Subject Code : P8BC4

CORE COURSE IV – CELL BIOLOGY AND PHYSIOLOGY

Unit I Tissues

Types of tissue. Epithelium – organization and types. The basement membrane. Bone and cartilage. Major classes of cell junctions – anchoring, tight and gap junctions. Major families of cell adhesion molecules (CAMs) – the cadherins (classical and desmosomal). The integrins. The extracellular matrix of epithelial and nonepithelial tissues. ECM components – collagen, elastin, fibrilling, fibronectin, laminin and proteoglycans.

Unit II Biomembranes, cell cycle, cell death

Membrane assembly – importins and exportins. Membrane transport. Diffusion (passive and facilitated) active transport (symport, antiport, Na+ K+ ATPhase), ion gradients, ion selective channels, group translocations, porins, endocytosis and exocytosis. The cell cycle : phases, regulation by cyclins and cyclin – dependent kinases. Checkpoints in cell cycle regulation. Programmed cell death – Brief outline of apoptosis. Differences between apoptosis and necrosis.

Unit III Blood

Composition and functions of blood. Separation of plasma and serum. Plasma proteins in health and disease. Red blood cells – formation and destruction. Important aspects of RBC metabolism. The RBC membrane – principle proteins (spectrin, ankyrin, glycophorins). Anaemias. Composition and functions of WECs. Blood coagulation – mechanism and regulation. Fibrinolysis. Anticoagulants.

Unit IV Body Fluids

Lymph – composition and functions. CSF – composition and clinical significance. Formation of urine – structure of nephron, glomerular filtration, tubular reabsorption of glucose, water and electrolytes. Countercurrent multiplication, tubular secretion. Composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids.

Unit V Neuromuscular System

Structure of neuron. Propagation of action potential: structure of voltage – gated ion channels. Neurotransmitters-examples, release and cycling of neurotransmitters. The neuromuscular junction – activation of gated ion channels. The acetylcholine receptor. Structure of skeletal muscle. Muscle proteins – myosin, actin, troponing and tropomyosin and other proteins. Sequence of events in contraction and relaxation of skeletal muscle. Pathophysiology of Duchenne muscular dystrophy. Cardiac muscle – $Ca2^{+}$ -Na^{+} exchanger, Ca2+ -ATPase. Brief outline of channelopathies. Cardiac

myophathy. Smooth muscle – regulation by Ca2+ and nitric oxide. Source of energy for muscle contraction.

Books Recommended :

1. Lodish et.al. Molecular Cell Biology 5th ed. 2003, WH Freeman (for unit 1,2,5).
2. Murray et al. Harper's Biochemistry 26th ed. Mcgraw Hill 2003 (unit 2 Biomembranes, unit 3, unit 4, unit 5 muscle).
3. Smith et al. Principles of Biochemistry. Mammalian Biochemistry. McGraw Hill 7th ed. (for unit 3, unit 4).

References:

1. De Robertis and De Robertis. Cell and Molecular Biology. Lea and Febiger 8th ed.
2. Alberts et al. Molecular Biology of the Cell 4th ed. Garland Sci. 2002.