A. Course description:
This system-based course integrates the basic sciences into a study of neuroscience and behavior in both health and disease states. Each of the basic science topics is incorporated into an integrated body of knowledge covering neuroanatomy, neurophysiology, neurological correlation, neuropharmacology, neuropathology, microbiology, human behavior and biochemistry. This goal will be achieved via selected lectures, relevant laboratory sessions, seminars topics, and self-directed learning methods. 

The overall goal of the Neuroscience I course is to provide basic knowledge and understanding of the structure, function of the nervous system, biochemical basis of human behavior, as well as the pathological basis of neurological and mental disorders. Fundamental principles of anatomy, physiology, pharmacology, pathology, microbiology and human behavior will be applied to pathological situations to distinguish the clinical basis for central nervous system disorders.

B. General objectives:
1) Outline the general organization of the nervous system.
2) Describe the gross features of the human central nervous system (brain and spinal cord).
3) Discuss chemical synaptic transmission in terms of mechanisms, functions, and properties, and drugs modulating synaptic transmission.
4) Describe brain coverings, cerebrospinal fluid (CSF), and blood supply of the central nervous system.
5) Define the structural basis, physiological, and pharmacological properties of the pathways that transmit sensory and motor information in the central nervous system.
6) Describe the anatomical and physiological basis for higher-order cortical functions in the central nervous system.
7) Describe pathogens that infect the central nervous system and the specific diseases related to the infection process.
8) Describe the pathological changes in central nervous system tissue that underlies various neurological diseases.
9) Describe the principles that guide our understanding of human behavior and the biochemical basis of various behavioral disorders.
10) Correlate lesion sites at specific levels of the central nervous system with neurological and pathological findings of various neurological disorders.
11) Describe the pharmacology of drugs employed in the management of various mental and neurological disorders.
Methods of Instruction:
   I. Lectures.
   II. Practical classes.
   III. Small group discussion: Cerebrovascular accidents.

Evaluation and Grading System:
1. First in-course exam (Written) = 40%.
2. Second in-course exam (Practical) = 18%.
3. Evaluation at small group discussion = 2%.
4. Final course exam (Written) = 40%.

Recommended Text Books:
1. Anatomy:

2. Physiology:

3. Biochemistry:
   - Supplementary Departmental Handouts.

4. Pharmacology:
   - Supplementary handouts.

5. Pathology:
   - Supplementary handouts.

C. Specific (learning) objectives:
By the end of this module, the students are expected to achieve the following learning objectives:

A. Lectures:

<table>
<thead>
<tr>
<th>#</th>
<th>Lecture title</th>
<th>Lecture objectives</th>
</tr>
</thead>
</table>
| 1, 2 | Introductory Meeting and Introductory Clinical Case (Parkinson's disease) (All) | 1. Understand the general outline of the Neuroscience module.  
2. Be familiar with the modalities of teaching throughout the course.  
3. Acknowledge the important relation between normal and abnormal structure and function.  
4. Appreciate the importance of basic neurosciences in clinical application and neurology. |
| 3   | Microscopic structure of the NS (Anatomy)                                   | 1. Classify the types of neurons.  
2. Describe the structure of the different parts of neurons.  
3. Describe anterograde and retrograde axonal transport.  
4. Describe the structure and types of synapses.  
5. Describe the process of myelination of myelinated axons.  
6. Describe the types of glia cells and their functions.  
7. Describe the elements of the blood-brain barrier and the blood-CSF barrier.  
8. Describe the structure of the choroid plexus and the meanings. |
| 4   | An overview of synaptic transmission of the CNS (Pharmacology)               | 1. Review the physiology of synaptic transmission and the electrical Properties of synaptic potentials  
2. List the criteria for accepting a chemical as a neurotransmitter.  
3. Describe the mechanisms by which drugs cause presynaptic and postsynaptic modulation of synaptic transmission.  
4. List the major excitatory neurotransmitters.  
5. List the major inhibitory central neurotransmitters.  
6. Identify the major receptor subtypes of CNS neurotransmitters and their functional role.  
7. Indicate the involvement of neurotransmitters in the pathophysiology of Diseases. |
| 5   | Introduction and basic structural organization of the CNS (Anatomy)          | 1. Describe the organization of the NS.  
2. Overview of the main parts of the CNS.  
3. Identify the main parts of the brain in CT scan and MRI.  
4. Describe the surface anatomy of the brain.  
5. Explain the concept of nuclei, fasciculi, lemnisci, tracts, laminae, white and gray matter inputs (afferent) and outputs (efferent) |
| 6   | Gross morphology of the brain (Anatomy)                                     | 1. Demarcate the major lobes, gyri and sulci of the cerebral hemisphere.  
2. Describe the organization of the cerebral hemisphere into cerebral cortex, white matter and nuclei  
3. Describe the types of fibers in the white matter of the cerebral hemisphere: projection (internal capsule), commissural and association fibers.  
4. Identify the basal ganglia nuclei.  
5. Identify main parts of the diencephalon and name the main functions of each part  
6. Define parts of the brainstem and briefly describe its internal structure.  
7. Identify the superficial attachments of the cranial nerves.  
8. Briefly describe the brain ventricles and meanings. |
| 7   | Cerebral hemisphere (Anatomy)                                               | 1. Describe the organization of the cerebral cortex. (Layers and columnar organization).  
2. Locate the motor, sensory and other cortical areas.  
3. Describe the cortical areas related to the written and spoken language.  
4. Identify the structures in coronal, sagittal and horizontal sections of brain.  
5. Describe the types of fibers in the internal capsule. |
<table>
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<tr>
<th>Page</th>
<th>Topic</th>
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<th>5.</th>
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</thead>
<tbody>
<tr>
<td>8</td>
<td>Gross morphology of spinal cord (Anatomy)</td>
<td>Describe the gross anatomical features of the spinal cord.</td>
<td>Describe the level of the different spinal segments comparing to the level of their respective vertebrae.</td>
<td>Identify important gross features of spinal cord, nerve roots, and spinal ganglia.</td>
<td>Describe the internal features of spinal cord (gray matter and white matter) in the different regions.</td>
<td>Summarize the location, origin, course and termination of the important ascending and descending tracts of spinal cord.</td>
</tr>
<tr>
<td>9</td>
<td>Brain meninges, ventricles and CSF (Anatomy)</td>
<td>Describe the arrangement of the meninges and their relationship to brain and spinal cord.</td>
<td>Explain the occurrence of epidural, subdural and subarachnoid spaces.</td>
<td>Locate the principal subarachnoid cisterns, and arachnoid granulations.</td>
<td>Describe the ventricles of brain and importance of their choroids plexus.</td>
<td>Summarize the pathway of cerebrospinal fluid (CSF) circulation</td>
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<tr>
<td>10</td>
<td>Characteristic features of CNS pathology (Pathology)</td>
<td>To know the selectivity of disease and vulnerability of certain areas to specific disease processes.</td>
<td>To know the types and functions of the various elements in the CNS &amp; their response to injury.</td>
<td>To know the types of cerebral herniations, their anatomical locations &amp; complications.</td>
<td>To know the pathology of cerebral edema.</td>
<td>To know the types, causes &amp; effects of hydrocephalus.</td>
</tr>
<tr>
<td>11</td>
<td>Blood supply of the CNS (Anatomy)</td>
<td>Describe the four arteries supplying the CNS.</td>
<td>Follow up each artery to its destination.</td>
<td>Describe the circle of Willis and its branches.</td>
<td>Discuss the principle of end artery type of circulation.</td>
<td>Describe venous drainage of the brain.</td>
</tr>
<tr>
<td>12</td>
<td>Physiology of the brain circulation and CSF Formation (Physiology)</td>
<td>Describe the cerebral blood flow mechanism and the controlling factors.</td>
<td>Explain the significance of cerebral perfusion pressure and the mechanism of its control.</td>
<td>Describe the pressure-volume correlation and the mechanisms of its control.</td>
<td>Discuss the autoregulation mechanisms of cerebral blood flow in health and disease states.</td>
<td>Describe formation, composition and circulation of the CSF.</td>
</tr>
<tr>
<td>13</td>
<td>Vascular diseases of the CNS (Pathology)</td>
<td>Define stroke, transient ischemic attack, and the areas &amp; cells in the brain, which are most susceptible to ischemia &amp; hypoxia.</td>
<td>Describe global/ ischemic encephalopathy, laminar necrosis, Border-Zone (Watershed) infarcts.</td>
<td>Understand regional infarction and describe their pathology.</td>
<td>Know the types of intracranial hemorrhage &amp; their pathological features.</td>
<td>Know the effects of hypertension on the brain.</td>
</tr>
<tr>
<td>14</td>
<td>Vascular disease and trauma of the CNS (Pathology)</td>
<td>List the types of aneurysms in the brain, their pathology, and outcome of their rupture.</td>
<td>Define berry aneurysms in the circle of Willis and describe their clinical and pathological manifestations.</td>
<td>Describe the types, morphology, pathology and complications of open and closed injury to the brain.</td>
<td>Describe the pathology of diffuse axonal injury.</td>
<td>List the complications of trauma to the brain and spinal cord.</td>
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</tbody>
</table>
| 15 | Higher functions of the neocortex (Physiology) | 1. Describe the language function of the neocortex  
2. Name and locate the large association areas in the cerebral cortex and describe their functions.  
3. Define the terms categorical hemisphere and representational hemisphere, and summarize the differences between the hemispheres and their relationship to handedness  
4. Review the function of the limbic and frontal and frontal association areas.  
5. Define and explain agnosia, unilateral neglect, dyslexia, and prosopagnosia.  
6. List the common types of aphasia.  
7. Discuss the neural basis of learning and memory. and list parts of the brain that appear to be involved in memory. |
| --- | --- | --- |
| 16 | Metabolism of neurotransmitters (Biochemistry) | 1. Discuss the synthesis and degradation of gamma-amino-butyric acid (GABA)  
2. Discuss the synthesis and degradation of dopamine, epinephrine and nor-epinephrine  
3. Discuss the formation and catabolism of serotonin  
4. Discuss the glutamate metabolism  
5. Understand the brain peptides as neurotransmitters |
| 17 | The biochemical basis of selective neurological disorders (Biochemistry) | 1. Discuss the sphingolipids metabolism and their disorders (shingolipidoses)  
2. Understand the biochemical bases of Huntington disease  
3. Understand the biochemical bases of Alzheimer disease  
4. Understand the role of biochemical mechanisms in brain damage due to stroke |
| 18 | Development of CNS (Anatomy) | 1. Describe the formation of neural tube and neural crest.  
2. Describe the development of brain and spinal cord.  
3. Describe the positional changes of spinal cord.  
4. Describe the development of the spinal nerves and their spinal ganglia.  
5. Describe the development of meninges.  
6. Describe the development of brain vesicles from the neural tube.  
7. Describe the development of the different parts of brain.  
8. Describe the development of brain ventricles and choroid plexuses  
9. Describe the development of pituitary gland  
10. Describe the development of the cranial nerves and their ganglia.  
11. Describe the congenital anomalies of brain and spinal cord. |
| 19 | Bacterial meningitis (Microbiology) | - Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment and prevention of meningitis caused by Neisseria menegitidis, group b Streptococci, S. Penmoniae, Hemophilus influenzae, and Listeria momcytogenesis |
| 20 | Viral and fungal meningitis (Microbiology) | 1. Describe the morphology, physical properties, pathogenesis, laboratory diagnosis, treatment of polio virus, coxaki, enteroviruses, echo, arbovirus and rabies virus  
2. Describe Cryptococcus neoformans, its morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment its importance |
| 21 & 22 | Inflammatory conditions of the CNS (Pathology) | 1. Compare &contrast the clinical and pathological findings in bacterial and viral meningitis.  
2. Know the pathology of tuberculous meningitis and tuberculosis  
3. List the types of syphilitic & fungal diseases in the brain  
4. Describe viral encephalitis and the main morphological features in the commoner types.  
5. Know about prion diseases in the CNS. |
| 23 | Limbic system and olfactory pathways (Physiology) | 1. Summarize the components of the limbic system.  
2. Describe the location, structure and the main connections of the hippocampal formation, amygdala and septal nuclei.  
3. Describe olfactory pathway  
4. Describe the neural circuits involved in emotional responses and stereotyped behaviors. These include sexual and maternal behavior, fear, rage, and motivation  
5. Discuss the brain regions involved in sexual behavior in both sexes.  
6. Describe the parts of the brain involved in producing the balance between rage and placidity. |
| 24 | Drugs used in schizophrenia and psychotic disorders (Pharmacology) | 1. Outline the anatomy of the serotonergic, noradrenergic (norepinephrine) and dopaminergic pathways, and summarize their known and suspected functions.  
2. Describe the major symptoms and signs of schizophrenia  
3. Describe the dopamine hypothesis of schizophrenia.  
4. List the major receptors blocked by antipsychotic drugs.  
5. Describe the classifications of antipsychotic drugs  
6. Describe the pharmacodynamics of antipsychotic drugs and correlate these pharmacodynamic to their clinical uses.  
7. List the adverse effects and the behavior effects of the major antipsychotic drugs.  
8. Describe the pharmacokinetics and pharmacodynamic of lithium. |
| 25 | Antidepressants (Pharmacology) | 1. Describe the monoamine theory of depression  
2. Describe the classification of antidepressants.  
3. Describe the probable mechanisms and the major pharmacodynamic properties of tricyclic antidepressants.  
4. List the toxic effects that occur during chronic therapy and after an overdose of tricyclic antidepressants.  
5. Describe the therapeutic use and toxic effects of MAO inhibitors.  
6. Identify the second and third generation antidepressants and their distinctive properties.  
7. Identify the prototype selective serotonin reuptake inhibitor and list its major characteristics.  
8. Identify the major drug interactions associated with the use of antidepressant drugs. |
| 26 | Brainstem (Anatomy) | 1. Identify the gross features of the brainstem.  
2. Briefly describe the internal structure of the brainstems (ascending and descending pathways, sensory and motor cranial nuclei, substantia nigra, red nucleus, olivary nucleus and reticular formation).  
3. Describe the main connections of the sensory cranial nuclei.  
4. Describe the main connections of the motor cranial nuclei.  
5. Review the blood supply of the brainstem.  
6. Describe lesions in the brainstem such as medial medullary syndrome and lateral medullary syndrome.  
7. Describe the main connections of the substantia nigra and the red nucleus.  
8. Describe the main connections of RF and correlate these connections with its main functions. |
| 27 | Arousal mechanisms and consciousness and sleep (Physiology) | 1. Describe the functions of the reticular formation and discuss the nonspecific sensory system in the reticular formation.  
2. Describe the genesis and electrophysiological basis of EEG.  
3. Describe the primary types of rhythms that make up the EEG and the behavioral states that correlate with each.  
4. Define and explain synchronization and alpha block.  
5. Summarize the behavioral and electroencephalographic characteristics of each of the stages of slow-wave sleep.  
6. Summarize the electroencephalographic and other characteristics of rapid eye movement (REM) sleep, and describe the mechanisms responsible for its production.  
7. Describe the pattern of normal nighttime sleep in adults and the variations in this pattern from birth to old age. |
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<th>Page</th>
<th>Section/Title</th>
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<th>4.</th>
</tr>
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<tbody>
<tr>
<td>28</td>
<td>EEG: a clinical perspective and pathophysiology of epilepsy (Physiology)</td>
<td>Outline the clinical uses of the EEG. Particularly in the diagnosis of epilepsy.</td>
<td>Summarize the neuropsychological basis of epilepsy.</td>
<td>List the major types of epilepsy.</td>
<td>Summarize the behavioral and electroencephalographic characteristics of major types of epilepsy</td>
</tr>
<tr>
<td>29</td>
<td>Sedative-hypnotics (Pharmacology)</td>
<td>Identify the major chemical classes of sedative-hypnotics.</td>
<td>Describe the sequence of CNS effects of a typical sedative-hypnotic over the entire dose range.</td>
<td>Describe the pharmacodynamics of benzodiazepines, including interactions with neuronal membrane receptors.</td>
<td>Compare the pharmacokinetics of commonly used benzodiazepines and barbiturates and discuss how differences among them affect clinical use.</td>
</tr>
<tr>
<td>30</td>
<td>Drugs used In epilepsy (Pharmacology)</td>
<td>Define epilepsy and understand the classification of seizures</td>
<td>Understand the biochemical markers of epilepsy.</td>
<td>Understand cellular mechanisms underlying epilepsy</td>
<td>Describe the major drugs for partial seizures, generalized tonic-clonic, absence, myoclonic seizures, and status epilepticus.</td>
</tr>
<tr>
<td>31</td>
<td>General anesthetics (Pharmacology)</td>
<td>Understand the physiochemical theories of anesthesia; lipid and protein theory.</td>
<td>Describe stages of anaesthesia</td>
<td>Describe drugs used as pre-anesthetics and the rationale of their use.</td>
<td>Identify the main inhalation anesthetic agents and describe their pharmacodynamic and pharmacokinetics properties.</td>
</tr>
<tr>
<td>32</td>
<td>Cerebellum: (Anatomy)</td>
<td>Identify the major lobes and regions of cerebellum.</td>
<td>Summarize the structure of the cerebellar cortex; identify the deep cerebellar nuclei and their connections.</td>
<td>Summarize the afferent and efferent connections of the cerebellum and their arrangement in cerebellar peduncles.</td>
<td>Describe the major functions of the cerebellum and how each side of the cerebellum controls the ipsilateral side of the body.</td>
</tr>
</tbody>
</table>
| 33 | Basal ganglia (Anatomy) | 1. Understand the anatomical and functional definition of the basal ganglia.  
2. Identify the different components of the basal ganglia.  
3. Describe the connections of the different components of the basal ganglia and the indirect pathways from the basal ganglia to the lower motor neurons.  
4. Describe signs and symptoms of lesions which affect different components of the basal ganglia. |
| 34 | Antiparkinsonism drugs (Pharmacology) | 1. Describe the neurochemical imbalance underlying the symptoms of parkinson's disease.  
2. Identify the mechanisms by which drugs can alleviate parkinsonism.  
3. Describe the therapeutic and toxic effects of the major antiparkinsonism drugs.  
4. Identify the compounds that inhibit dopa decarboxylase and comt and describe their use in parkinsonism.  
5. Identify the chemical agents and drugs that cause Parkinson symptom. |
| 35 | Motor pathways (Anatomy) | 1. Define the terms upper and lower motor neurons with examples.  
2. Describe the corticospinal (pyramidal) tract and the direct motor pathways from the cortex to the trunk and limbs.  
3. Briefly describe the indirect motor pathways from the cortex to the trunk and limbs through extrapyramidal tracts such as rubrospinal and reticulospinal tracts.  
4. Describe motor pathways to the face muscles.  
5. Compare the signs and symptoms of the upper and lower motor neuron lesions. |
| 36 | Control of movements and posture: motor functions of cerebrum and brain stem (Physiology) | 1. Describe in general terms how posture and movement are regulated, and outline the function of each of the main components of the regulatory systems.  
2. Describe the cortical motor area, the pyramids, and the corticospinal tracts.  
3. Discuss the function of the pyramidal system in relation to skilled voluntary movement.  
4. Define decerebrate and decorticate rigidity, and comment on the cause of each.  
5. Describe the postural reflexes that are integrated in the medulla oblongata, the pones, midbrain, and the cerebral cortex.  
6. Discuss the motor functions of the brainstem and outline the major functions descending motor pathways originating in the brain stem.  
7. Define decerebrate and decorticate rigidity, and comment on the cause of each.  
8. Describe the postural reflexes that are integrated in the medulla oblongata, the pons, midbrain and cerebral cortex. |
| 37 | General sensory pathways of the trunk and limbs (Anatomy) | 1. Describe gracile and cuneate tracts and pathways for conscious proprioception, touch, pressure and vibration from the limbs and trunk.  
2. Describe dorsal and ventral spino cerebellar tracts and pathways for unconscious proprioception from the limbs and trunk.  
3. Describe lateral spinothalamic tract and pathways for pain and temperature from the limbs and trunk.  
4. Describe ventral spinothalamic tract and pathways for simple touch from the limbs and trunk. |
| 38 | General sensory pathways of the face area, Taste pathways and Hearing pathways | 1. Describe pathways for general sensations (pain, temperature, touch and proprioception) from the face area.  
2. Describe taste pathways.  
3. Describe hearing pathways. |
| 39 | Somatic and visceral sensation pain and thermal sensations (Physiology) | 1. Name the types of nerve fibers that mediate warmth and cold in peripheral nerves, and describe where impulses generated in warmth and cold receptors terminate in the cortex.  
2. Name the receptors that mediate pain, and explain the differences between fast and slow pain.  
3. Compare superficial, deep, and visceral pain.  
4. Define chronic and acute pain.  
5. Define and explain phantom limb pain.  
6. Define hyperalgesia and give examples of primary and secondary hyperalgesia.  
7. Define visceral pain and describe pathways carrying pain from visceral organs.  
8. List major stimuli of visceral pain.  
10. Explain referred pain and give examples.  
11. List and explain ways to inhibit pain sensations and describe the brain analgesic system.  
12. Discuss example of referred pain from the heart and appendix and other visceral organs. |
### Opioids and opioid antagonists

**Pharmacology**
1. Describe the neural mechanisms of pain sensation and its control.
2. List the receptors affected by opioid analgesics and the endogenous opioid peptides.
3. List of major opioid agonists and rank them in analgesic efficacy.
4. Describe the main pharmacodynamic and pharmacokinetic properties of agonist opioid analgesics and list their clinical uses.
5. List the main adverse effects of acute and chronic use of opioid analgesics.
6. Identify opioid receptor antagonists and mixed agonist-antagonist.

### CNS stimulants and drugs of abuse

**Pharmacology**
1. Describe the clinical uses of the opioid receptor antagonists.
3. Describe the pharmacological types of drug dependence.
4. Describe the major pharmacological actions of drugs that are commonly abused.
5. Describe the major signs and symptoms of withdrawal of drugs that are commonly abused.
6. Identify the most likely causes of fatalities from commonly abused agents.

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### B. Laboratory Sessions

**Students are requested to:**
1. Study and prepare the laboratory materials prior to the laboratory session.
2. Prepare a summary of the laboratory procedure.
3. Understand the class materials relevant to the laboratory session.
4. Instructors and faculty will be in the laboratory room to help you understand and learn the required skills.
5. Bring your atlas and relevant text books or notes to help you in identifying the structures in the anatomy Laboratory.
6. Spend the time in the laboratory class to be sure that you have learned the assigned skills.

<table>
<thead>
<tr>
<th>Laboratory Title</th>
<th>Objectives</th>
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<tbody>
<tr>
<td>Neuroanatomy I</td>
<td>Gross morphology of brain: identify major components of brain, know major lobes, major gyri and sulci identify major components of brain stem, important landmarks and the main arteries of the brain including the circle of Willis.</td>
</tr>
<tr>
<td>Neuroanatomy II</td>
<td>Study and identify the major components of brain in coronal transverse and sagittal sections including thalamus, hypothalamus Brain ventricular system included capsule, basal ganglia etc. Use dissected brains, CT scan &amp; MRI.</td>
</tr>
<tr>
<td>Neuroanatomy III</td>
<td>Study major parts of the brainstem, origin of the cranial nerve Also identify (using the main nuclei (including the cranial nuclei) and the main ascending and descending pathways in the brainstem. Also, identify the main nuclei, laminae, and tracts in the spinal cord.</td>
</tr>
<tr>
<td>Pathology I</td>
<td>Study Images of CNS including cell reactions,</td>
</tr>
<tr>
<td>Pathology II</td>
<td>Study images of hemorrhage Interactions of CNS</td>
</tr>
</tbody>
</table>
| Neurophysiology        | **A. Coetaneous sensations**
                          | Determine tactile sensibility by determining two point discrimination.                         |
|                        | **B. Reflexes:**
                          | Demonstrate deep tendon reflexes and explain their clinical significance. The following reflexes will be studies: knee jerk, ankle jerk, biceps, and triceps reflex. |
                          | Demonstrate and elicit the following superficial reflexes and explain their physiological significance. The following reflexes will be studied: corneal reflex, palatal reflex, abdominal reflex, and Babinski’s sign. |
|                        | **C. Muscle tone.**                                                                         |
|                        | **D. Electromyogram (EMG)**                                                                 |
|                        |                                                                                             |
### Lab title

**Microbiology**

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<tr>
<th>Objectives</th>
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<tbody>
<tr>
<td>1. Describe the method of specimen collection including the process of lumbar puncture, transportation of specimen, and storage.</td>
</tr>
<tr>
<td>2. Describe the laboratory method used for the specimen processing, including media used, incubation environment, colonial morphology and bacterial identification.</td>
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<tr>
<td>3. Prepare a sample culturing resembling CSF specimen and identify the organisms involved. Write the laboratory findings in the hospital laboratory format.</td>
</tr>
</tbody>
</table>

### Summary of teaching activities in the module:

<table>
<thead>
<tr>
<th>Department</th>
<th>No. of Lectures</th>
<th>No. of Sessions</th>
<th>No. of Discussion seminars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy</td>
<td>14</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Physiology</td>
<td>7</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Microbiology</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Pharmacology</td>
<td>9</td>
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<td>3</td>
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<tr>
<td>Pathology</td>
<td>5</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>39</strong></td>
<td><strong>7</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

### Please note the following:

Lecture Room will be Science Hall 2.

### Laboratory groups

The students will be divided into 5 major groups (A, B, C, D and E).

### Small group discussion:

One seminar topic will be discussed in the module: Cerebrovascular accident.

- **Group A:** A1, A2, A3 and A4.
- **Group B:** B1, B2, B3 and B4.
- **Group C:** C1, C2, C3 and C4.
- **Group D:** D1, D2, D3 and D4.
- **Group E:** E1, E2, E3 and E4.

### Exams

**The Midterm and Practical exam:**

The midterm exam and practical exam will be held on Sunday 14/3/2010.

**The Final exam:**

The date of the final exam will be held on Thursday 10/6/2010.

Note: All faculty members from the Basic Science Departments involved in teaching the module are kindly reminded that they must be involved in all aspects of exams.

### D. Introductory clinical case:

**Parkinson's disease**

A 39-year-old woman presented with one week history of diplopia and right-sided numbness. Her medical history was benign, and she had no history of previous neurologic events. Her general neurologic examination was notable for patchy predominantly right-sided hemisensory loss. Her neuro-ophthalmic examination was remarkable for nearly complete ophthalmoplegia, with the only surviving eye movement being right abduction. MRI demonstrated a large ring-enhancing lesion in the left paramedian pons with multiple, predominately periventricular T2 bright signal, compatible with extensive demyelinating disease. Lumbar puncture is performed, revealing elevated IgG index, synthesis rate, and positive oligoclonal bands. After taking a day off from work, her symptoms begin to resolve and by 3 weeks are completely gone. Three months later, she developed dysequilibrium and her gait becomes unsteady.
One-and-a-half syndrome (one whole gaze palsy and one half of a gaze palsy) results from a lesion in the paramedian pons. This has also been termed paramedian pontine exotropia. All classes of eye movements include an ipsilateral gaze palsy (resulting from involvement of the ipsilateral abducens nucleus) and an ipsilateral INO, secondary to damage to the MLF. The only residual intact eye movement therefore is abduction contralateral to the lesion. Common etiologies include stroke and demyelination.

Three minicases:

1-Epilepsy
The parents of a 5-year-old girl bring her for evaluation of “inattention and spacing out.” She started kindergarten this autumn, and her teacher has remarked that she is not paying attention, is daydreaming, and sometimes appears not to have heard what the teacher is saying. She had a normal birth and developmental history, and the parents have not witnessed these behaviors. Neither of the parents is particularly concerned, and the mother reveals that when she was this age her parents and teachers used to tell her that she was daydreaming, but that she finally managed to finish high school and went on to college to become a pharmacist. The father reports that he had absence seizures as a child but was successfully treated with ethosuximide and outgrew his seizures when he was in his early teens. Two additional family members with a history of epilepsy are identified on the father’s side.
The general physical and neurologic examinations of the child are normal.
The physician has the girl perform hyperventilation in the office. After 1 minute she stops the hyperventilation, stares, and becomes unresponsive. This lasts for 10 seconds after which she is completely back to her baseline.

2-Meningitis
A 44-year-old man is brought to the emergency department by his family for evaluation of fever, headache, and mental status changes. His symptoms have been progressive over the past 3 days. One week before his problem started, he has been complaining of sore throat and low grade fever for which he received only acetaminophen. On examination, he is febrile at 39.4 degrees C, and he is difficult to rouse. When roused, his speech is normal. He has marked neck stiffness. The rest of his neurological examination is unremarkable. His CT with and without contrast is limited by motion artifact, although no obvious mass lesions are identified. CSF analysis shows increased opening pressure at 35cm H2O, 4 red blood cells, 1200 white blood cells (87% neutrophils, 13% lymphocytes), protein of 120mg/dl, and glucose of 18mg/dl with serum glucose of 92mg/dl.

3-Ataxia
41 Right-handed man was referred for evaluation of Ataxia. His problem started 4 years ago as gradual onset, progressive unsteadiness. It was associated with new onset slurring of speech. His past medical history is significant for hypothyroidism for which he was on thyroid replacement therapy (L-Thyroxine).
Social history: He emigrated from Italy to Canada at age of 1 year. He previously owned a small business, but currently he is unemployed. He is married and has one son aged 5 years. He has no history of alcohol use, nor did he smoke or used illicit drugs.
His neurological exam is as follows: He has marked scanning dysarthria, has slow vertical and horizontal saccades but with no nystagmus. He has slow tongue movements. His muscle bulk, tone and power were all normal. He has generalized hyper-reflexia, and his plantar responses were both flexors (i.e. normal). He has marked dysmetria on finger to nose (FNF), heel to shin, and has slow and irregular movements on rapid alternating movements. He has broad-based stance and has staggering gait. His sensory exam was normal including vibration proprioception sensations.
His lab work up showed normal Vitamin B12, and Vitamin E levels, normal serum copper. All other lab results were also normal. Brain MRI showed pontocerebellar atrophy. His family history is as follows: His great grandfather died of similar condition at age 80 years, his father and one of his uncles also died of similar condition. His affected uncle had an affected daughter who died at age 25 years. He has one unaffected uncle and one unaffected aunt.

Questions:
1. What part of the nervous system is responsible for his ataxia?
2. Discuss the basic functions of the cerebellum
3. What is the mode of inheritance for this patient’s ataxia?
4. Discuss the basic genetic abnormalities of Autosomal dominant ad Autosomal dominant ataxias.
5. What is meant by the phenomenon of “Anticipation” in genetics?
Case for small group discussion: Cerebrovascular accident (Stroke):
A 65 years old male with history of chronic arterial systolic hypertension, non-insulin dependent diabetes, and heavy smoking for the last 40 years, presented with acute onset right-sided weakness. He went to bed at 11 pm and woke up in the morning at 7 am with weakness involving the right side of the face, arm, and to a lesser degree the leg. His family also noted his speech was slurred and he had difficulty producing words. He did not have any change in the level of consciousness and no visual problems. He was taken to the emergency room and reached there at 8 am.

Past medical history is significant for one attack of transient painless loss of vision in the right eye 6 months ago, and an attack of right-sided weakness, which gradually improved one year ago.

Physical exam revealed normal pulses, normal heart sounds, and a carotid bruit on the right. Neurologically, he had dysarthria and dysphasia (aphasia). There was right lower facial weakness, weakness in the right arm and leg, and right homonymous hemianopia. Tone was increased on the right. Reflexes were brisk on the right with positive Babinski sign.

Questions:

1- Localize where would the lesion most likely be and why?
2- What is the most likely pathology of the lesion?
3- Identify the most likely etiology for that pathology.
4- Identify the risk factors this patient has.
5- How would you expect the physical findings to be had this patient had a lower motor neuron disease instead?
6- Discuss the available treatment options for this patient, medical and surgical if relevant.