

16. ANIMAL BIOTECHNOLOGY

Unit 1: Cell Biology

Prokaryotic and eukaryotic cell architecture. Molecular organization and functions of cell membrane. Organisation and functions of the cytoplasm, cell organelles, endoplasmic reticulum, ribosomes, Golgi complex, mitochondria, lysosomes, nucleolus and subnuclear structures. Protein secretion and targeting. Intracellular digestion. Oxidative phosphorylation. Cell division. Cell growth and differentiation. Control of proliferation and self regulation. Cell motility. Cell trafficking and signaling. Apoptosis.

Unit 2: Molecular Biology

DNA replication in prokaryotic and eukaryotic cells. Structure and functions of DNA polymerases. Molecular mechanisms of DNA repair. Synthesis and processing of different types of RNA. RNA polymerases. Protein biosynthesis. Genetics of mitochondria and plasmids. Transposons and intervening sequences. Minisatellites and macrosatellites. Molecular mechanism of spontaneous and induced mutations. Site directed mutagenesis. Recombination in bacteria, fungi and viruses. Molecular mechanism of genetic recombination, transduction, transformation and conjugation.

Unit 3: Gene Structure and Expression

Organisation of prokaryotic and eukaryotic genome. Repeated and non-repeated DNA sequences. The structure and chemical nature of the gene. Expression of genetic information, transcription – mechanism of transcription in prokaryotes and eukaryotes, transcription unit, regulatory sequences and enhancers, transcription factors, post-transcriptional modifications. DNA-protein interactions. Genetic code. Mechanism of translation and its control, post-translational modifications. Control of gene expression in prokaryotes and eukaryotes.

Unit 4: Genetic Engineering and Recombinant DNA Technology

Isolation and purification of DNA / RNA from prokaryotes / eukaryotes. Reverse transcription. Restriction endonucleases. Generation of DNA fragments, Cloning and expression vectors, plasmids, cosmids, phages, viruses (vaccinia, herpes, retrovirus and adenovirus), shuttle vectors. Cloning and expression in prokaryotic and eukaryotic hosts. DNA libraries, screening and characterization of DNA clones, transformation of bacterial and animal cells. Oligonucleotide synthesis. *In situ* mutagenesis. DNA amplification. Production of diagnostics and vaccines using r-

DNA technology. Genetically modified foods / products. Genetic manipulation of rumen microbes. Safety aspects of genetic engineering. Ethical issues related to use of biotechnology products. Patenting and Intellectual Property Rights.

Unit 5: Animal Tissue culture and Hybridoma Technology

Development of cell (tissue) and organ culture techniques. Nutrient requirements of mammalian cells. Media for culturing cells. Growth supplements. Primary cultures. Established cell lines. Stationary, Roller and Suspension culture techniques. Large scale production of cells using bioreactors, microcarriers and perfusion techniques. Characterisation and maintenance of cells, karyotyping, cryopreservation and revival. Detection of contaminants in cell cultures. Isolation and culture of lymphocytes. Application of cell and organ cultures. Micromanipulation of cells. Cell cloning. Cell fusion and Somatic cell hybrids. Principles and methods of hybridoma technology. Production and characterization of monoclonal antibodies and their application in animal health and production.

Unit 6: Embryo Transfer and Related Techniques

Induction of superovulation. Embryo collection and evaluation. Embryo splitting. Embryo sexing. Embryo transfer. Advantages of embryo transfer in farm animals. *In vitro* fertilization. Embryo cloning. Nuclear transplantation. Production of transgenic animals and gene farming. Identification and transfer of gene influencing production and disease resistance.

Unit 7: Molecular Biology Techniques

Quantitation of nucleic acids. Gel electrophoretic techniques. Isolation of plasmids. Production of radioisotopic and non-radioisotopic probes. Nucleic acid hybridization. *In situ* hybridization radioisotopic methods of biochemical analysis. Autoradiography. Blotting techniques. Nucleic acid sequencing methods. Methods of peptide synthesis. Protein purification methods. Restriction Fragment Length Polymorphism (RFLP). DNA fingerprinting. Polymerase Chain Reaction (PCR). Computer applications in molecular biology. Animal cloning and transgenic technology.