ZOS554- NEUROBIOLOGY AND BEHAVIOUR

Teaching hours **10hrs/Unit**

COURSE OUTCOME:

1. This course is focused on understanding the structural complexity and functioning of the nervous system across the animal kingdom.
2. Complexity of nervous systems among different animal groups and its evolutionary significance with respect to its structural and functional organizations are discussed.
3. Students are taught different mechanisms of communication between animals of same/different species.
4. Levels of learning by animals and how this information is stored in the form of memory are highlighted.
5. Animal behavioural studies are also dealt to understand how the nervous system helps animals to face different psychological conditions caused due to stress, anxiety, depression, etc.
6. In addition different classical and modern tools for labelling neurons and understanding its functional role are discussed. This knowledge will help students to take up neurobiology as long term research carrier.

UNIT- I

Organization of nervous systems: Structural organization of vertebrate brain (Human, Mouse and Zebra fish) and invertebrate brain (Aplysia and *Drosophila*). Structure and functions of neuron and glia cells. Resting membrane potential: Potassium and Sodium ions across the neural membrane. Role of Sodium and Potassium Channels in maintaining resting membrane potential. Action potential: Axon hillock and generation of action potential. Neural transmission: chemical and electrical synapses, excitatory and inhibitory neurotransmitters

UNIT- II

Neuromuscular junction: Synaptic connection between neurons and muscles. Molecular basis of synaptic transmission across the neuromuscular junction. Muscle contraction: Types and functions of muscle fibres. Molecular mechanism of muscle contraction. Neuro- Muscular disorders: Etiology of Amyotrophic lateral sclerosis (ALS), Multiple sclerosis and Muscular dystrophy

UNIT- III

Associative learning: Types of associative learning (Classical and Operant conditioning). Neuronal regulations of classical and operant conditioning. Non-Associative learning: Types of non-associative learning (Habituation and Sensitization). Molecular mechanisms of habituation and sensitization. Memory in Animals: Types of memory (sensory, short-term and long-term memory). Memory storage sites in vertebrates (hippocampus) and insects (mushroom bodies). Molecular mechanisms of short-term and long-term memory.

UNIT- IV

Pheromones: types, chemistry and significance of pheromones in animal communications. Neural circuits regulating pheromone communications in insects and mammals. Dance language in honeybee: types and significance of dance language in honeybee. Auditory communication in insects: Types and significance of sound production in insects. Different types of sound producing organs in insects. Reproductive strategies and mating system in animals: polygamy, monogamy and polygyny.

UNIT- V

Classical Neuroanatomical tools: Golgi-silver staining and cobalt filling of neurons in vertebrate and insect nervous system. Camillo Golgi and Ramon Cajal. Transgenic tools: Gal4-UAS system for labelling neurons in insects and zebra fish. BRAIBOW in mouse brain. Electrophysiological tools: Patch-clamp techniques (voltage and current clamp). Immuno-histochemical methods: Antibody staining for localization of different neurotransmitters (GABA, Acetyl Choline, Glutamate Dopamine and Serotonin) and its receptors.

References

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2. Kandel E, Schwartz J H and Jessell T (2012). Principles of Neural Science. 5th Edition. Elsevier Publisher
3. Manning A. and Dawkins M. S. (2012). An introduction to Animal Behaviour, Cambridge University Press
4. Meriney S D and Fanselow E (2019). Synaptic transmission. First Edition. Academic Press
5. Munz T (2016). The dancing bees. University of Chicago Press
6. Patel B A, Yadav R S and Khadilkar S V (2017). Neuromuscular Disorders: A Comprehensive Review with Illustrative Cases. Springer Press
7. Sajikumar S (2015). Synaptic tagging and capture. First Edition. Springer Press
8. Sheng M, Sabatini B and Südhof T C (2012). The Synapse: A Subject Collection from Cold Spring Harbor Perspectives in Biology. Cold Spring Harbor Press
9. Simmons P. and David Y. (2010) Nerve Cell and Animal Behaviour, 3rd Edition. Cambridge University Press
10. Wyatt T D (2014). Pheromones and Animal Behavior: Chemical Signals and Signatures. 2nd Edition. Cambridge University Press