

NEUROSCIENCE MODULE

PHASE I



FACULTY OF MEDICAL SCIENCES
UNIVERSITY OF SRI JAYEWARDENEPURA



Neuroscience Module

Phase 1

Faculty of Medical Sciences
University of Sri Jayewardenepura
Gangodawilla
Nugegoda

Introduction

The nervous system facilitates, contact of an individual with his external and internal environment and aids appropriate responses. Neuroscience module introduces the basic development, structure and function of the nervous system emphasizing common neurological disorders.

The content areas include the normal and abnormal development of the nervous system, organization of human nervous system, control of movements, integration of different sensory modalities like general sensations (pain, touch etc) and special sensations (vision, hearing) as well as higher cerebral functions like speech and memory.

The above content areas are covered by lectures, dissections, practicals, tutorials and small group discussions. Language lab activities are incorporated to improve the knowledge on English language relevant for the neuroscience module. To further enhance the knowledge on neuroscience, IT lab activities have also been included. The activities during self study slots and student seminars will further enhance student centered learning.

At the end of the neuroscience module the students are expected to understand how the structure of the nervous system is related to the functions. Finally we expect the students will use the knowledge and skills acquired during this module to solve clinical problems in neurology. This module will definitely be a good base for the phase II neuroscience module.

Good luck and all the best for you and hope you will enjoy learning this module!

Neuroscience module Committee.

Committee

- Dr. Ranil de Silva (Chairperson)
- Dr. Shyamale Samaranayaka (Convener)
- Dr. Deepthi Samarage
- Dr. Chandana Hewage
- Dr. B.M.H.A. Bannaheka
- Dr. M.R.P.H. Liyanage
- Ms. Lohini Athithan
- Dr. Manjula Pathirana
- Dr. Disala Welgama
- Dr. Thayalini Viswalingam

Overall aim

At the end of the neuroscience module the students should acquire basic knowledge on development, structure and functions of the nervous system and should be able to identify common disorders that affect the nervous system.

General Objectives

At the end of the Neuroscience module, the student should be able to;

1. Describe the normal and abnormal development of CNS.
2. Describe the Structure of the head and neck region.
3. Describe common and special sensations and its clinical relevance.
4. Describe Anatomical and Physiological basis of motor system and its clinical relevance.
5. Discuss physiological basis of higher functions and disordered physiology.

Main Content Areas

- Embryology and organization of central nervous system.
- Sensory system.
- Motor system.
- Higher functions, Sleep and Hypothalamus

Embryology & organization of the Central Nerves System (CNS)

Objectives	Broad content area	Learning strategy	Learning materials	Duration	Department
1.0. Describe the development of CNS	Development of CNS and Pituitary gland. Describe the development of brain stem (Midbrain, Pons, and Medulla) and nuclei. Spinal cord. A	Lecture	Snell Neuro anatomy Embryology Langman Inderbir singh	1hr	Anatomy
1.1. Development the face and neck.	Describe the development of head and neck region Pharyngeal arches and its derivatives. (Endoderm, Mesoderm and Ectoderm) Describe the embryological basis of developmental abnormalities of the CNS. Development abnormalities of the face. A	Lecture SGD		1hr	Anatomy Anatomy

<p>2.0. Describe the Osteology and arrangement of the skull and cervical spine.</p>	<p>Discuss the boundaries contents and foraminae of anterior, middle and posterior cranial fossae.</p> <p>Describe the Osteology, Development and ossification</p> <p>A</p>	<p>Model room demonstration</p>	<p>Snell/Grant's/Mcmin's</p>	<p>1hr</p>	<p>Anatomy</p>
<p>3.0. Describe the Scalp.</p> <p>3.1. Describe the gross anatomy of the face, temporal fossa</p> <p>3.2. Identify and describe the content and the boundaries of deeper planes of the head and neck.</p> <p>3.3. Identify and describe the muscles that are key to deep planes of the head and neck.</p>	<p>Describe the layers of the scalp with its attachment and relevant clinical features. A</p> <p>Deep styloid region/sub parotid region, Infra temporal region, Pterygopalatine fossa,</p> <p>Triangles of the neck. B</p> <p>Describe hyoglossus, lateral pterygoid and scalenus anterior with relations B</p>	<p>Lecture</p> <p>Dissection /model demonstration SGD</p>		<p>1hr</p> <p>2*3hrs</p>	<p>Anatomy</p> <p>Anatomy</p>

6.0. Describe the arrangement of the CNS	Identify and describe, Basic components of brain (Fore brain, mid brain, hind brain). Describe the regions sulci and fissures of the cerebral cortex.	AVP		3hrs	Anatomy
	Structure of the spinal cord, cross sections of the spinal cord.	Dissection/ Demonstration		3hrs	Anatomy
	Ability to draw and describe cross section of the brain stem. A	Lecture		2hrs	Anatomy

7.0. Describe the anatomical pathways of cranial nerves with functions and dysfunctions.	Cranial nerve i, ii, viii will be discussed under sensory system.				
	Anatomical pathways of cranial nerves. Functions of the 3rd 4th and 6th nerves. A	Lecture on orbit eyeball and 3 rd , 4 th , 6 th cranial nerves. Model demonstration SGD eye movement	Snell/ Ganong	1hr	Anatomy
				1hr	Physiology
				3hrs	Anatomy
	Discuss the nuclei arrangement function and nerve distribution of the 5th nerve. Discuss conditions which affect these nerves and there clinical manifestation. Eg: herpes zoster	Lecture		1hr	Anatomy
Anatomical pathway of the 7th nerve and 7th nerve palsy, (LMN & UMN lesions of 7th nerve) A	Lecture Tutorial	Snell/ Ganong	1hr 2 hrs	Physiology	

Cont...	<p>Discuss the anatomical pathway and distribution of 9th and 10th nerve. Discuss lesions at different sites.</p> <p>Anatomical pathways of 11th nerve, distribution & functions and dysfunctions.</p> <p>Discuss Anatomical pathway of 12th nerve distribution functions and dysfunction</p> <p>Discuss clinical evaluation of cranial nerves A</p>	Lecture		1hr	Physiology
8.0.Para nasal sinuses, Ear and larynx.	<p>Discuss important clinical features.</p> <p>B</p>	Dissection with prosected specimen		3hrs*3	Anatomy
			3hrs 2 hrs	Physiology ”	

Neuroscience module
Sensory system

Objectives	Broad content area	Learning strategy	Learning materials	Duration	Department
1.0. Describe a sensory receptor and its adaptation to its function	<p>Define a sensory receptor and describe basic anatomical and physiological features.</p> <p>Name and define the types of sensory receptors</p> <p>Physiological basis of sensory transmission</p> <p>Explain adaptation on sensory receptors. A</p>	Lecture	Snell Neuro-Anatomy & Ganong	1hr	Physiology
2.0. Describe the somato sensory pathways, sensory modalities and the anatomical basis of sensory impairment.	<p>Dorsal column pathways. Touch, position sense, vibration, proprioception, stereognosis, graphesthesia</p> <p>Spino-cerebellar tracts. A</p>	Lecture Demonstration.		2hrs	Anatomy

<p>2.1. Describe perception of different modalities of pain in the brain.</p>	<p>Pain and temperature Anterior, lateral spinothalamic tracts. (The student should be able to interpret ascending pathways at spinal cord medulla, pons and midbrain.) A</p>	<p>Lecture</p>		<p>1hr</p>	<p>Physiology</p>
<p>2.2. Describe the physiology of pain and physiological and surgical methods of pain relief.</p>	<p>Intensity location and quality of different sensation encoded in the brain.</p>	<p>Lecture</p>		<p>1hr</p>	<p>Physiology</p>
	<p>Describe the difference between Fast and slow pain Superficial, deep and visceral pain. Describe referred pain and phantom limb Define hyperalgesia Endogenous analgesic system. Describe pain relieving methods and their basis. C</p>	<p>Lecture</p>		<p>1hr</p>	<p>Physiology</p>

3.0. Discuss basic pathologies of the sensory pathways.	Tabes dorsalis, Syringomyelia, Pernicious anaemia and multiple sclerosis. Traumatic lesions of the spinal cord. B	Lecture		2hrs	Physiology
	Spinal Shock	PBL		3hrs	Physiology+Anatomy
4.0. Describe the embryological, anatomical and physiological basis of the Visual system and accessory structures of the eye ball.	Discuss the development of eye and relate its attachments to the brain.	Lecture		1hr	Anatomy
	Describe visual pathway and the organizations of visual cortex, the anatomical basis for visual field changes	Lecture Dissection SGD		1hr	Physiology
	Describe the structure and how it is related to function of the layers, cavities and receptor cells of the eye ball.	Lecture		1hr	Anatomy
	Describe retina and explain how it's adapted to its function. A Discuss night blindness & vitamin A deficiency. Color blindness and strabismus. B	Lecture		2hrs	Physiology

	<p>Explain the principles of refraction, accommodation and convergence. Discuss hyperopia, myopia, astigmatism, presbiopia. B</p>	<p>Lecture. Tutorial</p>	<p>Snell/ Ganong</p>	<p>1hr 1hr</p>	<p>Physiology „</p>
<p>5.0. Describe capture and transmission of sounds in the ear. Explain how sound waves are converted into generator potential.</p>	<p>Describe the anatomy of the external, middle & inner ear, labyrinth & how it's related to their functions.</p> <p>Explain sound transmission, bone conduction, air conduction. A</p>	<p>Lecture Model demonstration SGD</p> <p>Combined practical</p>	<p>Ganong / Kumar & Clerk</p>	<p>1hr 2hrs 3hrs</p>	<p>Anatomy Anatomy Physiology</p>
<p>6.0. Describe the major structures of the vestibular and cochlea system and its physiological basis of hearing and equilibrium.</p>	<p>Describe the innervations of the cochlea.</p> <p>Describe the neural pathways of auditory system and explain pitch, loudness, timbre. A</p>	<p>Lecture</p> <p>SGD</p>	<p>Ganong /Snell</p>	<p>1hr 2 hrs</p>	<p>Physiology Physiology</p>

	<p>The role of semi circular canals in rotational acceleration. The role of saccule and utricle in linear acceleration.</p> <p>Evaluation of hearing disorders, basics of Rinne's & Weber's tests and audiometry. A</p>	<p>Lecture Tutorial Practical</p>		<p>1hr 2hrs 3 hrs</p>	<p>Physiology Physiology Physiology</p>
<p>7.0. Relate the structure of gustatory receptors to function, identify the basic tastes. Describe the neural pathway</p>	<p>Types of taste buds, structure & distribution. Describe the basic taste modalities. Substance evoking taste sensation, taste thresholds and intensity discrimination, receptor stimulation. Trace the neural pathway. B</p>	<p>Lecture/PBL based on 7th nerve palsy. (Done with 7th nerve)</p>	<p>Ganong /Snell</p>	<p>1/2hr</p>	<p>Anatomy</p>

<p>8.0. Describe the structure and function of olfactory pathway.</p>	<p>Describe the receptor and pathways of the olfactory system Explain the following Olfactory threshold, olfactory discrimination, olfactory adaptation. Define anosmia Hyposmia dysosmia B</p>	<p>Lecture</p>	<p>Ganong /Snell</p>	<p>1/2hr</p>	<p>Physiology</p>
<p>9.0 Brain death</p>	<p>Describe physiological basis of the tests used in confirming the brain stem death</p>	<p>Lecture</p>		<p>1hr</p>	<p>Physiology</p>

	<p>Define reciprocal innervation, inverse stretch reflex, clonus, and lengthening reaction.</p> <p>Explain withdrawal reflex and its clinical importance:-mass reflex, hypotonia and hypertonia.</p> <p>A</p>				
<p>2.0. Describe the cortical motor areas and their activity.</p> <p>2.1 Describe the descending motor pathway and function.</p>	<p>Arrangement of motor cortex.</p> <p>Explain manifestations due to lesions in the cerebral cortex.</p> <p>Describe physiological basis of Cerebral palsy A</p> <p>Describe the descending motor pathway. Physiological basis of clinical features of LMN and UMN lesions.</p> <p>Compare and contrast clinical features of UMN and LMN lesions</p> <p>Cross sections of the spinal cord and brain stem A</p> <p>Explain the physiological basis of clinical features in CVA.</p>	<p>Dissection/ Lecture- demonstration</p> <p>Lecture</p> <p>SGD</p> <p>PBL</p>		<p>2hrs</p> <p>3hrs</p> <p>2hrs</p> <p>3 hrs</p>	<p>Anatomy</p> <p>Anatomy/Physiology</p> <p>Physiology</p> <p>Anatomy/Physiology</p>

3.0. Describe the anatomy and functions of the extra pyramidal system.	List the components of the extra pyramidal system. Structure and function of basal ganglia. Explain the structure and function of the nigrostriatal dopaminergic system. A	Lecture demonstration		3hrs	Anatomy
		Lecture		2hrs	Physiology
	Explain the physiological basis of Signs and symptoms of Parkinson's disease and Huntington's chorea. B	Student Presentation		1 hr	Physiology
4.0. Describe the structure and function of the cerebellum.	Briefly Describe the divisions of the cerebellum and their connections. Describe the evolutionary significances of structure with function Out line the functions of the cerebellum. A	Dissections		3hrs	Anatomy
		Demonstrations		2hrs	Anatomy
		Lecture		1hr	Physiology

Neuroscience module
Higher functions, sleep and hypothalamus

Objectives	Broad content area	Learning strategy	Learning material	Duration	Department
1.0. Discuss physiological basis of Memory & learning.	Discuss the anatomy of the limbic system.	Lecture-demonstration	Ganong /Snell	1hr	Anatomy
	Describe the stages of memory & neurological basis of memory, learning habituation & sensitization. A	Lecture		1hr	Physiology
2.0. Discuss physiological basis of Sleep & consciousness.	Explain the structure and function of the reticular formation. Describe the primary types of rhythms that constitute the normal EEG and behavioral correlation of each of them.	Lecture/practical	Ganong	1hr	Physiology
	Define synchronization Alpha block De synchronization B	Practical		3 hrs	„

	<p>Explain the EEG and behavioral characteristic of slow wave sleep</p> <p>REM sleep C</p> <p>Compare and contrast slow wave sleep and REM sleep. B</p> <p>Describe pattern of normal night time sleep in adult age and the variation in the sleep pattern from birth to old age.</p> <p>Briefly describe sleep disorders.</p> <p>Explain the concept of consciousness, altered consciousness & brain death. C</p>				
3.0. Discuss physiological and anatomical basis of Speech	Describe/identify arrangement, blood supply and innervations of the larynx.(already done under respiratory module)	Model viewing.	Ganong /Snell/ Cunningham's	1hr	Anatomy

	Neural control of speech, mechanism of speech production and Speech disorders. C	Lecture		1hr	Physiology
4.0. Hypothalamus	Identify the location and connection of the hypothalamus. List the functions. Explain temperature regulation, thirst mechanism and appetite control. Explain the Neuroendocrine functions. A	Lecture	Ganong	2 hrs	Physiology

Case Scenario 01

One of your friends had an accidental fall from height and has been admitted to the hospital. You also went with the patient to the hospital. As you are a medical student you were allowed to stay while the doctors examined the patient. The house officer in the ward told you that the patient had injury to the spinal cord most probably at the level of T 10. The doctor further informed you that the patient is in spinal shock.

When you came home you wanted to know more about the spinal shock and how the doctors suspect that the patient had spinal cord injury at the level of T 10 by examining the patient.

When you visited the patient after several weeks later you found that he had developed features of upper motor neuron lesions in his lower limbs.

What do you mean by upper motor neuron lesions and what are the clinical features you would see in this patient?

Case Scenario 02

One of your uncles had developed sudden onset weakness in the right side of the body and had been admitted to the hospital. When you visited the hospital to see him, you were allowed to look at the hospital notes. You found several medical terms written in the notes. These include stroke, lesion at the left side internal capsule, exaggerated tendon reflexes and extensor planter response in the right side

You wanted to know more about these terms to understand the condition

When you visited the ward one week later you found that your uncle's condition has improved. He showed another patient just next to his bed who was having the same problem (weakness in the right side of the body) but he could not speak. You noticed that this patient can very well understand what others say but can't produce speech.

You wanted to know why this patient had difficulty in speech and how this happened.

What are the other types of language disorders?