



Molecular Biology Research Training

NTHRYS provides Molecular Biology Research Training for interested candidates at its Hyderabad facility, Telangana. Please refer below for more details including Fee structures, Eligibility, Protocols and Modules etc.,. Please do call / message / whatsapp for more details on 9014935156 [India - +91]

Eligibility: BSc / BTech / MSc / MTech / MPhil / PhD in any Life Sciences studying or completed students

Protocols / Techniques Covered

1. Chromatin Immunoprecipitation (ChIP)

A technique used to investigate the interaction between proteins and DNA in the cell.

2. Reporter Assays (e.g., Luciferase)

Used to study gene expression by attaching a reporter gene to a regulatory sequence of interest and measuring its activity.

3. Real-Time PCR (qPCR)

A method for measuring the quantity of a target DNA sequence in real-time by amplification.

4. Western Blotting

Used to detect specific proteins in a sample based on their size and antibody binding.

5. Next-Generation Sequencing (NGS)

Enables rapid sequencing of large stretches of DNA base pairs spanning entire genomes.

6. **CRISPR-Cas9 Genome Editing**

A powerful tool for editing genomes with high precision by creating double-strand breaks at targeted locations.

7. **RNA Interference (RNAi)**

A method to silence gene expression in cells by using small RNA molecules to degrade mRNA of a specific gene.

8. **Fluorescence In Situ Hybridization (FISH)**

A cytogenetic technique that uses fluorescent probes to detect and localize the presence of specific DNA sequences on chromosomes.

9. **Mass Spectrometry for Proteomics**

Analyzes proteins by measuring the mass of peptides and their fragments to identify and quantify proteins in a sample.

10. **Single-Cell RNA Sequencing (scRNA-seq)**

Used to examine the gene expression profiles of individual cells for comprehensive analysis.

11. **Electrophoretic Mobility Shift Assay (EMSA)**

Detects DNA-binding proteins by observing the mobility shift of a DNA-protein complex during electrophoresis.

12. **Surface Plasmon Resonance (SPR)**

Measures binding interactions between molecules, such as protein-protein or protein-DNA interactions, in real-time without labeling.

13. **Two-Hybrid Screening**

A molecular biology method used to discover protein-protein interactions by testing for physical interactions between two proteins.

14. Site-Directed Mutagenesis

Introduces specific, predetermined mutations into a DNA sequence to study the effects of those mutations.

15. Bacterial Transformation

The process of introducing foreign DNA into bacteria, enabling the bacteria to express new genetic information.

16. Yeast Transformation

Similar to bacterial transformation but used to introduce DNA into yeast cells for genetic studies.

17. Gel Electrophoresis for DNA/RNA

A technique used to separate DNA or RNA fragments based on their size and charge by applying an electric field.

18. Microarray Analysis

A tool for analyzing gene expression or for genotyping multiple regions of a genome simultaneously.

19. Enzyme-Linked Immunosorbent Assay (ELISA)

A plate-based assay technique designed for detecting and quantifying soluble substances such as peptides, proteins, antibodies, and hormones.

20. Tissue Culture and Cell Line Maintenance

Techniques used to maintain and grow cell lines or tissues in culture media under controlled conditions.

21. Cell Fractionation

A process used to separate cellular components while preserving individual functions of each component.

22. Immunofluorescence

A technique that uses fluorescent-labeled antibodies to detect specific antigens in cells.

23. Transfection

The introduction of nucleic acids into cells to produce genetically modified cells.

24. Lentiviral Transduction

A method for delivering genetic material into cells using lentiviruses as vectors.

25. Immunoprecipitation

Used to isolate a specific protein from a solution by using an antibody that specifically binds to that protein.

26. Flow Cytometry

A technology that is used to analyze the physical and chemical characteristics of particles in a fluid as it passes through at least one laser.

27. Reverse Transcription PCR (RT-PCR)

Converts RNA to DNA with reverse transcriptase and then amplifies specific DNA targets using PCR.

28. Immunohistochemistry

A method for detecting antigens in cells of a tissue section by exploiting the principle of antibodies binding specifically to antigens in biological tissues.

29. DNA Microarrays

A tool to study how many genes are activated in different cell samples, which helps in understanding gene expression patterns.

30. Protein Purification

Various methods used to isolate a single type of protein from a complex mixture, which is

crucial for studying protein structure and function.

31. **Bisulfite Sequencing**

Used to determine the pattern of methylation of DNA by treating DNA with bisulfite and then sequencing it.

32. **Northern Blotting**

A technique that involves the transfer of RNA from a gel to a membrane and its subsequent detection by hybridization with a labeled probe.

33. **Southern Blotting**

Similar to Northern blotting but for DNA. It detects specific DNA sequences within a DNA sample.

34. **ChIP-Seq**

Combines chromatin immunoprecipitation with DNA sequencing to identify the binding sites of DNA-associated proteins.

35. **Library Preparation for Sequencing**

The process of preparing DNA or RNA for sequencing, which includes fragmenting the genetic material, adding adapters, and sometimes amplification.

36. **Electroporation**

A technique to introduce DNA, RNA, or proteins into cells using an electric pulse that temporarily opens the cell membranes.

37. **Gene Knockout**

A method where an organism is engineered to carry genes that have been made inoperative (have been "knocked out" of the genome).

38. **Gene Silencing**

The regulation of gene expression in a cell to prevent the expression of a certain gene.

39. Protein Expression and Purification

Expressing protein in a host system and then purifying it from other cellular components for further study.

40. In Vitro Transcription

The synthesis of RNA from a DNA template by RNA polymerase under laboratory conditions, outside living cells.

41. DNA Ligation

The process of joining two strands of DNA molecules by a covalent bond, typically catalyzed by DNA ligase.

42. X-ray Crystallography

A method to determine the atomic and molecular structure of a crystal by diffracting X-ray beams through the crystal.

43. Nucleic Acid Extraction

The process of purifying nucleic acids (DNA or RNA) from biological samples.

44. Ribosome Profiling

A technique that provides a snapshot of which mRNAs are being actively translated into proteins by capturing and sequencing fragments of mRNAs protected by ribosomes.

45. Microinjection

Injecting a substance into a microscopic structure, such as a single cell or a nucleus.

46. Liposome Transfection

A method to deliver genetic material into cells by encapsulating it in liposomes which fuse with the cell membrane.

Protein Crystallization

The process of forming a protein crystal, which can then be used for structural biology studies, particularly X-ray crystallography.

48. High-Performance Liquid Chromatography (HPLC)

A technique in analytical chemistry used to separate, identify, and quantify components in a mixture.

49. Enzyme Assays

Methods used to study the activity of enzymes, allowing the understanding of enzyme kinetics and function.

50. Glycan Analysis

Techniques used to analyze the structure and function of glycans (sugar chains or oligosaccharides) attached to proteins and lipids.

51. RACE (Rapid Amplification of cDNA Ends)

A technique used to obtain the full-length sequence of an RNA transcript.

52. Linkage Analysis

A genetic method that looks for patterns of inheritance of genetic markers in large families to discover the location of disease-causing genes.

53. Phage Display

A laboratory technique used to study protein-protein, protein-peptide, and protein-DNA interactions by using bacteriophages to connect proteins with the genetic information that encodes them.

54. Circular Dichroism (CD) Spectroscopy

A form of light absorption spectroscopy that measures the difference in absorbance of right-handed and left-handed circularly polarized light, which can be indicative of the conformation of biological molecules.

47.

55. Bioinformatics Analysis

Utilizing software tools to gather, analyze, and represent data from biological research, particularly useful in genomics and proteomics.

56. Molecular Cloning

A set of experimental methods used to assemble recombinant DNA molecules and to direct their replication within host organisms.

57. Dot Blot Analysis

A technique used to detect biomolecules, which is simpler and faster than Western blotting because it does not involve separation by electrophoresis.

58. Antibody Production and Purification

The process of generating antibodies specific to an antigen, followed by the purification of these antibodies for further experimental use.

59. Comet Assay (Single Cell Gel Electrophoresis)

A method for measuring DNA strand breaks in individual cells to assess DNA damage and repair.

60. Protein Footprinting

A method to study protein structure and interactions by observing how proteins affect the reactivity of nearby molecules.

61. Co-Immunoprecipitation (Co-IP)

A variant of immunoprecipitation used to isolate proteins and their interacting partners from a cell lysate.

62. Peptide Synthesis

The chemical synthesis of peptides, which are short chains of amino acid monomers linked by peptide bonds.

63. Capillary Electrophoresis

A technique that separates ions based on their electrophoretic mobility with the use of an applied voltage.

64. Metagenomics

The study of genetic material recovered directly from environmental samples, providing insights into the microbial communities and their natural processes.

65. Structural Genomics

The study of the three-dimensional structures of every protein encoded by a given genome.

66. SNP Genotyping

A method of measuring variations of single nucleotide polymorphisms between members of a species to understand genetic makeup.

67. Stable Isotope Labeling

A technique used in quantitative proteomics by incorporating non-radioactive isotopes into proteins or other biomolecules.

68. Knockdown Experiments

Techniques such as siRNA or shRNA that reduce the expression of specific genes in cells to study their function.

69. Atomic Force Microscopy (AFM)

A type of scanning probe microscopy with a resolution on the order of fractions of a nanometer, more than 1000 times better than the optical diffraction limit.

70. Cellular Reprogramming

The process of reverting mature, specialized cells into induced pluripotent stem cells.

Live Cell Imaging

The use of time-lapse microscopy to study living cells over time, which can provide insight into cellular function and behavior.

72. Protease Assays

Methods to measure protease activity in a sample to study various biological processes and disease states.

73. Protein-Nucleic Acid Pull-Down Assay

A method to study the binding interaction between proteins and nucleic acids by pulling down the complex from a mixture.

74. Thermal Shift Assay

A technique used to assess the stability of proteins and their complexes with ligands by monitoring protein denaturation through temperature increases.

75. Light Scattering

A method to measure the size distribution and structure of molecules and complexes in solution by detecting scattered light.

76. Isothermal Titration Calorimetry (ITC)

A technique to measure the heat released or absorbed during a biochemical binding event, providing insights into the thermodynamics of the interaction.

77. Biacore (Surface Plasmon Resonance Imaging)

An advanced version of SPR for detailed imaging and analysis of biomolecular interactions.

78. Blue Native PAGE

An electrophoretic technique used to analyze protein complexes in their native states.

71.

79. Reverse Phase Protein Array

A high-throughput antibody-based technique used for protein detection and quantitation in a complex biological sample.

80. SELEX (Systematic Evolution of Ligands by Exponential Enrichment)

A method to identify oligonucleotides that bind to a specific target molecule with high affinity.

81. Fluorescence Recovery After Photobleaching (FRAP)

Used to measure the movement of molecules within live cells by observing the recovery of fluorescence after a bleaching event.

82. Time-Resolved Fluorescence

A technique that measures the decay rate of fluorescence from a sample, providing insights into dynamic interactions at the molecular level.

83. Cell Invasion and Migration Assays

Methods to assess the ability of cells to move through an environment, important for studying cancer metastasis and other processes.

84. Homogeneous Time-Resolved Fluorescence (HTRF)

A versatile assay technique used for detecting biomolecular interactions in a homogeneous format.

85. Differential Scanning Calorimetry (DSC)

A technique that measures the heat flow associated with phase transitions in materials as a function of temperature, useful in studying protein folding/unfolding.

86. DNA Footprinting

A method to study DNA-protein interaction by detecting the protection of DNA from nucleolytic cleavage by bound proteins.

87. Optical Tweezers

A scientific instrument that uses a highly focused laser beam to manipulate microscopic particles including cells and molecules.

88. Proximity Ligation Assay

A technique to detect proteins, protein interactions, and modifications with very high sensitivity and specificity.

89. Bacterial Conjugation

A method for transferring genetic material between bacterial cells through direct cell-to-cell contact.

90. Transgenic Animal Models

Techniques to introduce new genes into animals to study gene function and disease processes.

91. FRET (Fluorescence Resonance Energy Transfer)

Used to measure the distance and interaction between two light-sensitive molecules.

92. Patch-Clamp Techniques

Methods to study the ion channels in cells by recording the current flow in very small patches of the cell membrane.

93. Microfluidics

Technologies that process or manipulate small amounts of fluids using channels with dimensions of tens of micrometers.

94. Nanostring nCounter Analysis

A digital molecular barcoding technology for profiling various types of molecules from RNA to DNA and proteins.

95. Laser Capture Microdissection

A technique to selectively isolate specific cells from a heterogeneous tissue section via direct microscopic visualization.

96. Cell Sorting

Techniques like FACS or magnetic sorting used to separate cells based on their properties for further analysis or culture.

97. Chemical Cross-Linking

Used to study the proximity between different protein regions or proteins in a complex by stabilizing their interactions with chemical links.

98. Cryo-Electron Microscopy

A form of electron microscopy where samples are studied at cryogenic temperatures, allowing the observation of structures in their native environment.

99. End-Point PCR

A basic form of PCR used to amplify DNA to detectable levels, followed by analysis via gel electrophoresis or other methods.

100. Digital PCR

A highly precise approach to quantitative PCR that partitions the sample into many individual reactions.

101. Microscale Thermophoresis

A technique to analyze biomolecules by observing their movement through temperature gradients.

102. Hybridoma Technology

A method to produce large numbers of identical antibodies (monoclonal antibodies).

103. RNA Pull-Down Assay

A method to identify RNA-binding proteins by capturing them with a bait RNA.

104. Gene Synthesis

The artificial synthesis of double-stranded DNA molecules without a template.

105. Yeast Two-Hybrid Assay

A method to detect protein-protein interactions by exploiting the properties of yeast genetics.

106. Far-Western Blotting

Similar to Western blotting but used to detect protein-protein interactions specifically.

107. EpiGenotyping by Sequencing

A technique to study changes in gene expression caused by epigenetic modifications, such as DNA methylation and histone modification.

108. Dynamic Light Scattering

Used for the characterization of small particles in solution by measuring the scattering of a laser beam.

109. Mass Spectrometry Imaging

A technique that visualizes the spatial distribution of compounds by their mass-to-charge ratios.

110. Pharmacokinetics

The study of how drugs are absorbed, distributed, metabolized, and excreted in living organisms.

111. Zebrafish Embryogenesis

Studying the developmental processes in zebrafish to understand vertebrate development

and genetic diseases.

112. Induced Pluripotent Stem Cells (iPSCs) Technology

Techniques to reprogram somatic cells to a pluripotent state that can give rise to any cell type.

113. Chromatin Conformation Capture (3C)

A method to analyze the spatial organization of chromatin in a cell.

114. Enzyme Kinetics

The study of the rates of enzyme-catalyzed reactions and how they are affected by various conditions and inhibitors.

115. Methylation-Specific PCR

A technique to detect DNA methylation patterns within specific DNA regions.

116. ChIP-chip (Chromatin Immunoprecipitation with DNA microarray)

Combines ChIP with microarray technology to identify the binding sites of DNA-associated proteins across the genome.

117. Antisense Therapy

Techniques involving antisense oligonucleotides to interfere with the expression of specific genes.

118. Automated DNA Sequencing

The use of robotic systems to perform rapid DNA sequencing.

119. Biochemical Assays for Cell Viability

Techniques to determine the number of viable cells in a sample based on certain biochemical criteria.

120. **Cellular Bioenergetics**

The study of the metabolic processes within cells that drive energy production.

121. **Proteomic Profiling**

The large-scale study of proteomes, including the set of expressed proteins in a cell, tissue, or organism, at certain times.

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