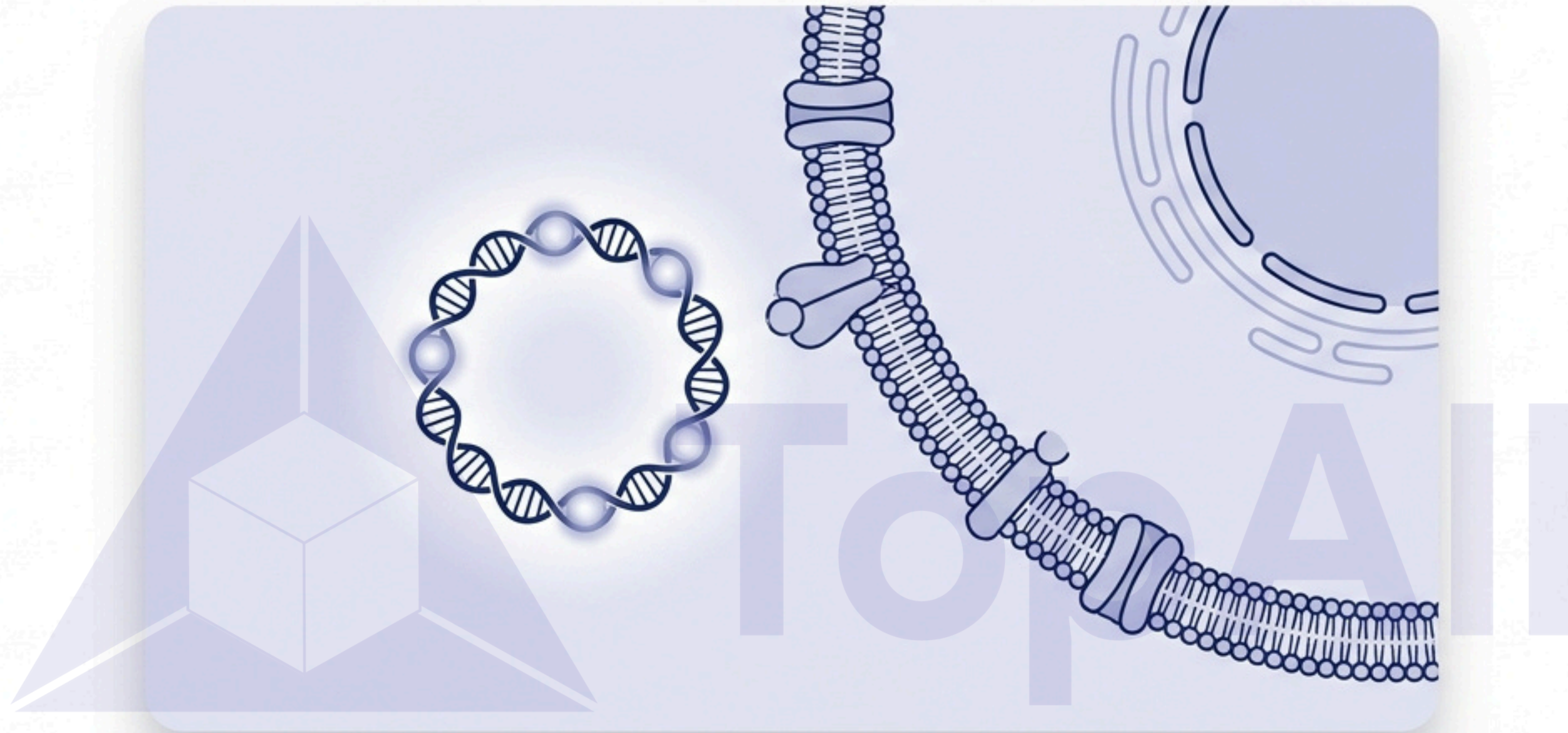




How DNA Enters Host Cells

The Mechanics of Transformation in Genetic Engineering

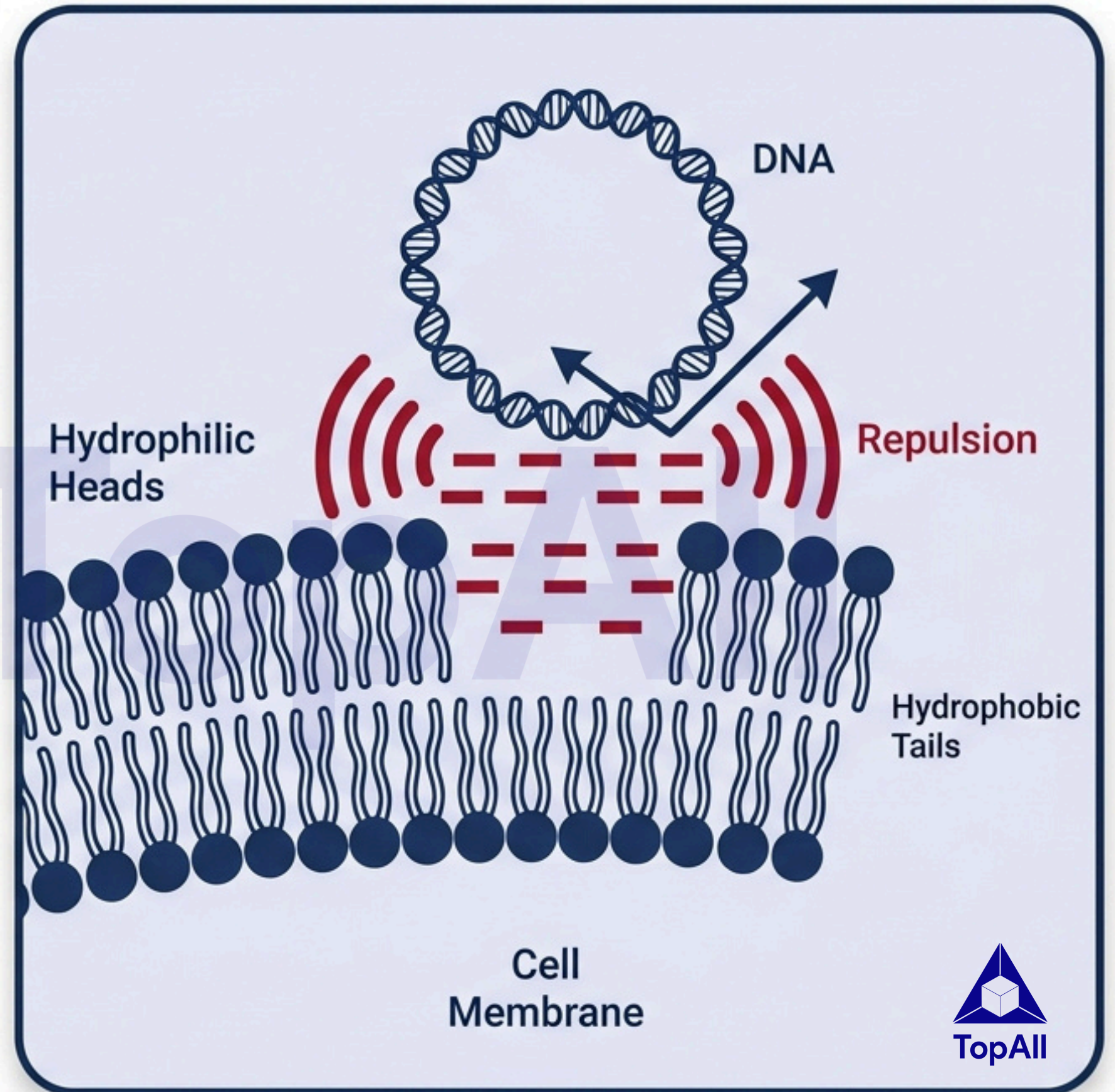
The Barrier to Entry

The Molecule

DNA is hydrophilic. It is a water-loving, negatively charged molecule.

The Membrane

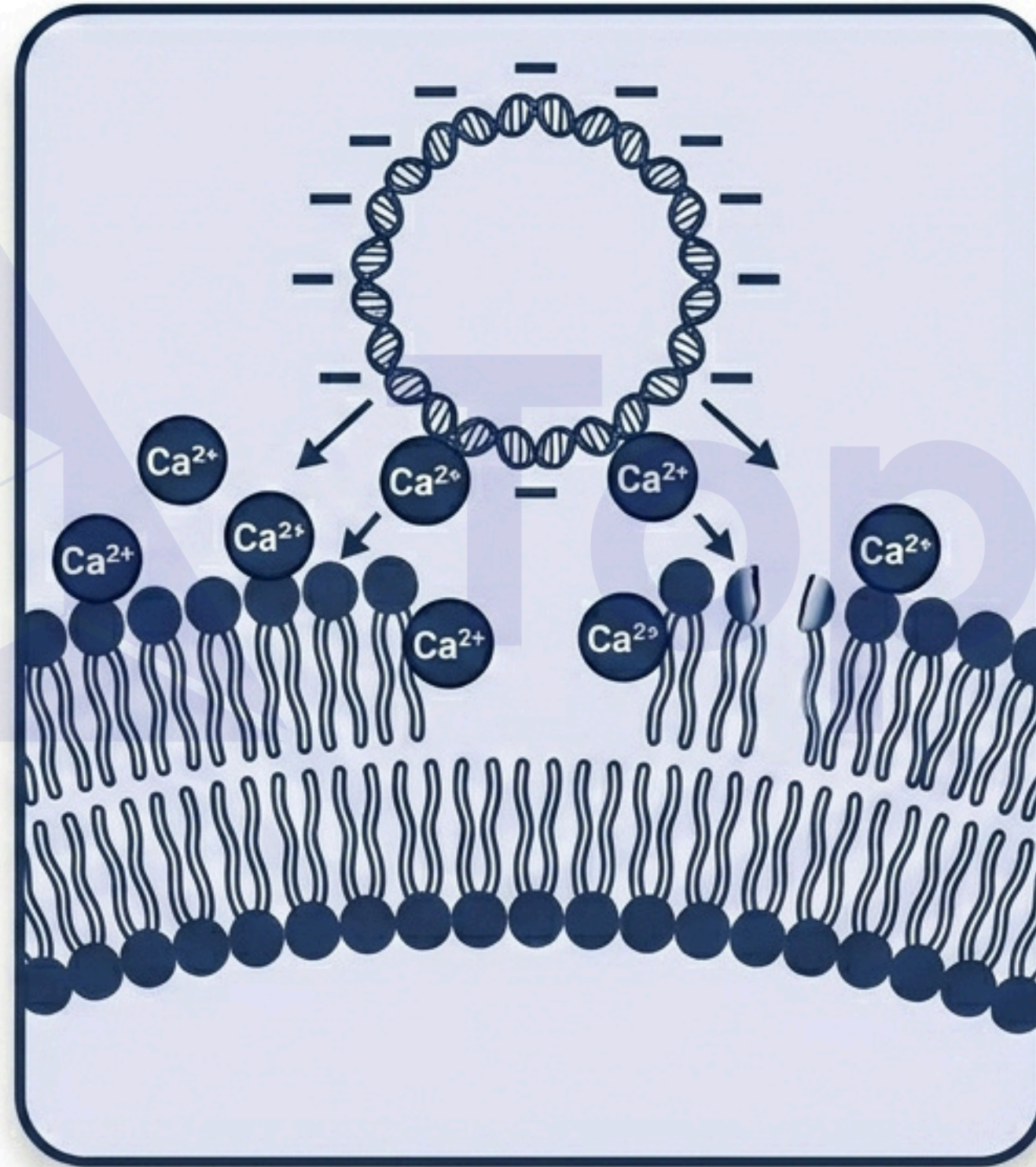
Cell membranes are hydrophobic. The lipid bilayer naturally repels DNA, preventing it from passing through the cell wall.



Step 1: Making the Host Competent

Treatment

Bacterial cells are treated with a specific concentration of a divalent cation, typically Calcium (Ca^{2+}).



Mechanism

This chemical treatment alters the cell wall, acting as a charge bridge that increases the efficiency with which DNA can enter through transient pores.



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$$E=mc^2$$



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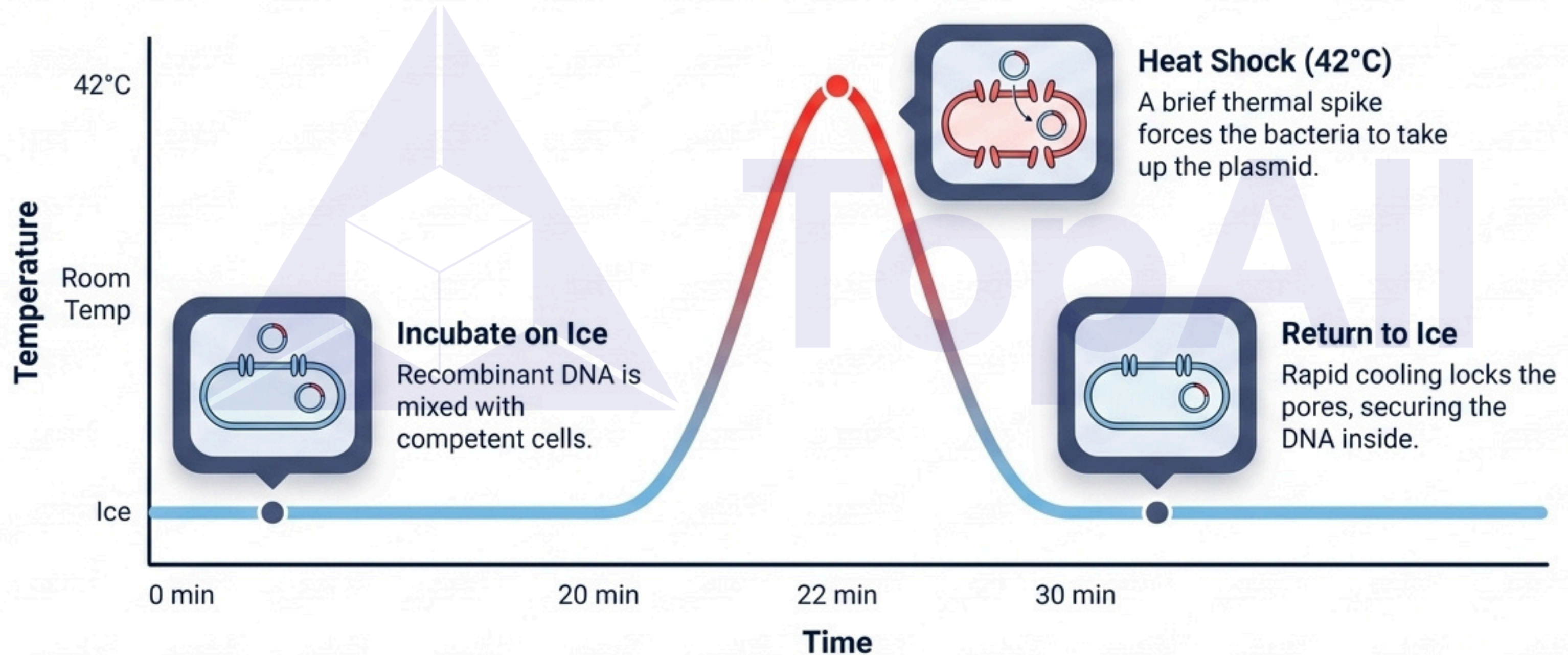
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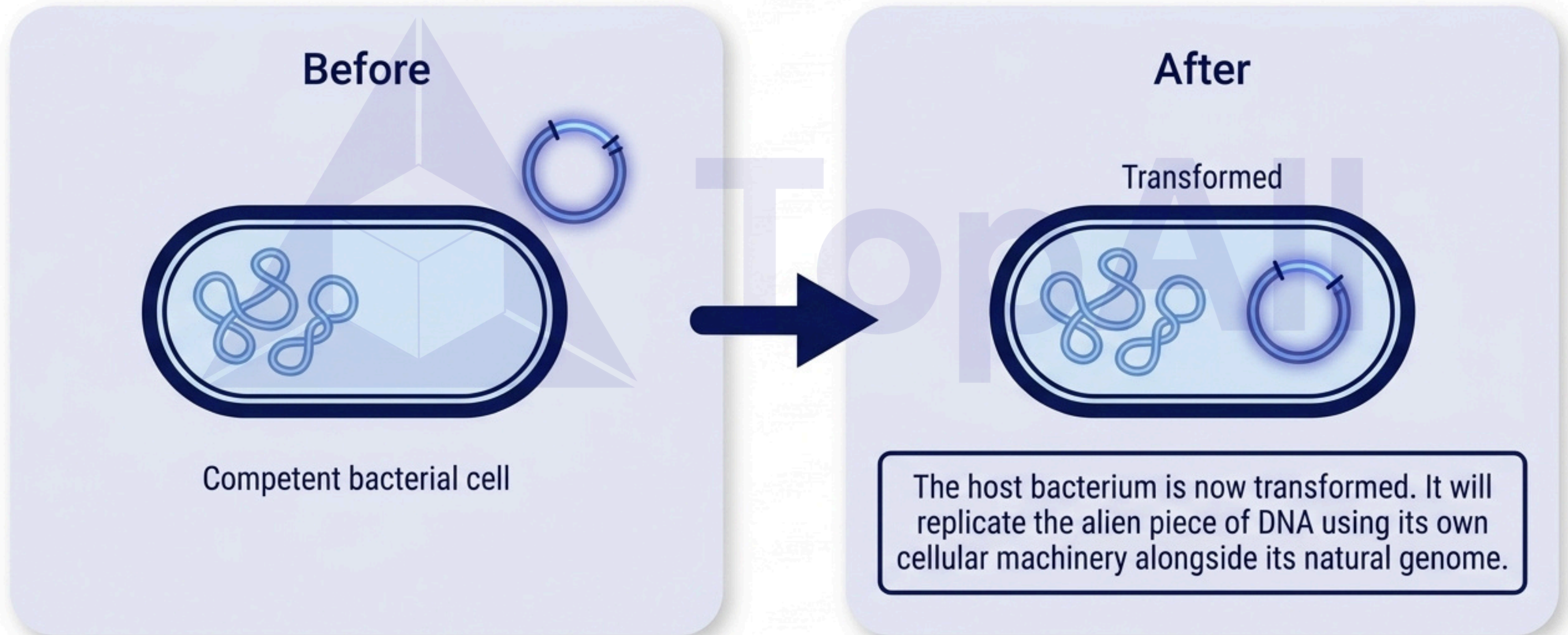
Step 2: The Heat Shock Protocol

Thermal Timeline



The Result: Successful Transformation

The recombinant DNA has bypassed the hydrophobic membrane.



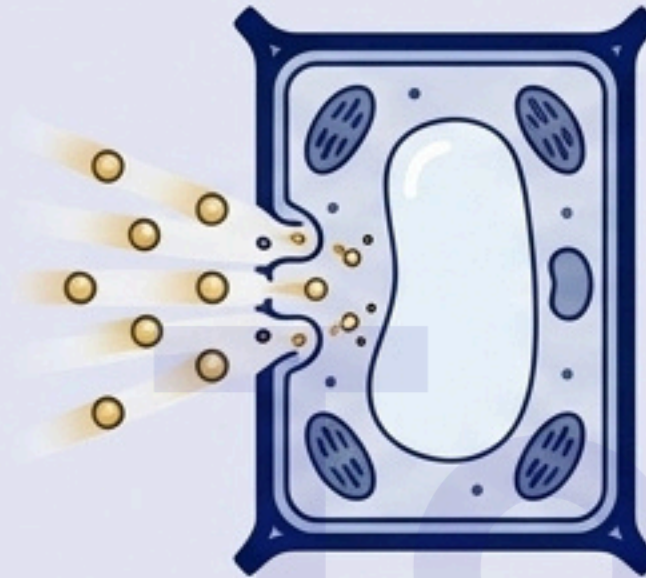
Alternative Methods for Eukaryotes



Micro-injection

For Animals

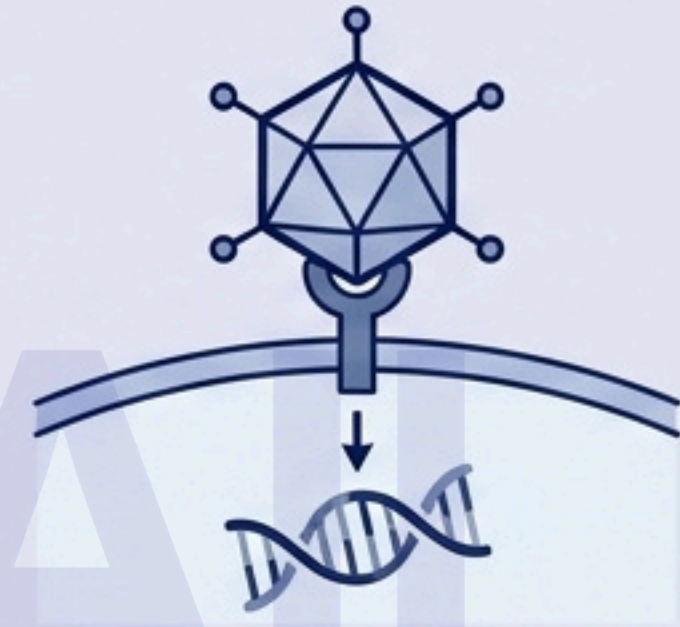
Recombinant DNA is directly injected into the nucleus of an animal cell.



Biolistics / Gene Gun

For Plants

Cells are bombarded with high-velocity micro-particles of gold or tungsten coated with DNA.



Disarmed Pathogens

For Plants & Animals

Modified, non-pathogenic vectors naturally infect the cell to transfer recombinant DNA.

NEET Key Takeaway: Transformation Methods

Target Host	Method	Mechanism
Bacteria	Heat Shock	Ca^{2+} Treatment + Ice $\rightarrow$ 42°C $\rightarrow$ Ice incubation
Animal Cells	Micro-injection	Direct injection into the nucleus
Plant Cells	Biolistics (Gene Gun)	Bombardment with DNA-coated gold/tungsten
Plants & Animals	Disarmed Pathogens	Natural infection via modified vector



You've Learned the Theory.

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