Molecular Techniques

Molecular techniques are laboratory methods used to study and manipulate nucleic acids (DNA, RNA) and proteins. They are essential in molecular biology, genetics, biotechnology, and clinical diagnostics.

Key Techniques

Polymerase Chain Reaction (PCR)

- **Purpose:** Amplifies specific DNA sequences.
- Variants: RT-PCR (for RNA), qPCR (quantitative), multiplex PCR.
- Applications: Pathogen detection, genotyping, cancer diagnostics.

Gel Electrophoresis

- Purpose: Separates DNA, RNA, or proteins based on size.
- Types:
 - \circ Agarose → for DNA/RNA.
 - \circ SDS-PAGE → for proteins.
- **Applications:** DNA fingerprinting, PCR product verification.

Nucleic Acid Extraction

- Purpose: Isolates pure DNA or RNA from biological samples.
- Applications: PCR, sequencing, transcriptomic studies.

Blotting Techniques

- Southern blot: Detects specific DNA sequences.
- Northern blot: Detects specific RNA transcripts.
- Western blot: Detects specific proteins using antibodies.
- Applications: Mutation analysis, gene expression, protein profiling.

DNA Sequencing

- Sanger sequencing: Accurate for short sequences.
- Next-Generation Sequencing (NGS): High-throughput genome/transcriptome analysis.
- **Applications:** Mutation discovery, personalized medicine, microbiome studies.

Microarrays

- **Purpose:** Analyze gene expression or detect genetic variations.
- **Applications:** Transcriptomics, biomarker discovery.

CRISPR-Cas9 / Gene Editing

- Purpose: Precisely modify specific genes.
- **Applications:** Functional genomics, gene therapy, disease modeling.

Flow Cytometry

- **Purpose:** Analyzes and sorts cells based on markers.
- **Applications:** Immunophenotyping, cell cycle analysis, apoptosis.

ELISA (Enzyme-Linked Immunosorbent Assay)

- **Purpose:** Quantifies proteins, antibodies, or hormones.
- **Applications:** Disease diagnosis, vaccine evaluation, immunology research.

RNA-Seq

- **Purpose:** Quantifies and sequences RNA to study gene expression.
- **Applications:** Transcriptome profiling, alternative splicing, non-coding RNA detection.

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Last update: 2025/05/31 09:00