DNA Hybridization Technique: Southern Blotting

Southern blotting is a laboratory technique used to detect **specific DNA sequences** in a mixture of DNA. It was developed by **Edwin Southern** in 1975 and is based on the **DNA hybridization** principle, where a labeled DNA probe binds to a complementary DNA sequence.

Steps of Southern Blotting

1. DNA Extraction and Digestion

- Extract DNA from cells.
- Cut the DNA into smaller fragments using **restriction enzymes**.

2. Gel Electrophoresis

- Load the fragmented DNA onto an **agarose gel** and run **gel electrophoresis**.
- DNA fragments **separate** based on size (smaller fragments move faster).

3. Transfer to a Membrane (Blotting)

- The gel is placed on a special **nylon or nitrocellulose membrane**.
- DNA is transferred from the gel to the membrane by **capillary action or electrophoretic transfer**.

4. Hybridization with a Probe

- A **radioactive or fluorescent DNA probe** (a short single-stranded DNA sequence complementary to the target sequence) is added.
- The probe binds (hybridizes) specifically to the matching DNA sequence on the membrane.

5. Detection

- Excess probe is washed away.
- The labeled probe is detected using **X-ray film (autoradiography) or fluorescence imaging**, revealing the **specific DNA bands** of interest.

Applications of Southern Blotting

✅ **Gene Mapping** – Identifies gene locations on DNA.
✅ **Disease Diagnosis** – Detects genetic mutations (e.g., sickle cell anemia).
✅ **Forensic Science** – Used in DNA fingerprinting for criminal investigations.
✅ **Paternity Testing** – Compares DNA samples to establish biological relationships.