



FORMAT FOR COURSE CURRICULUM

Course Title: Cellular and Molecular Neurobiology

Credit Units: 3

Course Level: PG

Course Code: to be decided later

Course Objectives: This course will provide an understanding on molecular mechanisms of neurological events with an emphasis on the cellular and molecular basis of signal transmission in the brain. This course will also deal with the immunology of the brain.

Pre-requisites: This course is open to students with a general understanding of biology.

Course Contents/Syllabus:

L	T	P/S	SW/F W	TOTAL CREDIT UNITS
3	0	0	0	3

	Weightage (%)
Module I–Neurogenomics	30%
<ul style="list-style-type: none">• Central dogma, genomics, transcriptomics and proteomics• Methods of gene transfer• Ion channels and transporters• Ligand-gated neurotransmitter receptors	

<ul style="list-style-type: none"> • Regulation of receptor gene expression • Molecules involved in synaptic transmission • Molecular markers for identification of specific neuron types • Neural stem cells • Apoptosis and autophagy in brain development 	
Module II– Neural Cell Signalling	35%
<ul style="list-style-type: none"> • Molecular signaling in neurons • G protein-coupled neurotransmitter receptors • Secondary messengers and Ca²⁺ mediated signaling • Protein kinases and Protein phosphorylation in neuronal signaling • cAMP response element binding (CREB) protein signaling • Akt/PI3K/mTOR axis • BMP signaling • Hedgehog/Notch/Wnt signaling in the brain development • Axis formation and involvement of Hox genes, Prosomeres and Pax genes • Nitric oxide signaling • Purinergic/ cholinergic signaling • Signaling impairments and brain function, dysfunction and dementia 	
Module III –Neuro-immunology and Neuro-inflammation	35%
<ul style="list-style-type: none"> • Mechanisms of neuroinflammation and Inflammosome • Microbial and parasitic infections of the brain • Gut brain axis, • Immune system and neuroimmunology • Neural- Immune interactions • Role of glial cells in brain immunity • Cytokines 	

<ul style="list-style-type: none">•Neural communication and neuroendocrine hormones•Clinical immune signaling in autoimmune diseases (Multiple Sclerosis and Guillain-Barre Syndrome)•Demyelination and neurodegeneration•Neuro-AIDS•Immunochemical techniques and antigen-antibody interactions	
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Student Learning Outcomes:

- At the end of the course, the students will be able to analyze the detailed molecular mechanisms and signaling cascades occurring in the brain.
- Students will be able to differentiate amongst the various immunological disorders related with brain
- Different cellular and molecular events in neurons will be examined in detail

Pedagogy for Course Delivery:

The class will be taught theories of advanced molecular neurobiology that emphasize fundamentals of functioning of nervous system at cellular and molecular levels including abnormalities of growth and proliferation giving rise to tumor in the brain. The interactive lectures delivered by the course instructor will help the students to be critical thinkers in area of neuroscience.

Lecture Plan/Session Plan:

Lectures: 44

Class Test: 1

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100	NA	70

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	Mid-Tem Exam	Project	Viva	Attendance	
Weightage (%)	10%	10%	5%	5 %	70 %

Text Reading:

- **Banjamini, Immunology (5th edition), Wiley Liss, 2003**
- **M. Roitt, Immunology (7th Edition), Mosby Publication, 2006**
- **Verkhratsky, Glial Neurobiology, A Text Book, Wiley, 2007**
- **Alberts B. et al (2002) Molecular Biology of the Cell (4th Ed.) Garland Publications.]**
- **Purves D. et al (2007) Neuroscience (4th Ed.) Sinauer.**
- **Bear, Connors, Paradiso (2007) Neuroscience: Exploring the Brain. Lippincott, Williams & Wilkins.**
- **Nicholls et al (2001) From Neuron to Brain. Sinauer.**