MISSION

Our mission is to educate and produce exemplary doctors who practice ethical patient centered health care, discover and advance knowledge and are responsive to the community needs.

VISION

To produce competent doctors equipped with sound knowledge based on scientific principles, imbued with ethics and moral values primed to serve the community through the profession.

Our aim is to

- Provide outstanding educational environment for medical students.
- Develop exemplary clinicians who are lifelong learners and provide the highest quality compassionate care and serve the needs of their community and the nation in the best traditions of medical profession.
- Ensure the highest ethical and professional standards in all of our deeds.

Exit Outcomes for the CKMC Graduate

Knowledge

- Integrate knowledge of basic and clinical sciences in disease prevention and promotion of health and well-being of community.
- Able to appraise varied information they would come across during professional work and testify innovative ideas to benefit human society through evidence-based health care practice
- Demonstrate scientific knowledge in all professional activities

- Demonstrate research skills which bring innovation and significance to health care practices.

Skills

- Able to perform physical examinations, formulate provisional diagnosis with appropriate investigations to identify specific problems.
- Perform various common procedures to diagnose and manage non critical clinical problems.
- Demonstrate competency in life saving procedures.
- Exhibit propensity of critical thinking, problem solving and lifelong self-directed learning skills.

Attitude

- Manifest ethical values and professionalism.
- Demonstrate professional attitude towards patients, their families, seniors and colleagues.
- Demonstrate dedication and professionalism when faced natural disasters in country.
- Demonstrate communication skills, inter professional skills and leadership.

knowledge	Skill	Attitude
Integrated knowledge of basic & clinical sciences	Communication skills	Ethical values
Patient centered care	Research skills	
Health promotion & disease prevention	Patient management skills	Professionalism
Community needs	Leadership skills	
	Critical thinking skills	

Introduction to the Study Guide

Dear Students,

We, at the Department of Medical Education, CMH Kharian Medical College, have developed this study guide especially for you. This study guide is an aid to

- Inform you how this part of your syllabus has been organized.
- Inform you how your learning programs have been organized in this block.
- Help you organize and manage your studies throughout the block
- Guide you on assessment methods, rules and regulations.
- Communicate information on organization and management of the block. This will help you to contact the right person in case of any difficulty.
- Define the objectives which are expected to be achieved at the end of the block.
- Identify the learning strategies such as lectures, small group discussions, clinical skills, demonstration, tutorial and case-based learning that will be implemented to achieve the block objectives.
- Provide a list of learning resources such as books, and journals for students to consult in order to maximize their learning.

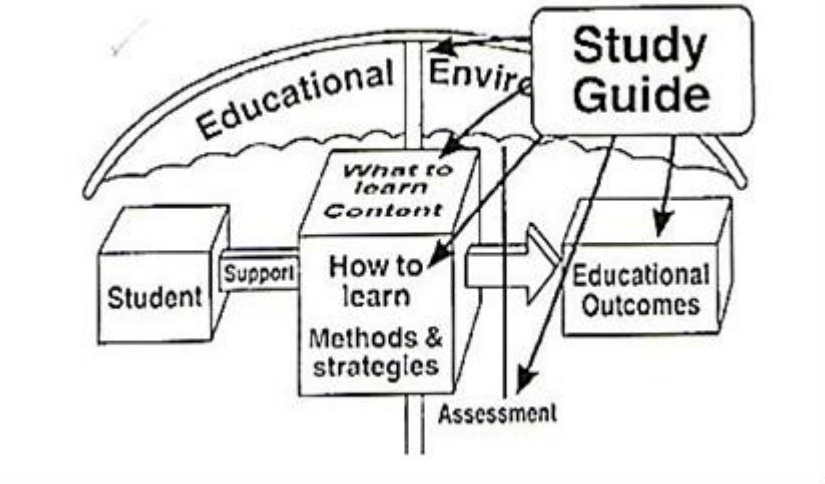


Figure 1 Objectives of study guide by Harden

Curriculum Integration

Medical college curriculum shall be organized in blocks of modules. The modules are named after body system for example a module of blood in a block. The key details are as follows:

1. There shall be three blocks in first year MBBS comprising modules.
2. The blocks shall be labeled as1, 2 and 3.
3. Each module in a block shall have a title. The name of the module shall represent the content taught and learned the majority of time in that module. Module shall be named after body systems.
4. The duration of three blocks shall vary between 8–11 weeks according to syllabus.
5. The syllabus shall be integrated horizontally around systems of the body.
6. There shall be vertical integration to the extent decided by the curriculum coordination committee.
7. Vertical integration shall be in case based learning sessions and in clinical lectures of basic sciences, scheduled in the structured training program.

Teaching and Learning Methods

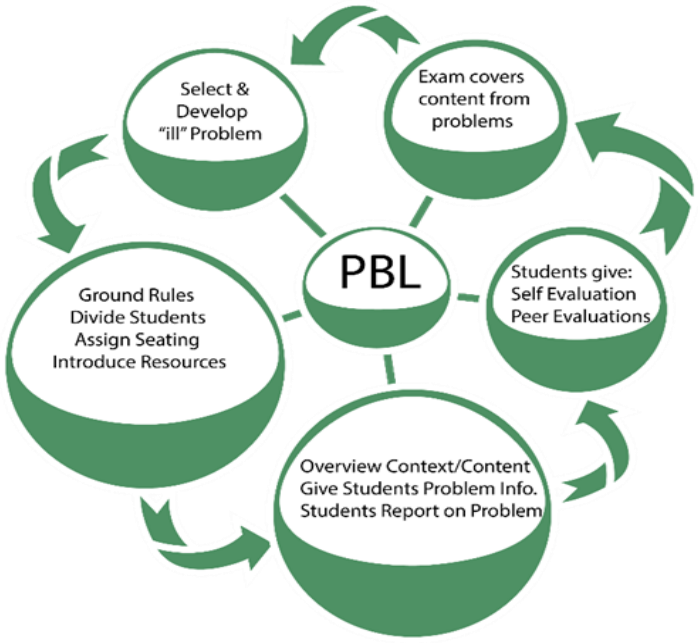
1: Small Group Discussions (SGD)

The topic will be taught in groups with the help of models and audiovisual aids. Pre-planned topics would help students to combine their wisdom in achieve learning objectives. Facilitator would be guiding to achieve learning objectives and making them on right track by clarify any misconception.

"Small group learning provides more active learning, better retention, higher satisfaction, and facilitates development of problem-solving and team-working abilities (Jahan, Siddiqui, AlKhouri, Ahuja, & AlWard, 2016).

2: Problem Based Learning (PBL)

This is group learning comprising of 8-10 students guided by a facilitator. For a specific problem given to students two sessions of 2 hours would be scheduled to achieve the learning objectives. In the first session students will discuss problem based upon their existing knowledge among the group and will produce a list of their learning objectives for further study. In the second session students share, discuss with each other to build new knowledge.



PBL is a self-directed learning and that type of educational strategy most likely produce doctors who are prepared for lifelong learning and able to meet the changing needs of their patients (Spencer & Jordan, 1999).

3: Large Group Interactive Session (LGIS)

These are meant to give overview of certain course content. They should be interactive so that students can not only gain knowledge but should completely understand it. Students may clarify the difficult concepts in these sessions. The lecturer introduces a topic and explains the underlying

phenomena through questions, pictures, videos of patient's interviews, exercises, etc. Students are actively involved in the learning process.

4: Self Directed Learning (SDL)

In this modern era of medical education, students assume responsibilities of their own learning according to the principles of adult learning. They can study independently, can share and discuss with peers, can take information from the sources of information college have like library, internet and teachers. Students will be provided time within the scheduled college hours for self-study.

5: Hands on Training

- **Lab session**

Histology, biochemistry, physiology practical will build skills in identification of normal histology of human body tissues. There would be test of these skills in OSPE exam.

- **Clinical Rotations**

The students will rotate in the clinical departments to see integration of knowledge into clinical practices.

Teaching and learning activities are meant to help students to gain new knowledge. It should be kept in mind that they are not meant to fully cover the objectives of the subject. It is therefore responsibility of students to attain more information to cover all objectives given in the overall objectives.

Class attendance and participation is of most important in gaining knowledge. If any help is needed module team can be contacted without any hesitation. Attendance will be strictly checked in different teaching activities. If attendance is less than 75%, students would not be allowed to sit for the examination.

Attendance in the examination is must and no students would be allowed to enter the examination area after starting the examination. In case of sickness, sick leaves from government/private hospitals or the emergency of the college hospital will only be entertained.

Assessment Format

Assessment is a goal-oriented process (Angelo, 1995). We assess in order to check whether the learning objectives set at the initiation of the program are met or not and to what extent (Amin,

2007).

No student will be allowed to sit in the annual examination if attendance is below 75% in theory and practical separately.

Assessment types

The assessment will be continuous. The purpose of continuous assessment is formative and summative.

Summative Assessment:

The marks of this type of assessment contribute in the final university result through internal assessment. It comprises:

- CBL/tutorial assessment
- Scheduled tests
- Sub-stages
- End of block exam
- Pre-annual exam

Scheduled tests and sub-stages will be conducted intermittently throughout the block. Their schedule will be intimated through the time tables.

The end of the block exam will be conducted after completion of weeks of instruction. It will comprise one theory paper and one practical exam for Anatomy, Physiology and Biochemistry. (Table of specifications (TOS) for exam has been provided)

Formative Assessment: Tests may be quizzes, surprise tests/written assignments/self-reflection by students during the teaching time but their marks will not be added to internal evaluation marks. The purpose of formative assessment is to provide feedback to the students, for the purpose of improvement and to teachers to identify areas where students need further guidance.

Internal Assessment

(Will be submitted to the university before professional exam)

- The weightage of internal assessment shall be 10 % in theory paper and 10 % in practical, in the annual professional examination (or 10 marks for 100 marks in theory and practical each)
- Scheduled tests, sub-stages, CBLs/tutorials, block examinations and pre-annual examinations, conducted by the college shall contribute towards internal assessment for professional examination.

Annual Professional Examination:

- The professional examinations schedule will be provided by NUMS.
- There will be two components of the final result

  (i) Examination-80 % (ii) Internal Assessment- 20 %
- There will be one theory paper and one Practical exam for Anatomy, Physiology and Biochemistry each. For practical the class will be divided into batches. Each batch will have practical exam of one subject on the specified day, according to schedule.
- Theory & Practical assessment shall be of 100 marks each in Anatomy, Physiology and Biochemistry, making a **total of 200 marks for each subject.**
- The Annual Theory paper shall be of 80 marks. 20 marks of internal assessment of theory papers, conducted throughout the year will be added to it, to make annual theory assessment of 100 marks. Similarly, the annual practical examination will be of 80 marks. 20 marks of internal evaluation of practical exams, conducted throughout the year will be added to it, to make annual practical assessment of 100 marks.
- The pass score shall be 50 out of 100, in theory and practical separately.

Schedule of examinations:

a) Continuous assessments schedule

Schedule provided by each department in Time table.

b) Formative tests: Throughout the block

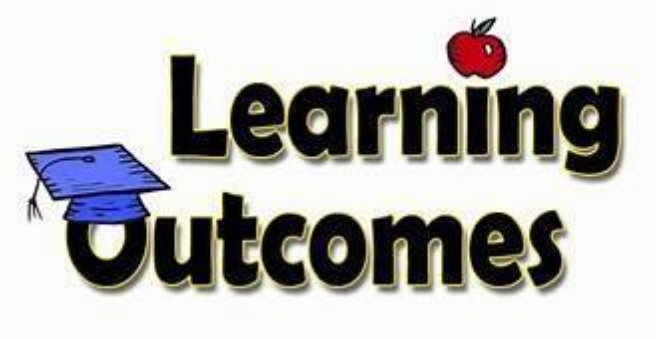
Block Development Committee

Chairperson curriculum committee	Principal Brig (Retd) Shoaib Nayyar Hashmi
Director Medical education	Dr Aasma Qaiser
Block Planner	Dr Aasma Qaiser
Resource Persons	Anatomy: Prof. Irfan Qadir Physiology: Dr Aiman Farogh Anjum Biochemistry: Prof. Dr. Aleem Ul Haq Medicine: Maj Usman Surgery: Dr Waqas
Study Guide Developed By	Department of Medical Education CMH Kharian Medical College Kharian

Structured Summery of Y2B2

Block Code	Y2B2
Pre requisite Block	Y2B1
Duration	8 weeks
Rationale	The Y2B2 block is taught as the second block after the students clear their first professional exam. In a period of 8 weeks, the block aims to form a basis for knowledge and skills related to the Neuroscience, brain and reproductive system. The concepts taught to the students in this block will help to lay a foundation for their knowledge of Neuroanatomy and reproductive system
Anatomy	Developmental and microscopic Anatomy of Neuroscience and reproductive system. Cancer biology, Genetic Disorders, Molecular Biology Techniques.
Physiology	Central nervous system including sensory, motor and autonomic nervous system
Biochemistry	Metabolism of Nucleotides, Metabolism of Xenobiotics, Metabolism of Amino acids and Proteins, Neurotransmitters, Biochemical Genetics.

Surgery	Common Surgical conditions relevant to anatomy of brain and spinal cord and reproductive system
Medicine	Disorders related to central nervous system including sensory, motor and autonomic nervous system.
BSP	Communication skills, professionalism, leadership and management, ethics Historical development of Medicine, Active listening, Medical ethics, study skills



Knowledge	• Describe the gross anatomical features of Cerebrum, Midbrain, Pons, Medulla and Spinal cord • Describe the sensory and motor parts of nervous system • Describe the major levels of central nervous system along with their functions • Describe the integrative function of nervous system • Describe the blood cerebrospinal fluid and blood brain barriers • Describe the structure of Nerve and explain the myelination of nerve fiber • Describe the ascending and descending tracts of brain stem

	• Describe analgesia system in brain & spinal cord • Describe the mechanism of consolidation of memory • Describe the functions of autonomic nervous system • Explain the Physiology, anatomy and pathogenesis of Head & neck and special sense problems. • Apply basic sciences to understand the causes of common Head & neck and special sense problems. • Explain the structural & developmental organization of GIT. • Explain the composition, functions, mechanism & control of following gastrointestinal secretions: salivary, gastric, pancreatic, biliary, small & large intestines. • Describe the mechanism of absorption of various nutrients and their role in malabsorption syndrome. • Explain the physiological anatomy, biochemistry functions and dysfunctions of Liver. • Explain the GIT hormones (structure, function) & their role in secretion and motility. • Describe the chemical nature, biosynthesis and the physiological functions of hormones on their target organs.
Skill	• Draw a labeled diagram of the identified structures with the help of eosin and hematoxylin pencils on the histology notebooks • Mark the main anatomical land marks on skull • Dissect various parts of head and neck and special senses, and related structure • Demonstrate their gross Anatomy and relationship to each other.

	• Identify the histological features of all the endocrine glands under microscope. • To perform all the steps of blood glucose estimation in the lab. • Dissect various parts of GIT, and related structures including peritoneum, to demonstrate their gross Anatomy and relationship to each other. • Identify different organs of GIT under microscope and on model.
Attitude	• Demonstrate the effective attitude towards the colleagues • Demonstrate a professional attitude, team building spirit and good communication skills • Observe lab safety rules

Course content:

2nd YEAR MBBS

Block 2 CODE Y2B2

In case of online classes MIT and Assessment will be online via zoom meeting and Google classroom

Course content

Anatomy

Neuro Anatomy					
S.No	**Topic/ Theme**	**Learning outcomes**	**Learning Objectives/ Content**	**MIT**	**Assessment Tool**
		By the end of this block the students will be able to:			
1.	Histology of nervous tissue	Correlate the light microstructure of different components of nervous system with their functions and predict functional outcomes of their altered structure.	• Enlist the components of nervous tissue. • Summarize the histological features and functions of neuron and neuroglia. • Classify neurons according to their morphology and functions with one example of each • Define neuroglia and enlist its main types. • Explain the myelinated and unmyelinated nerve fibers of central and peripheral nervous system • Explain the Histomorphological composition of peripheral nerve. • Define ganglia. • Differentiate between sensory and autonomic ganglia in tabulated form. • Apply knowledge of histology to explain the clinical scenarios related to multiple sclerosis, Alzheimer disease, Parkinson disease and neuron injuries.	LGIS	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE

			• Describe the histological features of white and grey matter of spinal cord. • Enumerate layers of cerebral and cerebellar cortices and enlist different cell types of these layers.		
2.	Histology of male reproductive system	Relate the light microstructure of different components of male reproductive system with their functions and predict functional outcomes of their altered structure.	• Correlate the Histomorphological features of testes and blood-testes barrier with their functions. • Explain the Histomorphological features of male genital ducts. • Explain the Histomorphological features of accessoryglands of the male reproductive system and penis. • Apply the knowledge of histology to explain the clinical scenarios regarding the following conditions. ▪ Immotile cilia syndrome ▪ Benign prostatic hypertrophy ▪ Carcinoma of prostate	LGIS	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE

3.	Histology of female reproductive system	Relate the light microstructure of different components of female reproductive system with their functions and predict functional outcomes of their altered structure	Describe the Histomorpholog cal features of following female reproductive organs Ovaries
			▪ Fallopian tubes
			▪ Uterus
			▪ Cervix
			▪ Vagina
			Apply the knowledge of histology to explain the clinical scenarios regarding the following conditions.
			  Endometriosis
			  Cervical carcinoma
				LGIS	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE

4.	Development of central	Comprehen	• Describe the development of neural	LGIS	MCQs/ SEQs/ SAQs/OSPE/

	nervous system and skull	d the embryologic al basis behind formation of different components of nervous system and correlate them with various relevant clinical presentation s.	tube with reference to neurulation, vesicles, brain flexures and ventricles. • Describe the development and positional changes of spinal cord. • Describe the formation and developmental changes in alar and basal plates. • Comprehend the embryological basis of various types of Spina bifida. • Enumerate the derivatives of rhombencephalon, mesencephalon and prosencephalon. • Compile the organization of Alar and Basal plate neurons in brain stem with reference to their type, type of innervation, cranial nerve and location. • Describe the development of the following ▪ Medulla oblongata ▪ Midbrain ▪ Pons ▪ Cerebellum ▪ Pituitary gland ▪ Supra renal gland • Apply the knowledge of embryology to explain the clinical scenarios regarding: ▪ Holoprosencephaly ▪ Schizencephaly ▪ Exencephaly ▪ Hydrocephalus		VIVA VOCE

			▪ Exencephaly ▪ Hydrocephy ▪ Microcephaly • Enumerate the cranial nerves with their composition (brain region, type and innervation). • Summarize in a tabulated form the contribution of neural crest cells and placodes to ganglia of the cranial nerves • Demonstrate different parts of brain and spinal cord on the given model. • Explain development of viscerocranium • Describe the stages of differentiation of neurocranium into membranous neurocranium and chondrocranium. • Describe the importance of fontanelle of skull in new born with reference to: ▪ Normal ossification of the skull ▪ Changes in intracranial pressure ▪ Newborn Cranium. ▪ Closure of different fontanelle • Describe the clinical abnormalities caused by premature closure of one or more sutures. • Explain the clinical condition caused by failure of the cranial neuropore to close. • Enlist different types of skeletal dysplasia's and explain achondroplasia and hypochondroplasia.		
5.	Introduction & organization	Comprehen	• Describe the major divisions, components and	LGIS	MCQs/ SEQs/ SAQs/OSPE/

	of the nervous system	d the basic organization of the main structures that form nervous system and gain a three dimensional appreciation of the parts of the brain and their relative positions to one another.	functions of the central nervous system. • Enumerate ventricles and coverings of brain and spinal cord with special emphasis on intracranial hemorrhages. • Summarize the process of lumbar puncture and enumerate the structures through which a needle will pass while performing spinal tap. • Demonstrate the structural anatomy of major divisions of central and peripheral nervous system in prosected specimens/models. • Describe the etiology, signs and symptoms of multiple sclerosis and herpes zoster. • Conclude the response of neuron in central nervous system and peripheral nerves.to injuries with special reference to myasthenia gravis		VIVA VOCE
6.	Gross Anatomy of skull	Appraise the gross features of cranial cavity and the structures contained within it to understand the anatomical basis of clinical conditions related to them.	• Explain and demonstrate the anatomical position of skull with special emphasis on planes of anatomical position. • Describe and demonstrate the boundaries and gross features of cranial fossae Enlist and demonstrate foramina along with structures passing through them in anterior, middle and posterior cranial fossae. • Recognize and demonstrate the important sutures, fontanelle and impressions on the interior of cranial vault.	SGD	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE

7.	Gross Anatomy of Spinal cord	Correlate the position and functions of the main nervous pathways and nerve cell groups in the spinal cord, with associated segmental injuries and diseases.	• Explain the gross appearance and the nerve cell groups in the anterior, posterior and lateral gray columns of spinal cord • Enumerate and illustrate the arrangements of ascending and descending tracts (white matter) in spinal cord at various levels. • Explain the given clinical conditions related to ascending and descending tracts of spinal cord. ▪ Tabes dorsalis ▪ Pyramidal tracts (upper motor neuron) lesions ▪ Extrapyramidal tracts (upper motor neuron) lesions ▪ Lower motor neuron lesions ▪ Acute spinal cord injuries ▪ Spinal shock syndrome ▪ Destructive spinal cord syndromes ▪ Complete cord transection syndrome ▪ Anterior cord syndrome ▪ Central cord syndrome ▪ Brown sequard syndrome ▪ Syringomyelia ▪ Poliomyelitis ▪ Multiple sclerosis ▪ Amyotrophic lateral sclerosis • Trace following pathways of superficial and deep sensations indicating the location of first, second and third order neurons ▪ Pain and temperature pathways ▪ Light touch and pressure pathways	LGIS	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE

			▪ Discriminative touch, vibratory sense and conscious muscle joint sense ▪ Muscle joint sense pathways to the cerebellum ▪ Posterior spinocerebellar tarct ▪ Anterior spinocerebellar tract ▪ Cuneocerebellar ▪ Spinotectal tract ▪ Spinoreticular tract ▪ Spino-olivary tract ▪ Visceral sensory tracts • Trace following pathways of superficial and deep sensations indicating the location of first, second and third order neurons ▪ Cortico spinal tracts ▪ Reticulospinal tract ▪ Tectospinal tract ▪ Rubrospinal ▪ Vestibulospinal ▪ Olivospianl ▪ Descending autonomic fibers ▪ Intersegmental tract		
8.	Gross anatomy of the brain stem	Appraise the anatomy of Brain stem to assess the signs and symptoms presented by the patient in identifying the exact location of a structural lesion.	• Describe gross appearance and internal structure of the medulla oblongata and analyze medulla oblongata at different levels. • Justify the significance of raised pressure in posterior cranial fossa to its effects on medulla oblongata. • Apply the knowledge of neuroanatomy to explain the following clinical scenarios: ▪ Arnold-chiari malformation	LGIS	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE

			▪ Medial medullary syndrome ▪ lateral medullary syndrome of Wallenberg • Describe the gross features, internal structure of pons and illustrate cross section of pons at different levels (facial colliculus and trigeminal nuclei) showing major structures at each level • Analyze the anatomical structures involved in Pontine hemorrhage and infarction of pons. • Describe the gross appearance, internal structure of mid brain and compare its cross sections at the level of superior colliculus and inferior colliculus showing major structures at each level. • Justify, how the blockage of cerebral aqueduct will produce lesions of midbrain structures? • Identify the gross features of medulla, mid brain and pons on a given model.		
9.	Gross anatomy of cerebellum & its connections	Appraise the structure, function and connections of the cerebellum with the remainder of the central nervous system to understand the anatomical basis of cerebellar dysfunctions.	• Describe the gross features, phylogenetic divisions of cerebellum. • Enumerate afferent and efferent fibers of superior, middle and inferior cerebellar peduncles. • Enlist intracerebellar nuclei and types of fibers constituting white matter of cerebellum and explain their routes of entry and exit • Summarize and demonstrate the pathways carrying afferent	LGIS	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE

			and efferent fibers to and from the cerebellum. • Enlist disturbances of voluntary movements, reflexes, ocular movements, speech, posture and gait resulting due to lesions of cerebellum. • Demonstrate different parts of cerebellum on given model. • Illustrate flattened view of cerebellar cortex showing the main cerebellar lobes.		
10.	Gross anatomy of cerebrum	Appraise the structure, function and connections of the cerebrum with the remainder of the central nervous system to understand the anatomical basis of associated clinical conditions.	• Describe the topographic anatomy of diencephalon and demonstrate the gross features of diencephalon on a given model. • Enlist main sulci and gyri of cerebral hemispheres and describe the extent of each of them. • Explain the divisions of cerebral lobes on superolateral, medial and inferior surfaces of cerebral hemispheres. • Explain the effects of lesions of different parts of internal capsule • Describe the cause, signs and symptoms and formation of senile plaques in Alzheimer disease. • Mark main sulci and gyri on lobes of cerebral hemispheres. • Demonstrate commissure, projection and association fibers on brain prosected specimen • Describe and demonstrate the motor and sensory cortical areas in following lobes of cerebral hemispheres. ▪ Frontal lobe	SGD	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE

			▪ Parietal lobe ▪ Temporal lobe ▪ Occipital lobe • Describe the effects of lesions in the motor cortex on voluntary movements and speech. • Describe the changes in personality due to lesions in the frontal eye field of cerebral hemisphere. • Enumerate types of aphasia and describe the lesions of speech areas responsible for producing aphasia. • Summarize the sign and symptoms due to lesions of sensory cortex, prefrontal cortex and somesthetic association areas • Explain the effects of lesion in the primary and secondary visual cortex. • Illustrate diagrams showing probable pathways involved in reading a sentence and repeating it out loud. • Illustrate diagrams showing probable pathways involved in hearing a question and answering it. • Illustrate the lateral and medial views of cerebral hemispheres showing motor and sensory areas.		
11.	Gross anatomy of reticular formation & limbic system	Correlate the structure and function of the reticular formation and the parts of the limbic system with associated clinical conditions.	• Describe the general arrangement and functions of reticular formation. • Enlist afferent and efferent projections of reticular formation • Enumerate components of limbic system and explain hippocampal formation with	SGD	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE

			reference to its afferent and efferent connections • Compile the effects of destruction of amygdaloid complex on behavior. • Demonstrate different components of limbic system on given model		
12.	Gross anatomy of basal nuclei & their connections	Appraise the location, connections and functions of basal nuclei to explain its common relevant diseases	• Enlist terminology commonly used to describe the basal nuclei. • Describe different nuclei, connections and functions of nuclei constituting basal ganglia • Enlist hyper kinetic disorders related with basal nuclei like chorea, hemiballismus and athetosis • Describe Parkinson disease regarding etiology, characteristics signs and symptoms, types and treatment • Identify different components of basal ganglia on given model/specimen	LGIS	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE
13.	Gross anatomy of cranial nerves	Appraise the location and connections of motor and sensory nuclei of the cranial nerves to identify the correct site of relevant cranial nerve lesions.	• Enumerate the cranial nerves and classify them into sensory, motor and mixed nerves. • Describe the nuclei, connection and intracranial course of all cranial nerves. • Demonstrate different cranial nerves on given model/specimen • Apply the knowledge of neuroanatomy to explain the clinical conditions regarding lesions of cranial nerves.	LGIS	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE
14.	Gross anatomy	Appraise the structure, function and connections of	• Describe the general appearance, divisions, nuclei and connections of thalamus.	SGD	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE

	of thalamus, hypothalamus and their connections	the thalamus with the remainder of the central nervous system to understand the anatomical basis of associated clinical conditions.	• Explain the general appearance, divisions and connections of hypothalamus. • Summarize the connections of hypothalamus with the pituitary gland. • Explain the following clinical disorders associated with Thalamic and hypothalamic lesions. ▪ Obesity and wasting ▪ Sexual disorders ▪ Hyper and hypothermia ▪ Diabetes insipidus ▪ Emotional disorders. ▪ Thalamic pain ▪ Thalamic hand		
15.	Gross anatomy of meninges and Dural venous sinuses of brain & spinal cord	Appraise the arrangement of the meninges of brain and spinal cord to identify different types of cerebral hemorrhages.	• Define meninges of brain and describe the Dural reflections in brain. • Explain the meninges of spinal cord • Enumerate the nerves and blood vessels supplying the meninges. • Differentiate among different varieties of intracranial hemorrhages. • Demonstrate the supratentorial and infratentorial compartments of tentorium cerebelli in a prosected specimen. • Define and enumerate paired and unpaired Dural venous sinuses along with their attachments. • Describe the location, important relations, communications of cavernous sinus and enumerate structures passing through walls and through the cavernous sinus.	LGIS	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE

16.	Gross anatomy of ventricular system, the CSF, & the blood brain & blood-CSF barriers	Appraise the anatomical organization of ventricular system, the CSF, & the blood-brain & blood CSF barriers to explain the relevant clinical scenarios.	• Enumerate ventricles and explain the boundaries of each ventricle of brain along with their choroid plexus. • Explain formation, circulation and absorption of CSF. • Define arachnoid villous and explain the role of arachnoid villi in absorption of CSF. • Summarize the formation of different barriers of brain. • Demonstrate queckenstedt sign in localizing blockage of subarachnoid space in vertebral canal. • Illustrate the floor of fourth ventricle.	LGIS	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE
17.	Blood supply of the brain & spinal cord	• comprehend the blood supply of brain and spinal cord • to explain the dysfunction that would result if the artery were blocked.	• Describe the blood supply of different parts of brain and spinal cord. • Explain the formation and importance of veins of brain. • Enumerate the vessels taking part in the formation of circle of Willis and summarize its importance. • Relate the interruption of cerebral circulation to cerebral artery syndromes due to anterior, middle and posterior cerebral artery occlusion. • Illustrate circle of Willis.	LGIS	MCQs/ SEQs/ SAQs/OSPE/ VIVA VOCE

LIST OF PRACTICALS

S.No	Topic/ Theme	Learning outcomes	Learning Objectives/ Content	MIT	Assessment Tool
		By the end of this block the students will be able to:			
1.	Nervous system	Identify H&E stained slides of different components of nervous system and appreciate their characteristic histological features to distinguish them from common Pathological conditions in future.	• Identify slide of nerve under microscope • Draw a labeled diagram showing its section on journal • List two points of identification.	Lab	OSPE VIVA VOCE
			• Identify & illustrate histological features of ganglia under light microscope. • Enlist two points of identification.	Lab	OSPE
			• Identify & illustrate • Histological features of spinal cord under light microscope. • Enlist two points of identification.	Lab	OSPE VIVA VOCE
			• Identify & illustrate histological features of cerebrum under light microscope. • Enlist two points of identification.	Lab	OSPE VIVA VOCE
			• Identify & illustrate histological features of cerebellum under light microscope. • Enlist two points of identification.	Lab	OSPE VIVA VOCE
2.	Male reproductive system	Differentiate between H&E stained slides of different components of male reproductive system and	Identify, differentiate and illustrate the light microscopic structure of following components of male reproductive system and enlist two points of identification ▪ Testis ▪ Epididymis ▪ Vas deferens	Lab	OSPE

		appreciate their characteristic histological features to predict functional outcomes that Result from their altered structure and function.	▪ Seminal vesicle ▪ Prostate		

ANATOMY CBLs:

CBL 1: Spinal Shock

An 18 years old young boy came to emergency with history of fall from electric pole 8 months back. He complained of severe backache and inability to move his both legs. On neurological examination, no movements in both lower limbs and sensory loss below the level of umbilicus was observed. On abdominal examination bladder was palpable. Radiograph of dorso-lumbar spine revealed fracture of T12. Patient was diagnosed as case of spinal shock. He was admitted in ward and recovered from shock after 2 days. After recovery from spinal shock, he was having permanent paralysis of both lower limbs and loss of urinary and bowel control. He was catheterized. His physiotherapy with bladder and bowel training was started. He stayed in ward for one month and then he was discharged on physiotherapy and weekly change of catheter. He was on regular follow up till now. Now he is having partial control of urine and has gained some sensations in the legs.

Learning objectives:

- Compare topographic anatomy of spinal cord in adult and newborn.
- Interpret neurological presentation of spinal cord injuries at different levels.
- Describe neurulation and transformation of neural tube into central nervous system.
- State embryological basis and presentation of neural tube defects.
- Correlate the development of vertebral column to structure and function.
- Describe the relation between spinal cord segment and vertebral level?
- Explain the cause of permanent paralysis and loss of urinary/bowel control in this patient.
- Enumerate the signs and symptoms of spinal shock.
- Enlist the signs and symptoms of UMN and LMN lesions.
- Illustrate cross section of spinal cord at various vertebral levels and justify the variable amount of gray and white matter at different levels
- Explain the significance of lamination of various tracts of spinal cord.
- Differentiate between following

- UMN AND LMN
- Tract, fasciculus and lemniscus
- Clasp knife and cogwheel rigidity
- Conscious and unconscious proprioception Crude and fine touch

Physiology

Central Nervous System

S.No	Topic/ Theme	Learning outcomes	Learning Objectives/ Content	MIT	Assessment Tool
		By the end of this block the students will be able to:			
1.	Processing of information in neuronal pool	Interpret the physiological mechanisms controlling the neuronal signals transmitting through synapse	• Differentiate between various synapses • Identify physiologic anatomy of the synapse • Elucidate the electrical events during neuronal excitation and inhibition • Summarize the transmission and processing of signals in neuronal pools (relaying of signals through neuronal pools prolongation of a signal by a neuronal pool, after discharge, synaptic fatigue)	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva
2.	Sensory receptors & receptor Potential	Interpret the physiological mechanisms Controlling the functions of sensory system.	• Classify the various types of sensory receptors. • Explain the sensory stimuli and differential sensitivity of receptors. • Explain the sensory transduction into nerve impulses. • Describe the local electrical currents at nerve endings— receptor potentials, adaptation of receptors • Classify the nerve fibers that transmit different types of signals on the physiological basis. • Describe the transmission of signals of different intensity in	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva

3.	Processing of information in neuronal pool	Interpret the physiological mechanisms controlling the neuronal signals transmitting through synapse	• Differentiate between various synapses • Identify physiologic anatomy of the synapse • Elucidate the electrical events during neuronal excitation and inhibition • Summarize the transmission and processing of signals in neuronal pools (relaying of signals through neuronal pools prolongation of a signal by a neuronal pool, after discharge, synaptic fatigue)	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva
4.	Sensory receptors & receptor Potential	Interpret the physiological mechanisms Controlling the functions of sensory system.	• Classify the various types of sensory receptors. • Explain the sensory stimuli and differential sensitivity of receptors. Explain the sensory transduction into nerve impulses. • Describe the local electrical currents at nerve endings receptor potentials, adaptation of receptors • Classify the nerve fibers that transmit different types of signals on the physiological basis. • Describe the transmission of signals of different intensity in nerve tract (spatial and temporal summation)	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva
5.	Sensory tracts and cortex	Explain the dorsal column medial lemniscal system and anterolateral pathways	• Identify the sensations carried by different sensory tracts • Differentiate between different sensory tracts	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva

			Describe the somatosensory cortex and somatosensory association areas • Explain the various thermal sensations, thermal receptors and their excitation and transmission of thermal signals in the nervous system		
6.	Brain analgesia system	Correlate the pathophysiological basis of pain pathways to their clinical significance	• Classify the different types of pain. • Compare and contrast the perception and transmission of the different types of pain. • Explain the pain suppression system in the brain and spinal cord. Describe the brain's opiate system endorphins and encephalin • Describe the clinical abnormalities of pain and other somatic sensations	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva
7.	Motor system / Spindle / stretch reflex	Interpret the Physiological mechanisms controlling the functions of motor system and higher mental functions.	• Relate the organization of grey and white matter in spinal cord to the pathophysiology of various spinal cord injuries. • Explain the role of proprioceptors (muscle spindles and Golgi tendon organs) in motor movements • Explain stretch reflex • Describe the flexor reflex and the crossed extensor reflex. • Explain the reciprocal inhibition and reciprocal innervation • Identify the reflexes of posture and locomotion in the spinal cord	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva

8.	Cerebral Cortex	Correlate the clinical presentations resulting from damage to different areas of cerebral cortex to their anatomical and functional cortical areas.	• Identify the various Brodmann's areas of cerebral cortex. • Explain the functions of the various areas of the cerebral cortex.	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva
9.	Pyramidal tract/ extra pyramidal tract	Differentiate between the Pyramidal and extrapyramidal system for voluntary motor control.	• Explain the role of primary motor cortex, premotor area, and supplementar y motor area in control of voluntary motor movements. • Identify the various pathways for transmission of signals for voluntary motor control from the motor cortex to the muscles. • Explain the significance of anterior motor neurons as the lower motor neurons. • Compare and contrast the upper and lower motor neurons and their lesions. • Identify the role of the brain stem in controlling motor function and role in posture of the body against gravity.	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva
10.	Cerebellum	Analyze the role of the cerebellum in executing motor movements.	• Explain the functional anatomy of cerebellum and basal ganglia. • Describe the neuronal circuits of the cerebellum. • Describe the pathophysiol ogical basis of the clinical abnormalitie s of the cerebellum and basal ganglia.	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva

11.	Basal ganglia	Explain the function of the basal ganglia in executing patterns of motor activity.	• Identify the role of the basal ganglia for cognitive control of sequences of motor patterns • Explain the function of the basal ganglia to change the timing, scale and intensity of voluntary motor movements. • Explain the role of various specific neurotransmitter substances in the basal ganglia and the pathophysiological disorders related to their deficiency.	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva
12.	Vestibular system	Explain the vestibular system	Explain the vestibular apparatus and function of the utricle and saccule in the maintenance of static equilibrium. • Describe the detection of head rotation by the semicircular ducts. • Explain the vestibular mechanisms for stabilizing the eyes.	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva
13.	Physiology of Speech	Correlate the 1mechanism of normal coherent speech with speech disorders	• Explain the functions of specific cortical areas and association areas in the physiology of speech. • Identify the function of the Wernicke's and Broca's Area. • Explain the pathophysiolog ical disorders related to speech.	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva
14.	Memory	Distinguish memory types in detail	• Describe memory and the role of synaptic facilitation and synaptic inhibition. • Explain shortterm, intermediate and long- term memory • Describe the consolidation of memory.	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva

15.	Sleep	Explain mechanism of sleep in detail	• Define Sleep and its types. • Differentiate between slowwave sleep and REM Sleep (paradoxical sleep, desynchronize d sleep). • Describe the basic theories of sleep and physiologic effects of sleep. • Identify the different types of brain waves and their origin in the various parts of the brain. • Explain the changes in EEG at different stages of wakefulness and sleep.	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva
16.	EEG/ epilepsy	Differentiate between various types of epilepsy in detail	• Explain the effect of varying levels of cerebral activity on the frequency of the EEG. • Define Epilepsy. • Differentiate between Grand mal, petit mal epilepsy and focal epilepsy	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva
17.	Functions of Thalamus and hypothalamus.	Explain the functions of thalamus and hypothalamus in detail with specific emphasis on temperature control and limbic system.	• Explain the functional anatomy of thalamus. • Describe the functions of thalamus. • Identify the role of limbic system. • Describe the functional anatomy and functions of hypothalamus. • Identify the normal body temperatures. • Explain the mechanisms of heat production and heat loss. • Describe the regulation of body temperature and role of the hypothalamus • Explain the mechanisms that decrease or increase body temperature • Appreciate the concept of a “set-point” for temperature control.	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva

			• Appraise the behavioral control of body temperature. • Interpret the various abnormalities of body temperature regulation with special focus on fever.		
18.	Higher Mental Functions	Associate functions of prefrontal and other cortical association areas to various psychiatric and organic illnesses.	• Discuss the higher intellectual functions of the prefrontal areas and the various cortical association areas. • Describe the functions of corpus callosum. • Discuss the pathophysiology and symptoms of depression, bipolar disorders, schizophrenia and Alzheimer's disease.	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva
19.	Autonomic Nervous System	Analyze the autonomic nervous system in detail	• Explain the general organization and physiological anatomy of ANS. • Explain the different, neurotransmitters, receptors and effector organs of ANS. • Discuss the various functions of ANS. • Describe the autonomic reflexes. • Explain the various drugs effecting ANS. • Identify the various disorders related to ANS and their pathophysiological basis.	Lectures/ LGIS/ SGD/ CBL	MCQ/ SAQ/ SEQ/ Structured Viva

Physiology Practical

S.No	Topic/ Theme	Learning outcomes	Learning Objectives/ Content	MIT	Assessment Tool
		By the end of this block the students will be able to:			
1.	Central Nervous System	Perform Superficial reflexes on an SP	• Define a reflex. • Define a reflex arc. • Define superficial reflex. • Enlist the superficial reflexes along with their root value. • Demonstrate superficial reflexes.	SGD/Lab	OSPE
2.		Perform deep reflexes on an SP	• Define deep tendon reflex. • Enlist deep tendon reflex. • Describe the root value of deep tendon reflex. Demonstrate the deep tendon reflex	SGD/Lab	OSPE
3.		Examine motor system on a subject	• Examine the muscles of the upper and lower limbs for bulk. • Examine the muscles of the upper and lower limbs for tone. • Grade the strength of the muscles of the upper and lower limbs. • Identify any involuntary movements if present.	SGD/Lab	OSPE
4.		Examine the Cerebellar Functions on an SP	• Examine the subject to assess the normal functions of the cerebellum. • Identify the abnormal findings if present, in relation to the functions of the cerebellum	SGD/Lab	OSPE

5.		Examine Cranial nerves on an SP	• Enlist the 12 pairs of cranial nerves. • Explain the various methods used for determining the intactness of the 12 cranial nerves	SGD/Lab	OSPE
6.		Examine the smell sensations	• Explain the Olfactory pathway. • Demonstrate the procedure to determine the sense of smell.	SGD/Lab	OSPE
7.		Examine the taste sensations	• Enlist different types of taste receptors. • Trace the pathway for Taste. • Explain the procedure to determine the sense of taste	SGD/Lab	OSPE

Physiology CBL

CBL-1: MULTIPLE SCLEROSIS

Sughra Bibi is a 32 year old assistant at a buffalo farm in a village near Narowal. She feeds and takes care of buffalos and cows. At age 27 she had first episode of blurred vision. She was having difficulty in sewing and knitting. She had made an appointment with an ophthalmologist, but when her vision cleared on its own, she was relieved and cancelled her appointment. Ten months later, the blurred vision returned, this time with other symptoms that couldn't be ignored. She had double vision and a "pins and needles" feeling and severe weakness in her legs. She was even too weak to walk the cattle to grass.

Sughra Bibi was referred to a neurologist who ordered a series of tests. Magnetic resonance imaging (MRI) showed typical lesions of Multiple Sclerosis. Nerve conduction studies showed prolonged latent period that was consistent with decreased and poor nerve conduction.

Learning Objectives:

By the end of session, student should be able to:

- Explain the given case scenario.
- Comprehend the functional unit of nervous system (the neuron), its types, functions and properties.
- Explain the processes of nerve degeneration and regeneration.
- Understand the morphology and types of synapses, their role in processing of information by the nervous system.
- Explain the role of second messenger system in post synaptic neuron in synaptic transmission.
- Differentiate the structure and function of various chemical substances that functions as synaptic transmitters.

- Conceive electrical events involved in excitation and inhibition of synapse including pre and postsynaptic inhibition.
- Comprehend the process of synaptic delay, fatigue and summation of inputs.

CBL-2: GUNSHOT WOUND

A 35 year old female was brought to the hospital after a gunshot wound in her abdomen. Her laparotomy was performed with the midline incision, bullet was removed and organs involved were repaired. She was discharged after 7 days. After 3 days of removal of stitches, the patient observed numbness and lack of thermal sensation in the area of her scar. The doctor reassured her for complete recovery in a few days. After one month she reported back with hyperaesthesia in the same area. On examination, the doctor observed the loss of pressure, two point discrimination and vibration sensation in the same area. She was reassured that her sensations will very likely come back after sometime. After 6 months, she had partially recovered from most of the lost sensations.

Learning Objectives:

By the end of session, student should be able to:

- Explain the given case scenario.
- Outline general and sensory classification of nerve fiber and their functional significance.
- Comprehend the concept of sensory receptors, their types, characteristics distribution in the body.
- Describe the mechanism of generation of receptor potential and transduction of sensory stimuli into nerve impulses.
- Discuss the concept of receptor adaptation, labeled line coding and detection of intensity, location and specificity of stimuli.
- Understand coding of intensity, location and quality of stimuli
- Explain DCML.

CBL-3: Injured Sole

45 year old laborer, while working at a construction site, accidently stepped on a nail. He withdrew his foot immediately shifting the entire weight of body on the other leg. On close inspection he saw his sole bleeding profusely. Initially he felt sharp cutting pain. A few minutes later all he felt was throbbing pain.

Learning Objectives

By the end of the session, student should be able to:

- Explain the given case scenario.
- Explain various types of pain.
- Differentiate between neospinothalamic and paleospinothalamic tract.
- Understand anterolateral system.
- Elaborate the significance of stretch reflex.
- Explain the structure and function of muscle spindle.

- Explain the structure and function of Golgi tendon.

Describe the withdrawal reflex and crossed extensor reflex. Comprehend regulation of muscle tone

CBL – 4: Clumsy Movements

A 48-year-old male presents with complaints of clumsy movements and an inability to coordinate his hand movements while eating, writing and other daily activities. He has had repeated episodes of fall due to difficulty in balance (ataxia).The physician noticed failure of progression in talking (dysarthria) while taking history. There was no significant history of trauma to head and other medical history was not significant. After a thorough examination, the physician found hypotonia and exaggerated deep reflexes. He also observed past pointing (dysmetria), intention tremors, inability to perform repetitive alternating movements (dysdiadochokinesia) and asynergistic movements. Romberg's sign was negative. Brain scan revealed atrophy of cerebellum.

Learning Objectives:

At the end of the session, the student should be able to:

1. Explain the given case scenario.
2. Discuss the anatomical and functional divisions of cerebellum.
3. Enlist the afferent and efferent pathways of the cerebellum and their significance.
4. Critically reflect on the integrative motor control of spinal cord, cerebellum, basal ganglia and cerebral cortex.
5. Describe the tests to evaluate cerebellar dysfunction and distinguish it from sensory ataxia.
6. Gain insight into the pathophysiology of hypotonia, exaggerated deep reflexes, intention tremors, asynergistic movements, dysdiadochokinesia, dysmetria, ataxia and dysarthria in cerebellar disorders.
7. Differentiate intention tremors from resting tremors

CBL – 5: I Can't Speak

A 58 years old female presented in emergency department with h/o sudden loss of consciousness which was persistent. There was hypertonia on Rt half of body & reflexes were exaggerated. Urgent CT scan brain showed hemorrhage in the area of Lt internal capsule of brain. There was h/o uncontrolled hypertension for the last 15 years. She was given supportive treatment and after regaining consciences after 10 days, she had difficulty in speech. She was able to understand written and spoken words but was unable to utter even simple words. There was spastic paralysis of Rt half of the body; ankle clonus was demonstrable and Babinski's sign was present. Sensory system was intact. A diagnosis of haemerrhagic CVA (Lt) was made.

Learning Objectives:

At the end of the session, the student should be able to:

- Explain the given case scenario.
- Summarize functional anatomy of motor cortex.
- Discuss the pathophysiolgy of cerebrovascular accident.

- Explain the pathphysiological basis of signs & symptoms of the patient.
- Appreciate the different speech areas and physiological role of each.
- Differentiate between types of aphasia & compare these with dysarthria. Compare the upper motor & lower motor neuron lesions.
- Explain the physiological basis of babinski's sign.
- Develop a brief narrative of the patients medical history.

Biochemistry

S.No	Topic/ Theme	Learning outcomes	Learning Objectives/ Content	MIT	Assessment Tool
		By the end of this block the students will be able to:		LGIS/ SGD/ CBL/ Practical/ Tutorial	MCQs/ SEQs/ OSCE/ Structured Viva
1.	Metabolism of Nucleotides	Understand the detailed metabolism of nucleosides and nucleotides, with their biochemical/ clinical significance	Describe the chemistry of nucleotides and types of nucleotides including typical and atypical nucleotides.	LGIS /CBL/ SDL	MCQs/ SEQs
2.			Explain the synthesis of nucleotides.	LGIS /CBL/ SDL	MCQs/ SEQs
3.			Describe the salvage pathway of nucleotides.	LGIS /CBL/ SDL	MCQs/ SEQs
4.			Describe the degradation of purines and related diseases.	LGIS/ CBL/ SDL/ Practical	MCQs/ SEQs
5.			Describe the degradation of pyrimidines and related diseases.	LGIS /CBL/ SDL	MCQs/ SEQs
6.			To correlate their Knowledge with different clinical conditions to interpret them.	LGIS /CBL/ SDL	MCQs/ SEQs
7.	Metabolism of Xenobiotics	Understand the detailed Metabolism of xenobiotics and the biochemical mechanisms involved as well as the significance of this process.	Explain different xenobiotics and Cytochrome P450 .	LGIS /CBL/ SDL	MCQs/ SEQs
8.			Illustrate the phase1 and phase 2 reactions of metabolism of xenobiotics.	LGIS /CBL/ SDL	MCQs/ SEQs
9.			Distinguish between ER and mitochondrial hydroxylation and its significance.	LGIS /CBL/ SDL	MCQs/ SEQs

10.			summarizes some principal features of cytochrome P450s.	LGIS /CBL/ SDL	MCQs/ SEQs
11.	Metabolism of Amino acids and proteins	Understand the metabolism of proteins and amino acids and the related biochemical disorders.	Explain amino acid oxidation, metabolic fate of amino acids, trsamination and deamination.	LGIS/ Practical	MCQs/ SEQs / OSCE
12.			Illustrate the transport of ammonia and formation of urea and its regulation.	LGIS/ CBL/ SDL/ Practical	MCQs/ SEQs / OSCE
13.			Understand the hyperammone mia and defects in enzymes related with urea cycle.	LGIS/ CBL/ SDL/ Practical	MCQs/ SEQs / OSCE
14.			Illustrate integration and regulation of metabolic pathways in different tissues.	LGIS/ CBL/ SDL/ Practical	MCQs/ SEQs
15.			Correlate their knowledge with different clinical conditions to interpret the diagnosis and under lying biochemical causes in relation to amino acids.	LGIS/ CBL/ SDL/ Practical	MCQs/ SEQs
16.	Neurotransm itters	To understand the chemistry, synthesis and mechanism of action of neurotransmi tters	Illustrate the chemistry, synthesis and mechanism of action of catecholamine s, serotonin, and Histamine	LGIS/ CBL/ SDL	MCQs/ SEQs
17.	Biochemical Genetics	Understand concepts of Biochemical genetics, cancer biology, some genetic disorders and common molecular biology techniques	Understand DNA Strucrure and its organization in eukaryotes and prokaryotes along with its replication	LGIS/ CBL/ SDL	MCQs/ SEQs
18.			Elaborate three types of RNA and prokaryotic and eukaryotic transcription.	LGIS/ CBL/ SDL	MCQs/ SEQs
19.			Understand post transcriptional modifications and translation of genetic code.	LGIS/ CBL/ SDL	MCQs/ SEQs
20.			Explain regulation of gene expression.	LGIS/ CBL/ SDL	MCQs/ SEQs

21.			Correlate their knowledge with different clinical conditions to interpret their diagnosis and under lying biochemical causes.	LGIS/ CBL/ SDL	MCQs/ SEQs
22.	Cancer biology	Understand the concepts of Cancer related to the genetics	Describe DNA repair mechanisms and some types of mutations.	LGIS/ CBL/ SDL	MCQs/ SEQs
23.	Genetic Disorders	Understand the genetic basis of genetic diseases	Illustrate the biochemical basis of some genetic disorders including Thalassemia, sickle cell anemia and some metabolic defects.	LGIS/ CBL/ SDL	MCQs/ SEQs
24.	Molecular Biology Techniques	Understand the application of knowledge of genetics in diagnosis of diseases and research	Summarize PCR, DNA cloning, Southern blotting, probes and RFLP	LGIS/ CBL/ SDL/ Practical	MCQs/ SEQs / OSCE
25.			Understand concept of gene expression prenatal diagnosis and gene therapy.	LGIS/ CBL/ SDL	MCQs/ SEQs

Biochemistry CBLs/SDLs

CBL-1:Metabolism of Nucleic acids (Acute Gout)

A moderately obese 54-year-old male appeared at the emergency department complaining of severe pain of 10 hours duration in his left big toe. He stated that he was a regular consumer of meat and soda (alcohol and sea food consumption are also risk factors). He had no other significant medical history. On examination, his left big toe was found to be red and markedly swollen around the metacarpophalangeal joint, and exquisitely sensitive. There was no evidence of arthritis elsewhere. Because of the history and location of the affected joint, the attending physician suspected that the patient was having an attack of acute gout. She ordered a number of lab tests, including a white cell count, determination of serum uric acid, and x-ray examination of the affected joint. The x-ray findings were non-specific; no indication of chronic arthritis was evident. Findings of other tests are tabulated below. Under local anesthesia, arthrocentesis was performed on the affected joint and a small amount of synovial fluid withdrawn and sent to the laboratory for detection of cells and crystals. Typical needle shaped crystals of MSU showing negative birefringence were detected in the synovial fluid.

LAB INVESTIGATIONS:

Test Name	Result	Normal Values
Serum Uric acid	680 µmol/L	Children 120-330 µmol/L Adult Male 210-430 µmol/L Adult Female 150-360 µmol/L
ESR	60 mm	1 – 10 mm in 1st hour
WBC Count	11.0 x 10^9 / L	4.0 x 11.0 x 10^9 / L
RA Factor	Negative	Negative

Gout is a disease caused by hyperuricemia mostly due to genetic factors while diet and lifestyle play a minor role in its causation. Uric acid is an end product of purine metabolism and as it is already near its saturation limit in plasma, minor increase due to mostly under-excretion from kidney or overproduction leads to its deposition in crystal form mostly where the solvent is stagnant like synovial fluid of relatively immobile joints. This crystallization appears first at the most immobile and coldest fluid body, typically big toe joint space and typically at night because temperature is further lower at night time and due to sleep and mobility is also further decreased. Crystals in a smooth lubricated environment play havoc and cause acute inflammatory response leading to severe pain, redness, warmth and loss of function locally. Moreover uric acid deposition in other soft tissues leads to formation of tophi.

LEARNING OBJECTIVES:

At the end of the block the students should be able to describe the :

- Structure and chemistry of nucleosides and nucleotides.
- Functions of nucleotides.
- The biochemical basis of various clinical features

REFERENCE BOOKS:

- Harper's text book of Biochemistry.
- Davidson's Practice of Medicine.
  Lippincott's textbook of Biochemistry

CBL-2:Nucleic Acids (ADA Deficiency)

A little girl aged 11 months was brought by her parents to a children's hospital. She had a number of attacks of pneumonia and thrush (oral infection usually due to a fungus Candida albicans) since birth. The major findings of a thorough workup were very low levels of circulating lymphocytes (i.e. **severe lymphopenia**) and low levels of circulating **immunoglobulins**. The attending pediatrician suspected **SCID**. Analysis of a sample of red blood Cells revealed a low activity of **ADA** and very high level (about 50 times normal) of **dATP**. This confirmed the diagnosis of SCID due to deficiency of ADA, the enzyme that converts **adenosine** to **inosine.**

The deficiency of ADA is inherited as autosomal recessive and accounts for almost 15% cases of SCID. T lymphocytes express high activity of enzyme normally. Lack of ADA activity leads to accumulation of

adenosine and dATP which is toxic to T cells. Secondarily B lymphocytes are also affected and lead to impaired **humoral immunity**. Defective immune system allows different **opportunistic infection** to occur and recur. An example of acquired immunodeficiency is AIDS. Such conditions can be treated by, antibiotics, fortifying immune system by immunoglobulins and treating the root cause.

LEARNING OBJECTIVES:

At the end of the block the students should be able to comprehend the :

- Ingestion and fate of nucleotides in human body
- Role of Nucleotides in DNA synthesis
- The biochemical basis of various clinical features

REFERENCE BOOKS:

- Harper's text book of Biochemistry. (Page 616)
- Davidson's Practice of Medicine.
- Lippincott's textbook of Biochemistry

CBL-3: DNA Damage and Repair (XerodermaPigmentosum)

An 8-year-old boy, an only child, presented at a dermatology clinic with a skin tumor on his right cheek. He had always avoided exposure to sunlight because it made his skin blister. His skin had scattered areas of hyperpigmentation and other areas where it looked mildly atrophied. There was no family history of a similar disorder. Because of the presence of a skin tumor at such a young age, the history of avoidance of sunlight, and the other milder skin lesions, the dermatologist made a provisional diagnosis of XP. The patient's fibroblasts and control fibroblasts were exposed to UV light, and cell samples were taken at 8 hour intervals for a total of 32 h post irradiation. Extracts of DNA were prepared and the numbers of dimers remaining at each time point indicated were determined. Only 24% of the dimers formed persisted in DNA extracted from the normal cells at 32 h, whereas approximately 95% were found in the extract from the patient's cells at 32 h. This showed that the UV-induced lesions had not been repaired, and thus confirmed the diagnosis of XP.

Exposure to unfiltered UV light causes formation of pyrimidine dimers in both prokaryotic and eukaryotic cells. This adduct formation prevents replication of DNA beyond this point. If these persist, it can lead to abnormal replication product and numerous mutations and multiple skin cancers. There are specific proteins in humans called XP proteins (uvr ABC in prokaryotes) which are continuously correcting such adduct formations by excision repair of damaged DNA. If there is a defect in one of these proteins (genetic), it leads to abnormal repair mechanism and disease resulting is called Xerodermapigmentosum. It must be differentiated from porphyrias.

LEARNING OBJECTIVES:

At the end of the block the students should be able to describe and illustrate the :

- Structure of DNA and its replication.
- Causes of DNA damage and repair mechanism.
- Xerodermapigmentosum and other related disorders

REFERENCE BOOKS:

- Harper's text book of Biochemistry.
- Davidson's Practice of Medicine.
- Lippincott's textbook of Biochemistry

CBL-4: Transcription (Tuberculosis and rifampin)

A 24-year-old girl presented with a 9-week history of cough, malaise and breathlessness. She had lost 5Kg weight in last two months but no history of night sweats or hemoptysis. She along with her 4 siblings and parents, lives in a house of only two rooms. On examination, she was mildly pyrexial (38°C) but had no anemia or clubbing. Crepitation was audible over the lung apex on right side. There were no other notable physical signs. Her hemoglobin and WBC count were normal but the CRP (C reactive protein) was raised. The chest X-ray showed unilateral upper- and middle-lobe shadowing but no hilar enlargement. Sputum was found to contain acid-fast bacilli and Mycobacterium tuberculosis was subsequently cultured. Mantoux test was strongly positive. A diagnosis of pulmonary tuberculosis was made. The patient was treated with isoniazid and rifampin for 6 months, together with pyrazinamide and ethambutol for the first 2 months. She was allowed home on medication when her sputum became negative on direct smear. After three months, the chest X-ray is now much improved.

RELATED LAB INVESTIGATIONS:

Test Name	Result	Normal Values
Hemoglobin	12.4 g/dL	Adult Male 13-18 g/dL Adult Female 12-16 g/dL
WBC Count	9.8 x 10^{9} / L	4.0 x 11.0 x 10^{9} / L
CRP	23mg/dL	5-10 mg/dL

Mantoux test (tuberculin skin test) (NOT SIGNIFICANT) "**QuantiFERON-TB Gold**" is a newer test which measures the response of immune system of body to MTB antigen in vitro	12mm induration	Less than 10mm in vaccinated individuals
Sputum for culture sensitivity	No growth	No growth
Sputum for AFB (smear test)	Positive only third time	Negative
Culture of MTBC (mycobacterium tuberculosis complex) 2-3 weeks Traditional solid media shows growth in 4-8 weeks	Positive	Negative
Nucleic Acid Amplification Tests (NAAT)	Detects genetic material of MTB	Not detected
LAM (lipoarabinomannan)antigen test in urine (mycobacterial cell wall component shed in plasma) 30 Min	Positive	Negative
Adenosine Deaminase Test **ADA**	Increased	-
HIV test	Negative	Negative

Pulmonary tuberculosis is an infection of lungs by a special bacterium called mycobacterium tuberculosis. Vaccine against TB is a part of EPI (extended program of immunization) by WHO which imparts roughly 20% additional protection against the infection. BCG vaccine (Bacillus Calmette–Guérin) is the only vaccine available and given to all the children round the world (90%) against tuberculosis. Though the disease is not common in developed countries, but in developing countries including Pakistan and especially African countries TB is quite prevalent and a major public health problem. Multidrug therapy with good compliance for 6 months at least is usually the treatment of choice. One of the antibiotic drugs is rifampin. Rifampin inhibits bacterial cell growth by inhibiting RNA synthesis. It binds to beta subunit of bacterial (prokaryotic) RNA polymerase and interferes with the formation of first phosphodiester bond. This prevents initiation of transcription in Acid fast bacilli (AFB). This slows growth and replication of the bacteria which are washed away in secretions. If there is resistance to this drug, the infection is called MDR-TB (multi-drug resistant TB).

MDR-TB and XDR-TB (extensive drug resistant TB) are serious public health problems and over 13 million die every year with TB worldwide. Dactinomycin (also called) Actinomycin D is an antibiotic and anticancer agent which binds DNA template and hinders the movement of RNA polymerase on it, blocking the transcription.

LEARNING OBJECTIVES:

At the end of the block the students should be able to describe the :

- Structure and types of RNA
- Pro and Eukaryotic gene transcription
- Post transcriptional modification of RNA including splicing

REFERENCE BOOKS:

- Lippincott's textbook of Biochemistry
- Harper's text book of Biochemistry
- Davidson's Practice of Medicine

CBL-5: Biotechnology Techniques-PCR etc (HCV & Lymphoma)

A 54-year-old male presented with fever, night sweats and weight loss. He also complained of a non-tender, non-inflammatory mass on left lateral side of his neck. The mass has grown to the size of a hazelnut since it was first noticed 6 weeks ago. On examination submandibular and supraclavicular nodes were palpable. Blood complete picture was normal but patient was diagnosed as a case of B Cell Non Hodgkin lymphoma with the help of tissue histology and bone marrow aspiration cytology. During the laboratory investigation phase he was incidentally found to be a patient of HCV infection as well.

In addition to commitment about the treatment and prognosis of the lymphoma, attending physician was also concerned about the status of his HCV infection. He ordered abdominal ultrasound to check for liver cirrhosis and Quantitative PCR to check for HCV viral load.

RELATED LAB INVESTIGATIONS:

Test Name	Result	Normal Values
Hemoglobin	14 g/dL	Adult Male 13-18 g/dL Adult Female 12-16 g/dL
WBC Count	11.5 x 10^9 / L	4.0 x 11.0 x 10^9 / L
(Tumor/mass)Lymph Node Biopsy	B Cell lymphoma cells seen	Normal cytology
Lymphoma cells in peripheral blood smear	Not seen	Not seen

Bone marrow biopsy for histological examination	Monoclonal lymphoid aggregates seen	No such aggregates
LDH	630 U/L	225-450 U/L
Anti HCV Antibody test	Positive	Negative
USG Abdomen	Nodular and shrunken appearance of liver but mild changes	Normal echo-texture
Quantitative PCR (for viral RNA)	700,000 IU/mL	Normally it is negative Viral Load is expressed as copies/mL**: Low:** less than 2 M/mL • **High**: more than 2 M/mL Or Expressed as International Units (IU/mL): • **Low:** less than 800,000 IU/mL • **High:** more than 800,000 IU/mL
Cytogenetic testing in culture sample (2 -3 weeks)	No abnormal chromosomal pairing or less or more chromosomes found	Normal chromosomal pairing and normal number
Fluorescent in situ hybridization (FISH) for t(14;18) of c-myc	No translocation found on microscopy	No translocation
PCR for Immunoglobulin light chain gene rearrangements	This test was carried out as there was a research center nearby and outcome had a research benefit as well. For patient it was helpful in determining whether it was reactive or malignant	

Though HCV and lymphoma is not a common combination in patients encountered in clinics but it has been selected to emphasize role of biotechnology techniques in diagnosis, management and prognosis of both the diseases. PCR is a very basic technique of DNA selected portion amplification in vitro from even minute quantities of DNA. It makes DNA ample to carry out any genetic analysis. In HCV patients quantitative PCR is routinely advised to see viral load. While in lymphoma certain related immunoglobulin gene rearrangement can be checked to understand etiology of the disease better.

LEARNING OBJECTIVES:

At the end of the block the students should be able to describe the :

- Molecular Biology Techniques and their applications
- Procedure, principle and uses of PCR
- Types of PCR

REFERENCE BOOKS:

1. Lippincott's textbook of Biochemistry
2. Harper's text book of Biochemistry

Practicals

Sr. No	Topic/ Theme	Learning outcomes	Learning Objectives/ Content	MIT	Mode of Assessment
		By the end of this block the students will be able to:		Practical	Theory/ OSCE/ Viva Voce
1.	Estimation of Total Bilirubin	Understand the estimation and clinical importance of Bilirubin	Comprehend Principle, procedure and normal values of estimation of Total Bilirubin	Demonstration/ Practical	OSPE/ OSCE/ Practical Performance
2.	Estimation of LDH	Understand the estimation and clinical importance of LDH	Explain Principle, procedure and normal values of estimation of LDH	Demonstration/ Practical	OSPE/ OSCE/ Practical Performance
3.	Estimation of Uric acid	Understand the estimation and clinical importance of Uric acid	Comprehend Principle, procedure and normal values of estimation of Uric acid	Demonstration/ Practical	OSPE/ OSCE/ Practical Performance
4.	Estimation of Amylase	Understand the estimation and clinical importance of Amylase	Comprehend Principle, procedure and normal values of estimation of Amylase	Demonstration/ Practical	OSPE/ OSCE/ Practical Performance
5.	Estimation of Urea	Understand the estimation and clinical importance of Urea	Describe Principle, procedure and normal values of estimation of Urea	Demonstration/ Practical	OSPE/ OSCE/ Practical Performance

6.	Paper Chromatography	Understand the Principal of technique of Paper Chromatography	Explain Principle, procedure and use of Paper Chromatography	Demonstration/ Practical	OSPE/ OSCE/ Practical Performance
7.	DNA Extraction	Understand the procedure and Clinical Role of DNA Extraction	Describe the detailed procedure for DNA Extraction	Demonstration/ Practical	OSPE/ OSCE/ Practical Performance
8.	Polymerase Chain Reaction	Understand the procedure and Clinical Role of PCR along with its application in other fields of Medicines	Comprehend Principle, procedure and Application of PCR	Demonstration/ Practical	OSPE/ OSCE/ Practical Performance

Medicine

S. No	Title /Theme	Learning outcomes	Learning objectives	MIT
	By the end of this block the students will be able to			
1.	Upper and Lower Motor Neuron Lesion	Correlate the relevant basic knowledge with clinical presentations upper and lower motor neuron lesion	Differentiate the symptoms of a lower motor neuron deficit from an upper motor neuron deficit with the physiological basis.	LGIS
2.	Parkinsonism	Correlate the relevant basic knowledge with clinical presentations parkinsonism	Justify the clinical presentation of cerebellar disease with reasoning	LGIS
3.	Cerebellar disease	Correlate the relevant basic knowledge with clinical presentations cerebellar disease	Demonstrate understanding of basic concepts of cerebellar dysfunction	LGIS
4.	Clinical importance of genetic disorders	Correlate the relevant basic knowledge with clinical presentations genetic disorders	Demonstrate understanding of basic concepts of Parkinsonism	LGIS

Surgery

S.No	Topic/ Theme	Learning outcomes	Learning Objectives/ Content	MIT	Assessment Tool
		By the end of this block the students will be able to:			
1.	Spinal trauma	Correlate the relevant basic knowledge with clinical presentations	• Explain the spine stability • Initial assessment of spinal injuries • Understanding of neurogenic syndromes caused by spinal trauma • Recognize the neurogenic shock & cauda equine syndrome	LGIS	MCQ SEQ SAQ Viva Voce
2.	Brain tumors		Explain the clinical presentations of brain tumors. There correlation with basic anatomy	LGIS	MCQ SEQ SAQ Viva Voce
3.	Nerve tube defects		• Explain the spina bifida, spina occulta, spina cystic • Meningococee & meningomyelo cele and correlate it with basic knowledge	LGIS	MCQ SEQ SAQ Viva Voce
4.	Vascular lesions & hemorrhages		• Concept of AV malformation & Aneurysma • Correlation of their clinical presentation with basic knowledge	LGIS	MCQ SEQ SAQ Viva Voce
RADIOLOGY					
1.	CT and MRI anatomy of brain and spinal cord at different levels	Correlate the relevant basic knowledge with clinical presentations	• Demonstrate understanding of basic concepts of brain and spinal cord • Justify the clinical presentation with reasoning	LGIS	OSPE
2.	CT and MRI Angiography			LGIS	OSPE

	of circle of Willis				
3.	Cranial fractures and hemorrhages			LGIS	OSPE

Behavioral Sciences

S. #	Title /Theme	Learning outcomes By the end of this block the students will be able to	MIT	Assessment tool
1.	Historical development of medicine.	Analyze the impact the historical development of medicine as a discipline	LGIS	MCQs
2.	Time management strategies.	• Recognize and apply the strategies of time management • Appraise the significance of integrity in being a leader	LGIS/ SGD/ Case study	MCQs
3.	Active listening skills.	• Demonstrate the ability use active listening techniques. • Recognize the significance of listening skills in doctor patient relationship.	LGIS/ CBL/SGD	MCQs
4.	Narrative medicine in patient care.	• Recognize the value of narrative medicine in patient centered care • Develop a brief patient narrative.	SGDs, Peer assisted learning	MCQs

Learning Resources

Anatomy

a) Clinical Anatomy for Medical Students by Richard Snell (9th edition).
b) Basic Histology Text and Atlas by Luiz Carlos and Junqueira (14th edition)
c) Basic Histology by Laiq Hussain Siddiqui (5th Revised edition)
d) Medical Embryology by Langman (14th edition).
e) Essential Clinical Anatomy by Keith Moore (7th edition).
f) The Developing Human by Keith Moore (10th edition).
g) General Anatomy by Laiq Hussain Siddiqui.

PHYSIOLOGY

a) Guyton and Hall Textbook of Medical Physiology, 13th Edition by John E. Hall.
b) Human Physiology: From Cells to Systems, 9th Edition by Lauralee Sherwood.
c) Ganong's Review of Medical Physiology, 25th Edition (LANGE Basic Science) by Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen Brooks.
d) Practical physiology by CL Ghai
e) Electronic modes

BIOCHEMISTRY

a) Lippincott's illustrated reviews, 7th edition
b) Harper's illustrated Biochemistry, 30th edition
c) M.N Chatterjea Textbook of Biochemistry , 8th edition
d) M.D Vasudevan, Sreekumari, M.D.S;Kannan, M.D. Vaidyanathan D.M Textbook of Biochemistry for medical students, 2016
e) Practical Biochemistry Manual (Prof Maj Gen AK Naveed, Dr Shakir Khan)
f) Electronic modes

Feedback on the study guide

We value your feedback and will use it for improvement of this Study guide.

Kindly provide feedback for this study guide. At the email:

dme@ckmc.edu.pk

References:

HARDEN, J.M. LAIDLAW, E.A. HESKETH, R. M. (1999). AMEE Medical Education Guide No 16: Study guides-their use and preparation. *Medical Teacher*, *21*(3), 248–265. https://doi.org/10.1080/01421599979491