

LS-648 CELLULAR AND MOLECULAR NEUROBIOLOGY [2 CREDITS]

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±32 lectures

S No	Course Content	Contact Hrs
1	Neurons & glia: Components and classification of neurons and glia. Different types of neurons, glia, astrocytes, oligodendrocytes, and Schwann cells, types of astrocytes--type-I, II astrocytes, functions of other glial cells: Oligodendrocytes and microglial cells. Cell specific molecular markers for neurons & glial cells.	3
2	Molecular structure of synapse and neuromuscular junction: Overview of central nervous system (CNS) synapse and NMJ, Kinds of CNS synapses, Molecular components of synaptic junction, Pre-synaptic and post-synaptic specialization, Molecular structure of neuromuscular junctions: Composition and properties of AChR, Development of NMJ, Signaling mechanism of AChR clustering. Diseases related with problem in synaptic transmission in NMJ.	5
3	The Cellular and molecular basis of neural development: Neural induction, Polarity and segmentation, generation of neurons and glia, Migration of neurons in the CNS. Determination of neural and glial cell identity, Axon outgrowth, Axon guidance, Target selection, Naturally-occurring neuron death, Synapse formation and function. Refinement of synaptic connections. Growth factors and survival of neurons: Transcription factors gradients-- regional differentiation, Cell death & neurotrophic hypothesis, Neurotrophins family and its receptors, Cytokines and growth factors in nervous system, competitive interactions during development. Functions in neuronal PCD.	6
4	Molecular biology of Channels and Sensory transduction: Basic properties of ion channels, Resting and gated ion channels, Ligand and voltage gated ion channels, Gap junction, different states of ion channels: closed, open, and refractory. Models of open and closed channels, Growth factor (BDNF) signaling, Second messenger mediated signaling (cAMP, cGMP, IP3, DAG, receptor tyrosine kinases), Activation of metabotropic and ionotropic receptors, Activation mechanism of common protein kinases (PKA, PKC, CAMKII, cGMP-dependent kinase). Alteration of signal transduction through genetic manipulation: optogenetics, Conditional knockout etc.	6

6	Neuroimmunological and neurodevelopmental disorders: Braininflammation: the role of astrocytes and microglia, Multiple sclerosis,NeuroAIDS. Cerebral palsy, autism.	3
7	Disorders of central nervous system: Models for understanding braindisorders. Molecular neurobiology of anxiety, depression, Alzheimer'sdisease and its possible interplay in between. Parkinson's disease,Multiplesclerosisand current therapeuticapproaches.	4
7	<ul style="list-style-type: none"> • Principleof Immunohistochemicallocalizationandanalysisinthenervousystem • Genetransferintoneuralcellsusingadenoviralvectors. • Anoverviewofprimaryneuronal cellculture • Purposeofwholecellvoltageclamprecording anditsoverview • Testsforanxietyand depression likebehaviorin animals 	5

Suggestedreadings:

1. Principles of Neural Science by Eric R. Kandel, James Harris Schwartz,ThomasM. Jessell
2. Fundamental Neuroscience by Larry R. Squire, Floyd E. Bloom, Susan K.McConnell
3. FromNeurontoBrainbyJohnG.Nicholls,A.RobertMartin,BruceG.Wallace,Paul A. Fuchs.
4. Development of the Nervous system by Dan H. Sans, Thomas A. Reh,WilliamA. Harris