch.

#### ***Process:***

1. Tutor selects a curriculum facet relevant to the module/theme that is being learned at that time.
2. Tutor asks for three student volunteers who are willing to prepare for three, 10- minute presentations.

3. The three volunteer students will discuss with the tutor and agree on three topics under a given curriculum facet. These topics will be either selected by the tutor or selected by the students with the concurrence of the tutor.
4. For a given learning session, 2 hours in duration, three students will deliver three, 10-minute presentations on a particular theme, selected by the tutor. After each 10-minute presentation here will be a 10-minute discussion.
5. Finally, the tutor will summarize the presentations of the session in the last 10 minutes.

#### **D. Practical sessions:**

##### ***Introduction:***

Practical sessions are designed to practically illustrate the concepts and principles introduced to the student in the lectures. Thus, the practical's will provide an opportunity for the students to acquire hands-on experience on an abstract concept or a principle they learned in the lectures; i.e. the students will experience for themselves how an abstract concept or a principle practically operates. Every theme that is studied within each module will have several practical sessions.

These practical's will range from demonstration of plastinated models to the dissection of cadavers. The topics of the practical sessions will be determined by the tutor as appropriate. A practical will be held for 2 hours in the newly built 'system based laboratories' under the guidance of a tutor. Depending on the nature of the subject matter taught within a module, a given module may or may not contain practical sessions.

##### ***Process:***

1. Tutors who teach in a particular theme, in collaboration with each other will determine an appropriate number of practical for a given theme.
2. Objectives of a given practical session will be developed and given to the students by the tutor before the practical.
3. Students will be pre-informed about a given practical topic. Depending on the type of practical and facilities available, 25 to 50 students will take part in a given practical session.
4. Students will record findings of the practical in a separate Practical Record Book.
5. At the end of the session the tutor will summarize the main learning points illustrated during the practical.

#### **E. Skills lab sessions:**

##### ***Introduction:***

Students will use the newly built, state-of-the-art skills lab to train the students in certain important practical, clinical skills from year 2; i.e., phase 2. An example for a skills lab session would be blood pressure measurement. Depending on the nature of the module, there may or may not be skills lab sessions for a given module.

##### ***Process***

1. The tutors who teach within a module in collaboration with each other will determine the number of skills lab sessions per module.
2. The tutors will then draw up the objectives for each session and inform the students about the objectives of the session prior to the skills lab session.
3. Depending on the nature of the skills lab session, students will either participate in small groups or as the whole batch. For example, for blood pressure measurement they will measure the blood pressure of each other in small groups.
4. Depending on the skill, the students will perform the skill either on themselves, on each other or on a simulator.
5. The students will record the findings of the skills lab session in a separate Skills Lab Record Book.



6. The tutor will at the end of the session summarize the main learning points.

### **F. Clinical teaching and learning sessions:**

#### ***Introduction***

Where relevant the students in small groups of 10, will visit a clinical setting (e.g., a ward, a clinic, or a surgical theatre, central sterilization unit) observe (e.g., observing the sterilization process in the central sterilization unit of the hospital) or experience (e.g., speaking with a patient who has a disease related to smoking) how a given concept or principle is clinically applied. Depending on the nature of the subject matter being taught, there may or may not be clinical teaching and learning sessions within a given module.

#### ***Process***

1. The tutors responsible for teaching and learning for a given module will determine the topics for which there will be clinical teaching and learning sessions.
2. The tutors will then draw up the objectives of a given session and communicate it to the student prior to the session.
3. The students will be divided into groups of 10.
4. A tutor will accompany the students to the clinical setting or a clinician (who is aware of the objectives of the session) from the relevant clinical setting will be assigned to show the students the relevant procedures that they need to observe or do.
5. Students will record their experience or observations in a 'Clinical Teaching and learning record book.

### **G. Tutorials:**

#### ***Introduction***

We have some tutorial sessions during the Module to help the students in clearing their concepts and solve their queries regarding the content of course and lectures.

#### ***Process***

In a tutorial session Tutors from all the departments will go and help the students to solve their Problems and queries

#### ***The aims of a tutorial***

- Tutorials help students to link together what they have heard in lectures and what students have read in textbooks, and to give them an opportunity to discuss these ideas. Discussion is critical; without it, it is not a tutorial.
- Tutorial is highly interactive, promotes opportunity for discussion, debate and critical reflection, and engages students in the subject content by way of analysis of the material being studied.
- Tutorials give students the opportunity to make mistakes (and learn from them) in a collegial and supportive environment.
- In addition tutorials provide the opportunity for contact between students, their peers and with academic staff.
- Help students to review the material they have learned in lectures, develop their ideas and implement their learning through questions and problem-solving.
- Give students a chance to ask questions, develop and voice opinions, argue and clarify their concepts and queries



## Assessment of the Module

### A. Continuous Assessment:

- These assessments will take place throughout the course
- They are mostly based the PBL sessions, Seminars, Case discussions, Clinical Skills, Laboratory and Practical activities
- Mid Module Examination comprising of MCQ's, SEQ's etc
- A proportion of marks (40%) from these assessments will contribute to the final summative module assessment

### B. Final assessment:

- The eligibility criterion for sitting the final examination will be the completion of 75% of attendance.
- This exam is held the end of the module assessment, and will be held under formal examination conditions, including MCQ, OSPE, OSCE and so forth.
- A proportion of marks (60%) from this assessment will contribute to the final summative mark of the module assessment.

