

The background of the title slide is a dark blue rectangle. It features a faint, stylized graphic of DNA double helices and molecular structures, rendered in a lighter blue color. The helices are intertwined, and various geometric shapes like hexagons and circles are scattered throughout, suggesting a scientific or biological theme.

Biotechnology: Principles & Processes

An in-depth exploration of Genetic Engineering and Recombinant DNA Technology

Understanding Biotechnology

"The integration of natural science and organisms, cells, and molecular analogues
for products and services." — EFB

CORE PRINCIPLES OF BIOTECH

Genetic Engineering

Techniques to alter the chemistry of genetic material (DNA/RNA) to introduce them into host organisms and thus change the phenotype of the host organism.

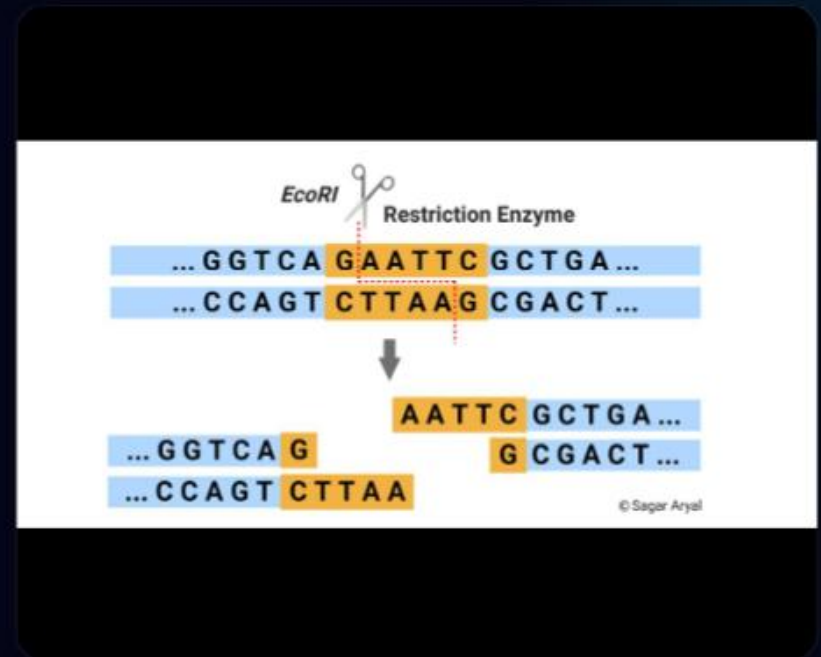
Bioprocess Engineering

Maintenance of sterile ambience in chemical engineering processes to enable growth of only the desired microbe/eukaryotic cell in large quantities for production.

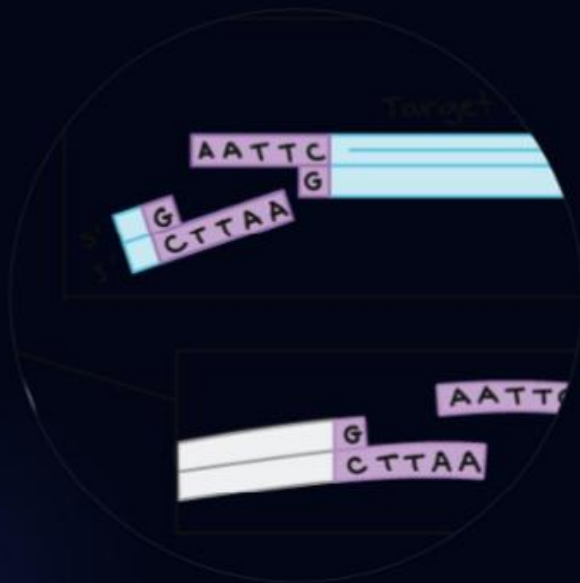
MOLECULAR SCISSORS

Restriction Enzymes belong to a larger class of enzymes called nucleases.

- **Exonucleases:** Remove nucleotides from the ends of the DNA.
- **Endonucleases:** Make cuts at specific positions within the DNA.
- They recognize specific **Palindromic sequences** to perform precise cleavages.



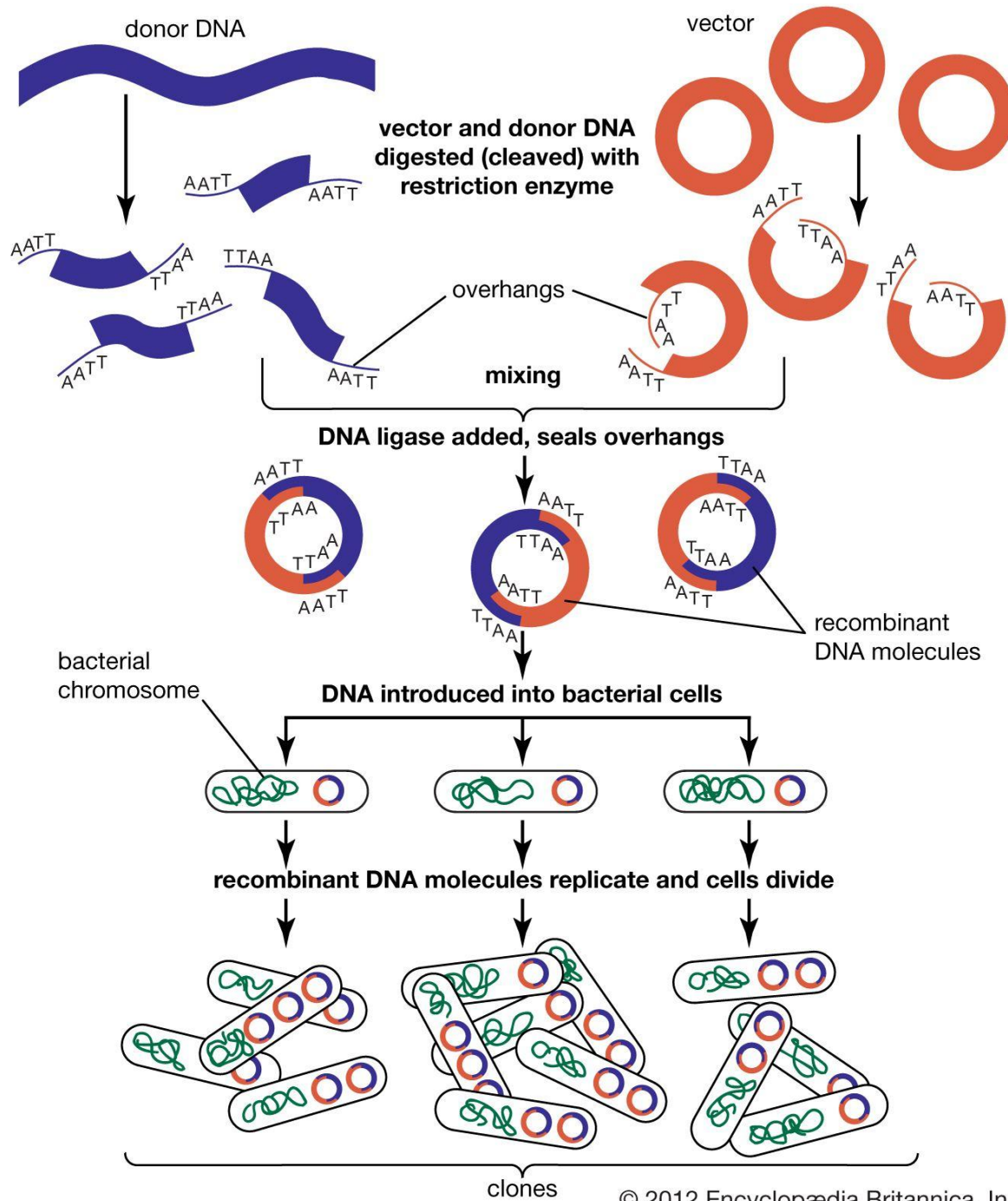
LIGATION AND STICKY ENDS



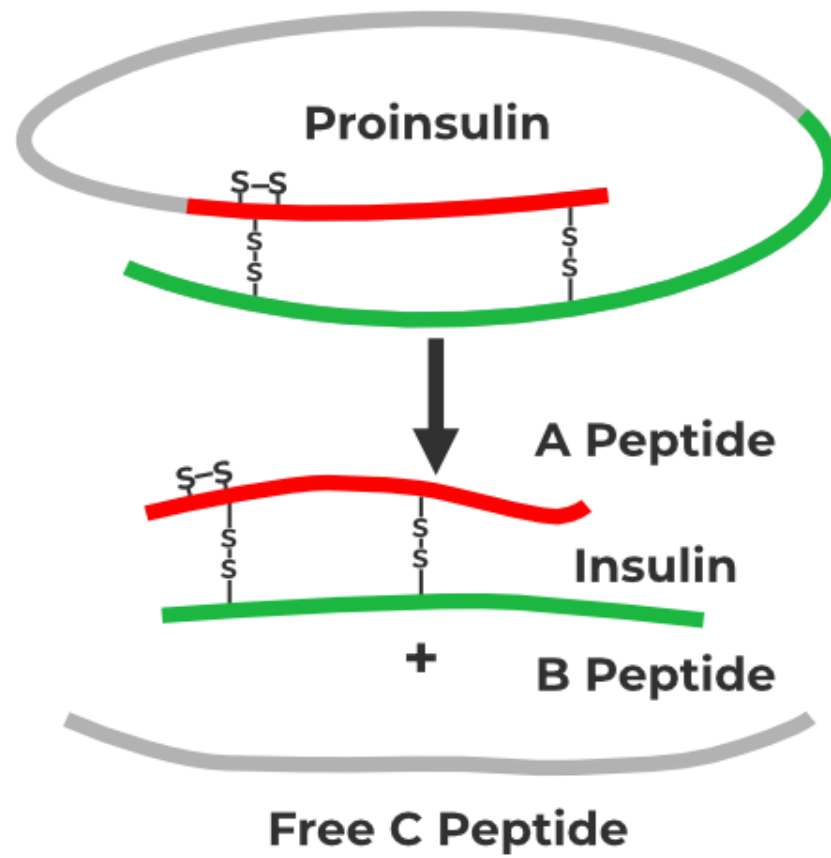
DNA Ligase: The Glue

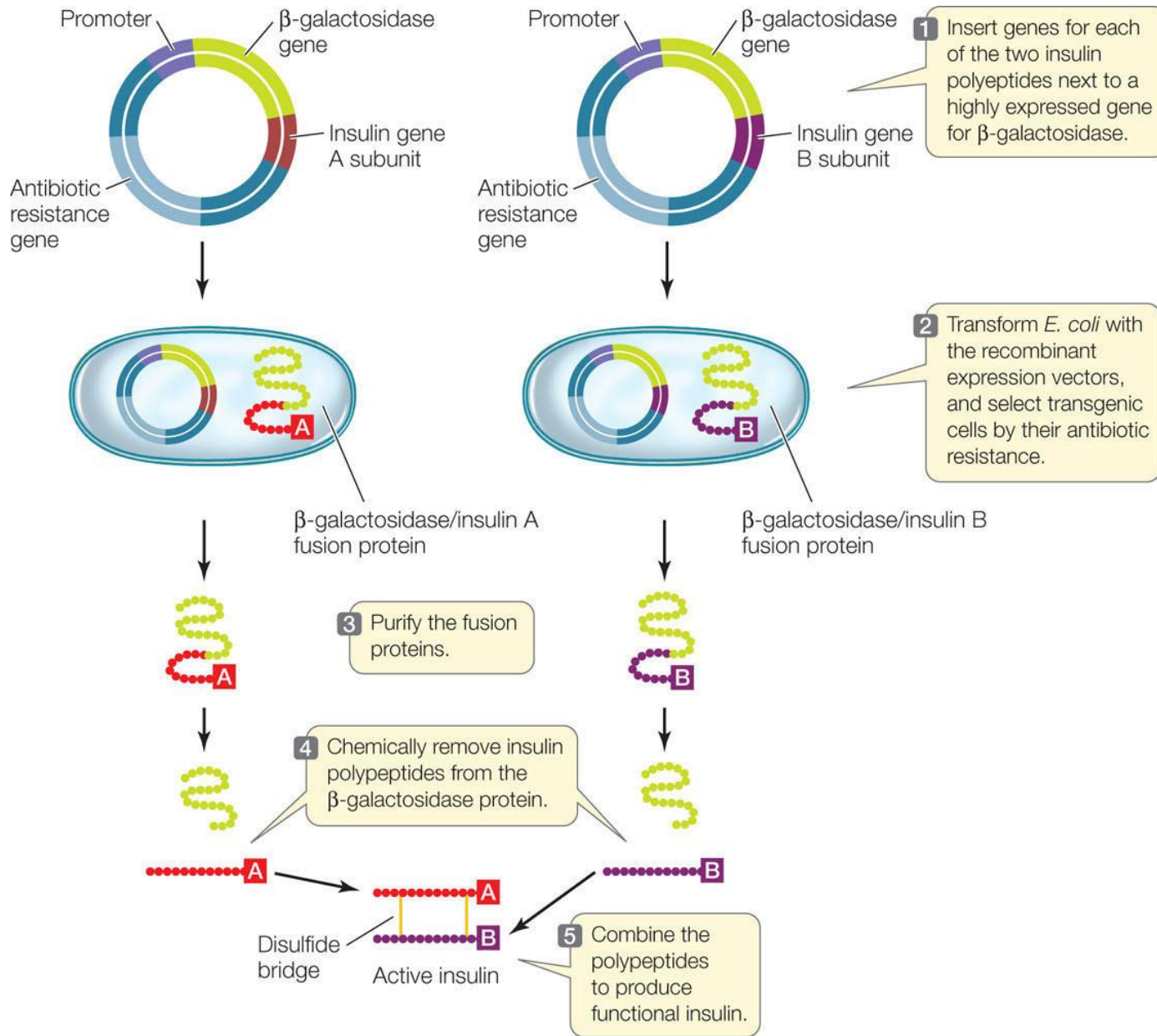
Restriction enzymes cut the DNA slightly away from the center of the palindrome sites, leaving single-stranded portions called **Sticky Ends**.

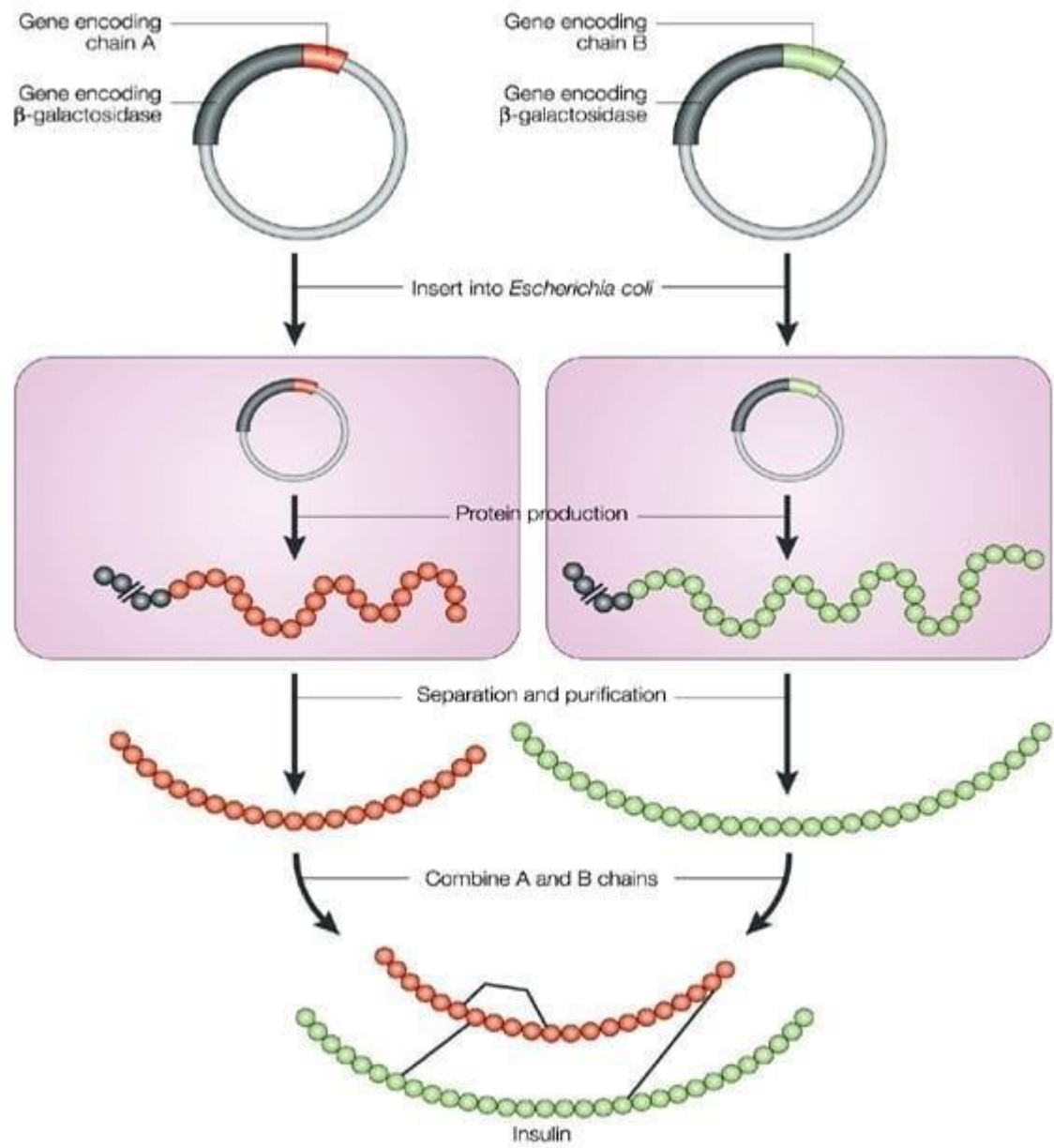
These ends form hydrogen bonds with their complementary counterparts. **DNA Ligase** then joins these fragments to create recombinant DNA.



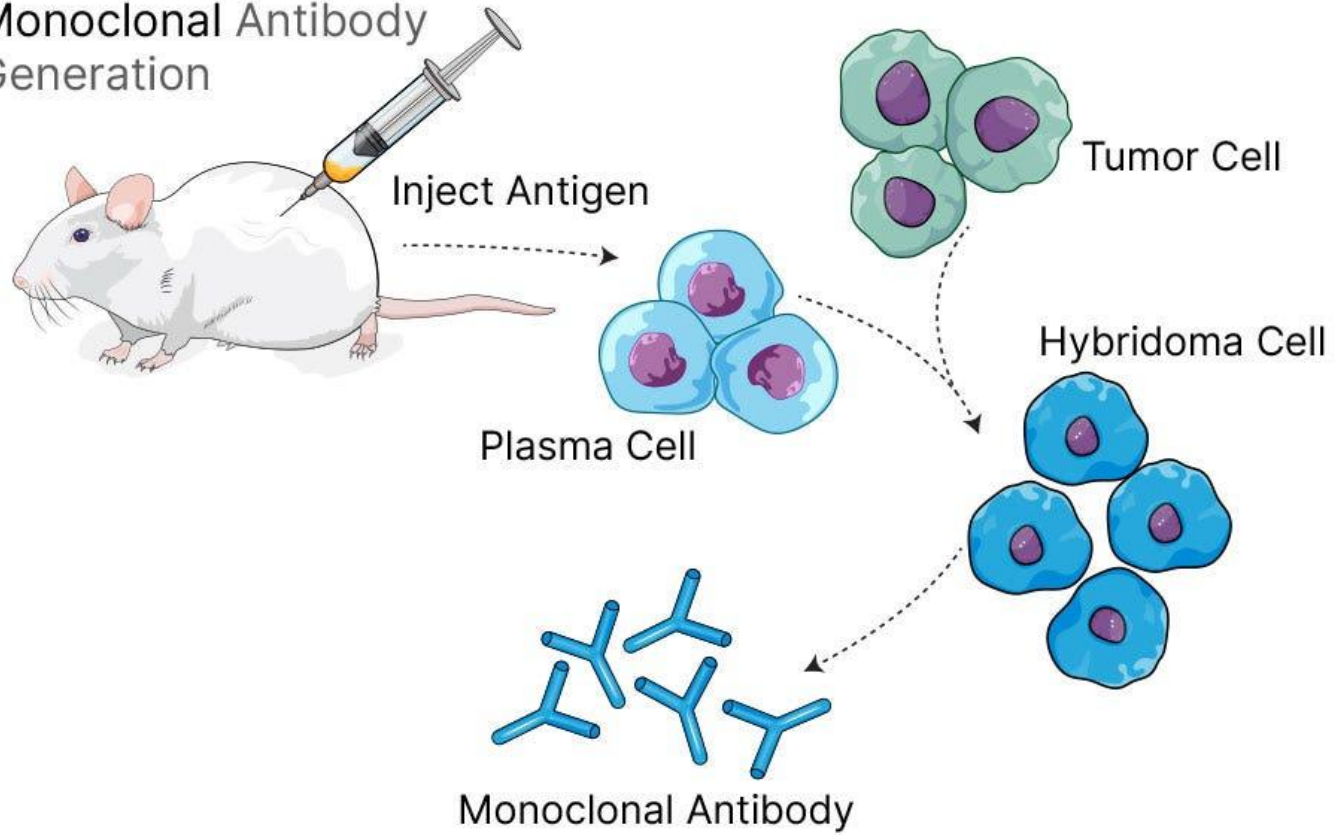




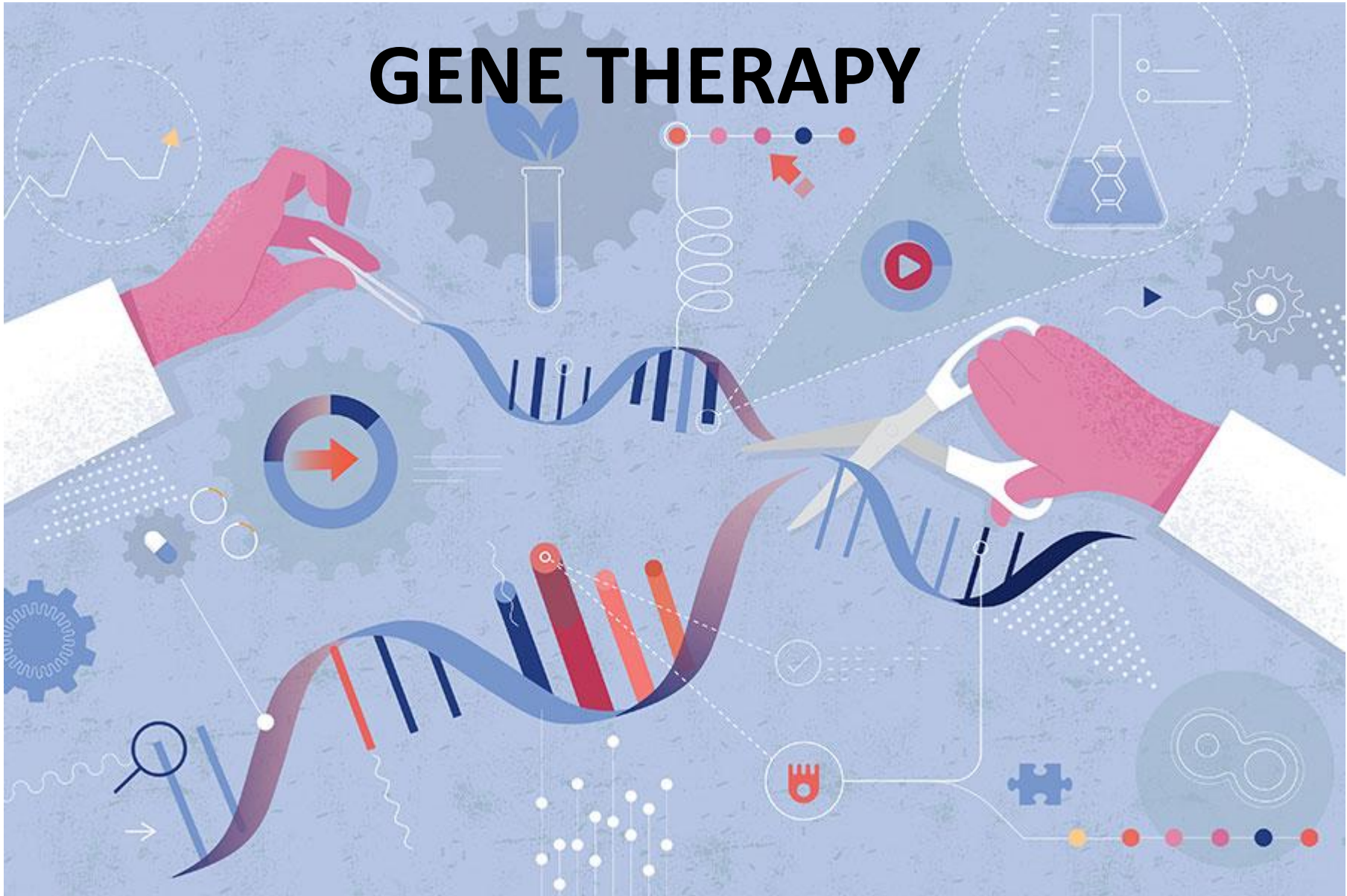




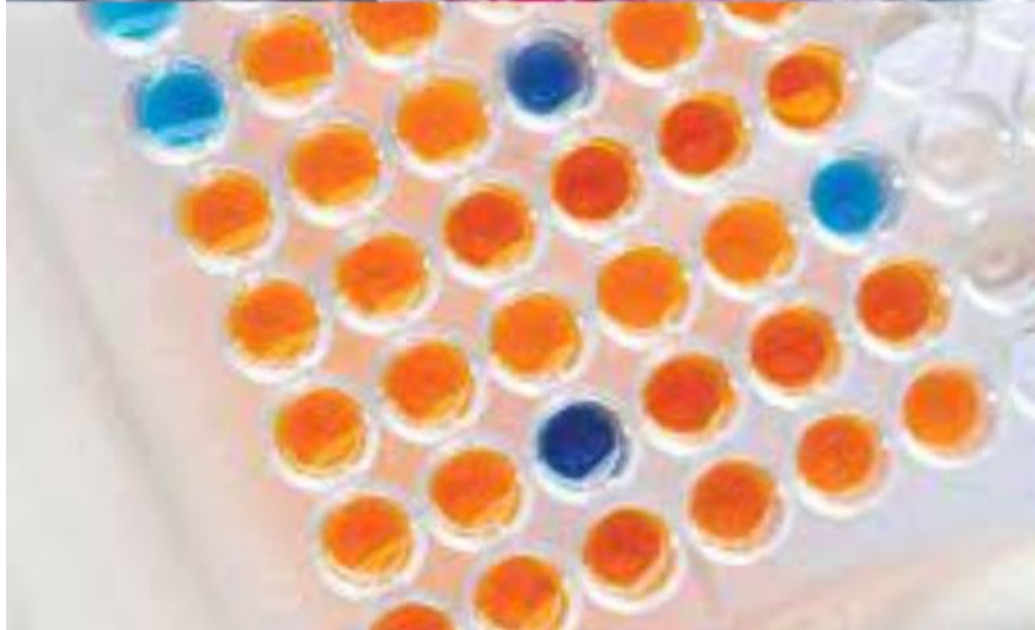
Monoclonal Antibody Generation



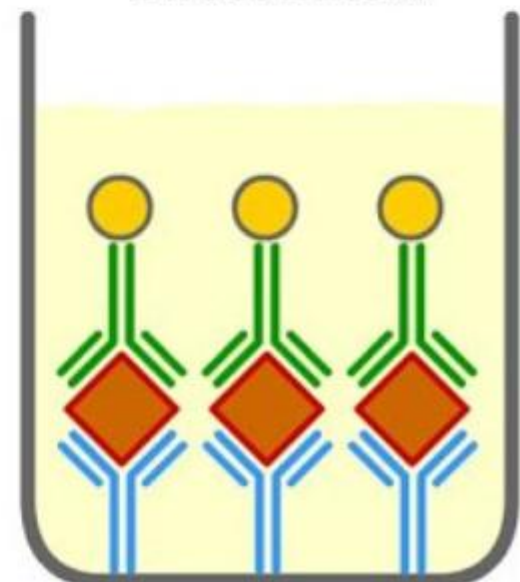
GENE THERAPY

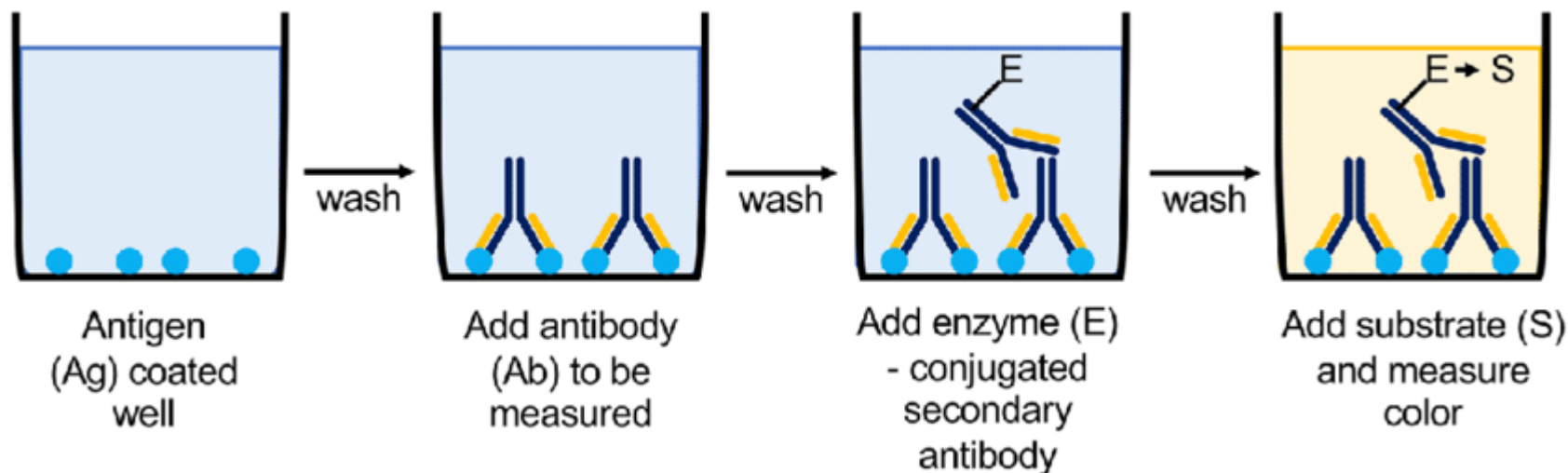
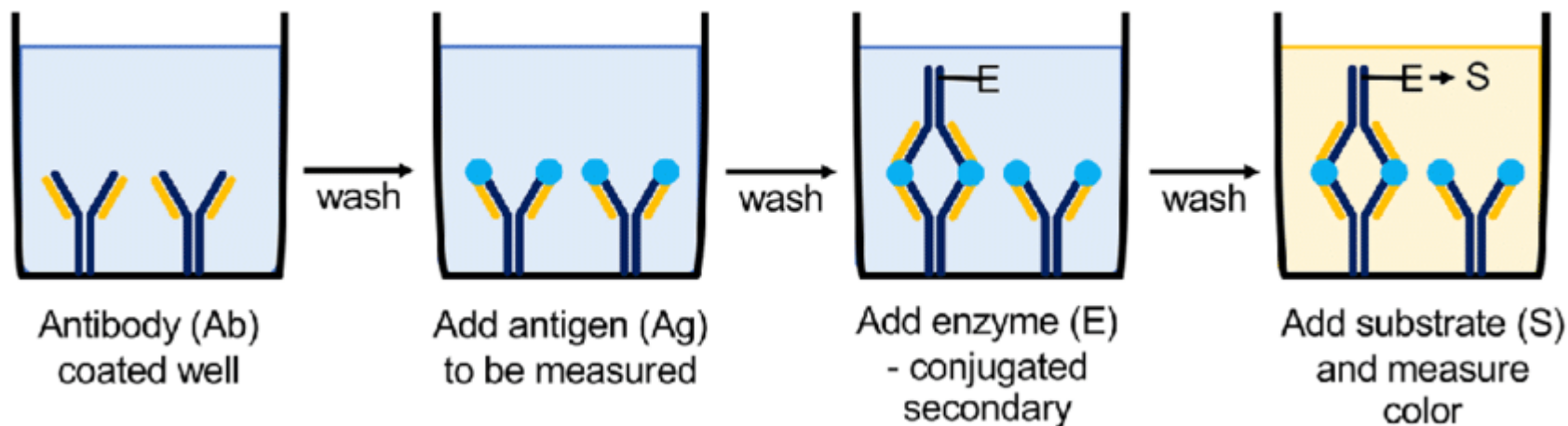


Enzyme-linked immunosorbent Assay (ELISA)



Direct ELISA





BT COTTON



**“Transgenic”
Cows that
Produce
Human Milk?**

EXPOSE REVEALED

First transgenic Cow

♥ Rosie was the first transgenic cow and it was produced in 1997. The gene for human protein alpha-lactalbumin was introduced in this cow. Thus, the cow could produce protein-enriched milk. This milk was nutritionally more balanced than natural cow milk.

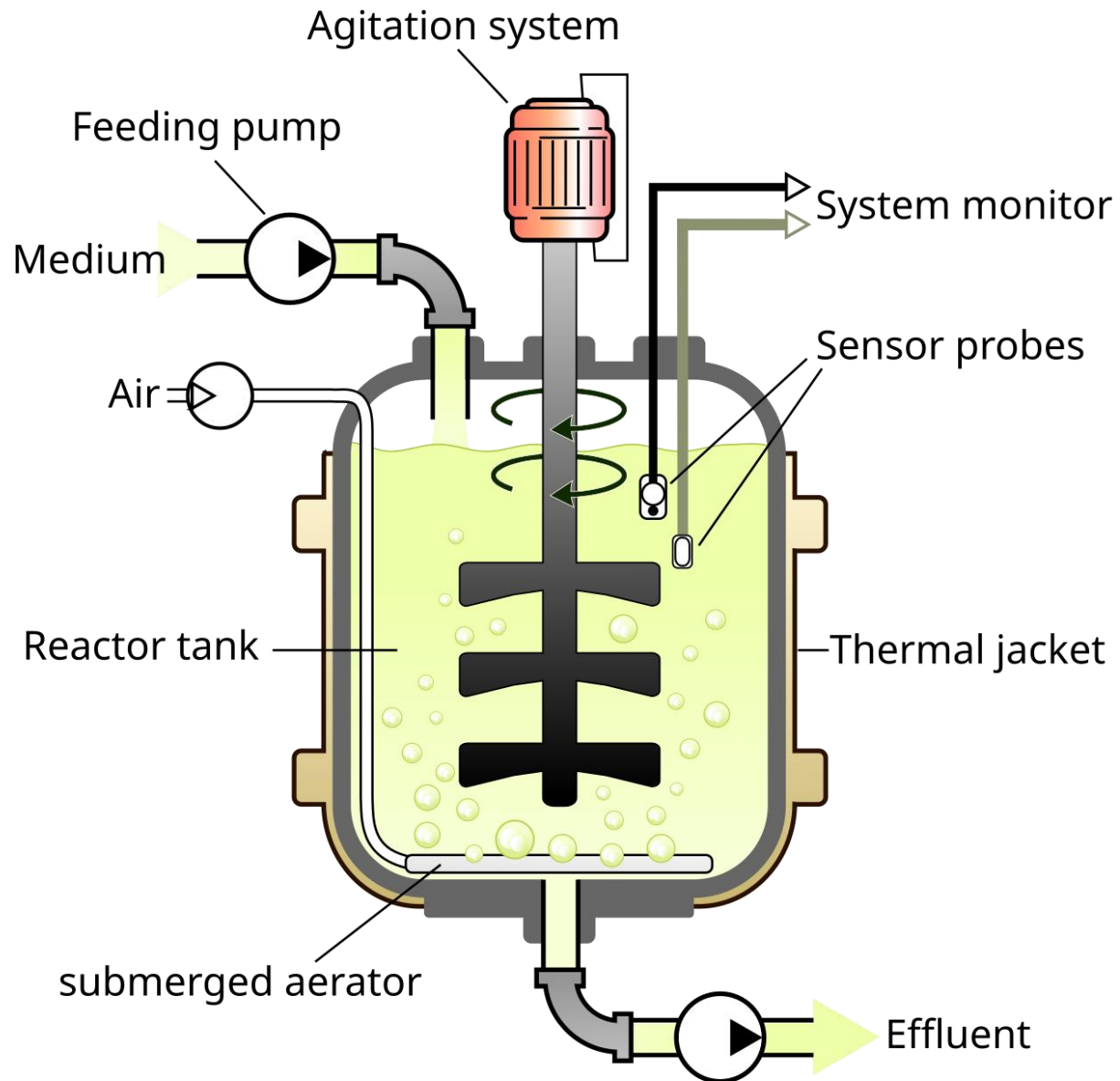


MASS PRODUCTION: BIOREACTORS

To produce large quantities of products, specialized vessels called **Bioreactors** are used (100–1000 liters).

- ✓ Provides optimal growth conditions (pH, Temp, Oxygen).
- ✓ Stirred-tank reactors ensure even mixing and oxygen availability.
- ✓ Continuous culture system maintains exponential growth phase.





DOWNSTREAM PROCESSING

Phase	Key Activities	Objective
Separation	Centrifugation, Filtration	Isolate product from biomass
Purification	Chromatography, Precipitation	Achieve high-grade chemical purity
Formulation	Addition of Preservatives	Increase shelf-life and stability
Testing	Clinical trials / Quality checks	Ensure safety and efficacy standards