

**DISCIPLINE SPECIFIC ELECTIVE COURSE –DSE-8**

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
<b>Membrane Biology (BS-DSE-8)</b>	<b>4</b>	<b>2</b>		<b>2</b>	Class XII pass with Biology and chemistry	<b>Basic cell biology</b>

**Learning Objectives:**

The objective of the course is to provide students with

- The basic understanding of membrane composition, structure-function relationship, and properties of membranes.
- To provide an understanding of the various types of membrane transporters and their molecular mechanisms.
- Provides an understanding of molecular mechanisms involved in vesicular transport processes and membrane fusion.

**Learning Outcomes:**

On successful completion of the course, a student will:

- Understand the general composition and structure of biomembranes.
- Gain knowledge of the basic properties of membranes such as membrane fluidity.
- Have knowledge about the various types of membrane transport mechanisms.
- Have knowledge about the molecular mechanism of vesicular transport and membrane fusion.

## SYLLABUS FOR DSE-8

### Course Contents -Theory

#### UNIT 1: Membrane composition and structure

No. of hours: 8

Composition of membranes: Lipids (Phospholipids, Glycolipids, sterols), Proteins (Peripheral Proteins, Integral Membrane Proteins and Lipid-Anchored proteins) and carbohydrates. Historical background and various membrane models. Comparison of various cellular and subcellular membranes. Lateral and transverse asymmetry in membranes. Role of Flippase, Floppase and Scramblase. Model systems to study membranes- Lipid monolayers, Planar bilayer, Liposome and their applications. Polymorphic Lipid-Water Systems. Determinants of polymorphic phases: Critical Micellar Concentration (CMC), lipid shape, critical packing parameter.

#### UNIT 2: Membrane dynamics

No. of hours: 6

Membrane fluidity: lateral, transverse and rotational motion of lipids and proteins. Factors affecting membrane fluidity- composition, barriers (tight junctions), cytoskeleton interactions, Microdomains- rafts, caveolae. Study of RBC membrane architecture. Homeoviscous adaptation. Techniques to study membrane dynamics: FRAP, TNBS, SPT.

#### UNIT 3: Membrane transport

No. of hours: 10

Thermodynamics of transport. Simple diffusion and facilitated diffusion. Passive transport glucose transporter and anion transporter. Primary active transporters- P-type ATPases, V-type ATPases, F-type ATPases. Secondary active transporters- Lactose permease, Na<sup>+</sup>-glucose symporter. ABC family of transporters- MDR and CFTR. Group translocation (PEP-PTS) and bacteriorhodopsin. Ion channels: voltage-gated ion channels (Na<sup>+</sup> and K<sup>+</sup> channel) and ligand-gated ion channels (Acetylcholine receptor) and aquaporins. Ionophores: valinomycin, gramicidin. Relationship between membrane transport and diseases.

#### UNIT 4: Vesicular transport and membrane fusion

No. of hours: 6

Vesicular transport. Vesicles, Clathrin-coated Vesicles and COP-Coated Vesicles (COPI and COPII).

Molecular mechanism of vesicular transport. Membrane fusion (dynamin protein, Rab proteins, NSF/ SNAP complex, SNARE proteins). Receptor Mediated Endocytosis: LDL and Transferrin.

### PRACTICALS

CREDIT: 2

TOTAL HOURS: 60

1. Effect of lipid composition on the permeability of a lipid monolayer.
2. Isolation of membrane phospholipids and separation by TLC.
3. Effect of temperature, pH, detergents and ionic strength on Tonoplast membrane of beetroot.
4. Determination of CMC of Neutral and Ionic detergents.

5. Preparation of RBC ghost cell.
6. Separation of RBC membrane proteins by SDS-PAGE.
7. Demonstration of Histidine uptake from the intestinal membrane.

**Essential readings:**

1. Garret, R.H., Grisham, C.M. (2016). Biochemistry (6th ed.). Boston, Cengage Learning. ISBN-10: 1305577205, ISBN-13: 978-1305577205
2. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Martin, K.C., Yaffe, M., Amon, A. (2021). Molecular Cell Biology (9th ed.). New York, WH: Freeman & Company. ISBN-13:978-1319208523, ISBN-10:1319208525.
3. Nelson, D.L., Cox, M.M. (2021). Lehninger: Principles of Biochemistry (8th ed.). New York, WH: Freeman and Company. ISBN: 13: 978-1319381493 / ISBN-10:1319381499.
4. Voet, D., Voet. J. G. (2013). Biochemistry (4th ed.). New Jersey, John Wiley & Sons Asia Pvt. Ltd. ISBN: 978-1-11809244-6.
5. Wardhan, R., Mudgal, P. (2017). Textbook on Membrane Biology (1st ed.). Singapore, Springer. ISBN-10: 9811071004, ISBN-13: 978-9811071003

**DISCIPLINE SPECIFIC ELECTIVE COURSE –DSE-9 :**

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Ethology (BS-DSE-9)	4	2		2	Class XII pass with Biology and chemistry,	NA

**Learning Objectives:**

Ethology or Animal Behavior is the scientific study of the wild and wonderful ways in which animals interact with each other, with other living beings, and with the environment in which they live in. One important aspect pertaining to the studies on Animal Behavior is that it can be conducted anywhere and at any time, depending on the interest of the researcher. Moreover, it is not confined to the four walls of the classroom or the laboratory. The behavioral biology has high applied value and currently linked to conservation biology, molecular biology, behavioral ecology and integrated pest management. This course will help the learners to understand and appreciate different types of animal behaviors, their adaptive, evolutionary and practical significance.