

MANGALORE UNIVERSITY
DEPARTMENT OF BIOSCIENCES
MSc BIOTECHNOLOGY

BTS 456 SIGNAL TRANSDUCTION (SOFT CORE COURSE)

Hours 40

Course outcome

Students will be able to:

- Understand the basics and advances of cell signalling
- Learn about signalling molecules in plants and animals.
- Learn about receptor family, signal transduction and second messenger pathways
- Get a glimpse of cell signalling during development and in unique cells based on external stimuli.

Unit I(13 hrs)

Cell signaling: Various types of cell signaling-endocrine, paracrine, juxtacrine and autocrine. Hormones and growth factors, neurotransmitters, peptide hormones, steroid hormones, eicosanoids, vitamins, gases etc as cell signaling molecules. Synaptic transmission in neurons – post synaptic receptors, depolarization, hyperpolarization, repolarization. Cellular responses to environmental signals in plants and animals. Plant hormones, signaling and signal transduction in plants. Thyroid hormone and steroid hormone signaling pathways – nuclear steroid receptor superfamily – mode of action.

Unit II (13 hrs)

Receptors - types of cell surface receptors. Basic tenets and mechanisms of signal transduction, GPCR, G proteins, Protein tyrosine kinase receptors, Cytokine receptors, Protein Serine, Threonine kinases, protein tyrosine phosphatases, guanylyl cyclases, Nucleotide exchange factors, Phosphorylation and dephosphorylation. Second messengers - cAMP, cGMP, Calcium and phospholipids – DAG, IP₃, PIP₂. Downstream signaling molecules mTOR, Akt, Ras, Raf. Plant hormone action. Differences between yeast and mammalian pathways.

Unit III (14hrs)

Cell signaling cascades: during development – Wnt, Notch, Hedgehog; during phases of the cell cycle, cell proliferation and apoptosis – mitogen activated protein (MAP) kinase pathway, TNF, TGF beta, Fas ligand-induced cascades; in response to extracellular signaling (ERK). Cell signaling in neurons – long term potentiation, long term depression. Cell signaling in the immune system and in cancer. Cross-talk between signaling pathways. JAK-STAT pathway, NF-kappa B signaling.

References

1. Molecular Biology of the Cell. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J.D., Garland Publishing Inc., 2002
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3. Cell and Molecular Biology. De Robertis, E.D.P. & De Robertis, E. M.F. B.I. Waverly Pvt. Ltd., 1971
4. Gilbert, S.F. Developmental Biology. Sunderland (MA): Sinauer Associates, Inc., 2000
5. Molecular cell Biology. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira P. & Baltimore, D. WH Freeman & Co., 2000
6. Cell and Molecular Biology. Concepts and experiments. Karp, G., John Harris, D., Wiley & sons, 1999
7. Principles of Cell and Molecular Biology. Kleinsmith, L. J. & Kish, V.M., Harper Collins Publishers, 1995