

U.G. 3rd SEMESTER SYLLABUS (BSc-Biotechnology)
DEPARTMENT OF MOLECULAR BIOLOGY AND BIOTECHNOLOGY
COTTON UNIVERSITY

PAPER : BTN401C

GENOMICS AND PROTEOMICS

(Credits: 3+1+1=5)

Theory

Unit 1: Genome and its organization-prokaryotic and eukaryotic, genome size variation, C-value, repetitive DNA; introduction to cloning and cloning vectors; introduction to genomics- structural, functional and comparative genomics. **8 hours**

Unit 2: DNA sequencing methods– manual & automated. sequencing technologies; Introduction to Genome Sequencing: Shotgun methods, **7 hours**

Unit 3: Introduction to genome mapping-physical and genetic map; web based servers and software for genome analysis: ENSEMBL and NCBI genome. **7 hours**

Unit 4: Introduction to protein structure, chemical properties of proteins, physical interactions in determination of properties of protein: short-range interactions, electrostatic forces, Van der Waal interactions, hydrogen bonds, hydrophobic interactions, determination of sizes, native PAGE **12 hours**

Unit 5: Introduction to proteomics, analysis of proteome. 2D-PAGE- Sample preparation, solubilization, reduction, resolution, reproducibility, mass spectrometry based methods for protein identification. **12 hours**

Practical

1. Restriction digestion of amplified DNA by PCR-RFLP
2. Use of SNP databases at NCBI
3. Software for Protein localization.

Suggested Readings

1. Fundamentals of Biochemistry- Voet D, Voet JG and Pratt CW. Wiley, 2006
2. Genomes- Brown TA. Garland Science, 2006
3. Principles of Gene Manipulation and Genomics- Primrose S & Twyman R. Blackwell, 2006
4. Introduction to proteomics- tools for the new biology- Liebler, Daniel C. Humana Press, Totowa, NJ, 2002
5. Gene Cloning and DNA Analysis: An Introduction- Brown. T. A, 2016
6. Analysis of Genes and Genomes- Richard Reece, Wiley-Blackwell, 2009

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PLANT BIOTECHNOLOGY
(Credits: 3+1+1=5)

Theory

Unit 1: Plant tissue culture-Introduction to plant tissue culture, plasticity and totipotency; Preparation of different plant tissue culture media, media selection, plant growth regulators; culture types- callus culture, cell suspension culture, protoplast culture and somatic hybridization, ovary and embryo culture, root and shoot tip culture, anther and pollen culture; somatic embryogenesis and organogenesis. **10 hours**

Unit 2: Application of plant tissue culture - micropropagation, secondary metabolite production, production of virus free plants, somatic embryo production and synthetic seeds, production of haploid, monoploid and triploid, germplasm conservation. **6 hours**

Unit 3: Plant genome organization- nuclear, chloroplast and mitochondrial genome; genome size; structural organization and expression of a typical plant gene: cis and trans regulatory elements, intron and exons, UTRs. **6hours**

Unit 4: Plant transformation- *Agrobacterium* mediated plant transformation; plant transformation vectors, marker and reporter genes **4hours**

Unit 5: Transgenic plants- trait improvement, crop improvement in terms of yield and quality; virus resistant, fungus resistant, insect resistant, Golden rice; edible vaccines; commercial use of transgenic plants **8hours**

Unit 6: Biotechnology for plant genetic resource conservation- plant genetic resources- concern over loss of PGRs, collection of PGRs, conservation of PGRs *-in situ, ex situ*, national and international PGR Centres/Institutes, characterization of PGRs for biodiversity conservation; molecular markers- RFLP, RAPD, AFLP, microsatellites (SSR), SNP, SSCP, SCAR; sustainable use of PGR-embryo rescue, cryopreservation. **10hours**

Unit 7: Bioethics and biosafety- ethical and biosafety issues with GM crops, sustainable equivalence, development of resistance; toxicity to wildlife **4hours**

Practical

1. Preparation of different tissue culture media-MS, Nitsch
2. Organ culture - meristem culture, anther culture, embryo culture.
3. Isolation and fusion of protoplast from leaves.
4. Preparation of synthetic seeds.
5. Preparation competent cell and transformation of *E. coli*

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Suggested Readings:

1. Plant Biotechnology: The genetic manipulation of plants- Slater, A., N. S. and Fowler M, oxford University Press, Oxford, 2008.
2. Plant Molecular Biology- Grierson, C. and Covey S. N., Springer Netherlands, 1991.
3. Plant Biotechnology- Hammond, J. H., P. Mcgarvey and V. Yusibov, Springer Verlag, Heidelberg, 2000.
4. Biochemistry and Molecular Biology of Plants. American Society of Plant Biologist- Buchanan, B. B., W. Gruissen and Jones R. L. Rockville, USA, 2000.
5. Plant Tissue Culture- MK Razdan ,Oxford /IBH Pub. Co. Pvt. Ltd.,2000.

PAPER : BTN402C

ANIMAL BIOTECHNOLOGY

(Credits: 3+1+1=5)

Theory

Unit 1: Introduction to animal cell culture –definition, history, design and layout of animal cell culture laboratory; scope of animal tissue culture; basic techniques of cell culture- primary culture, organ culture, embryo culture, monolayer culture, suspension culture, transformed animal cells and continuous cell line
10hours

Unit 2: Maintenance of cell culture- subculture, contamination, preservation; use of bioreactors, immobilized culture
5hours

Unit 3: Culture media -natural media- plasma clot, biological fluids, tissue extract, embryo extract; serum-serum containing and serum free media; semi synthetic and synthetic media, sterilization, common animal cell culture media- different constituents
4hours

Unit 4: Animal cell culture application- cell products-antibodies and immuno-regulators, recombinant products; gene therapy- targeted gene transfer, gene disruption, cell and tissue therapy, somatic cell fusion
8hours

Unit 5: Stem cells-properties, types, progenitor cells, cell lineages in animals, niche, culture of stem cells, embryonic stem cell transfer, applications
4hours

Unit 6: Reproductive technologies- Assisted reproductive technologies (ART); *in vitro* fertilization and intrauterine insemination
3 hours

Unit 7: Transgenic animals- objectives of gene transfer, transgenic animals -Sheep, Goat, Mice, Fish
5 hours

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Unit 8: Intellectual property rights; bio-piracy, ethical aspects of ART; therapeutic cloning- savior siblings, designer babies; animal welfare and animal rights, legislation for animal experiment, use of primates, biomedical research, xenotransplantation **9hours**

Practical

1. Visit to an animal cell culture laboratory
2. Demonstration of basic techniques used in animal cell culture.

Suggested Readings

1. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications- Freshney R. Ian, Wiley-Blackwell, 2010.
2. Biotechnology- Singh B.D. (1998) Kalyani Publishers
3. Principles and Practice of Animal Tissue Culture- Gangal S., University Press (India) Pvt. Ltd. Hyderabad.
4. Animal Biotechnology: Ranga M. (2006). Studam Publishers
5. Animal Biotechnology- Shenoy M. (2007). Laxmi Publication Pvt. Ltd., New Delhi
6. Bioethics- an introduction for biosciences- Mephram, B. (2008). Oxford University Press Inc., New York.

SEMESTER IV
PAPER: SEC II
SKIL ENHANCEMENT COURSE
CREDITS: 2

Skill Enhancement Course-II: Will be offered by University
