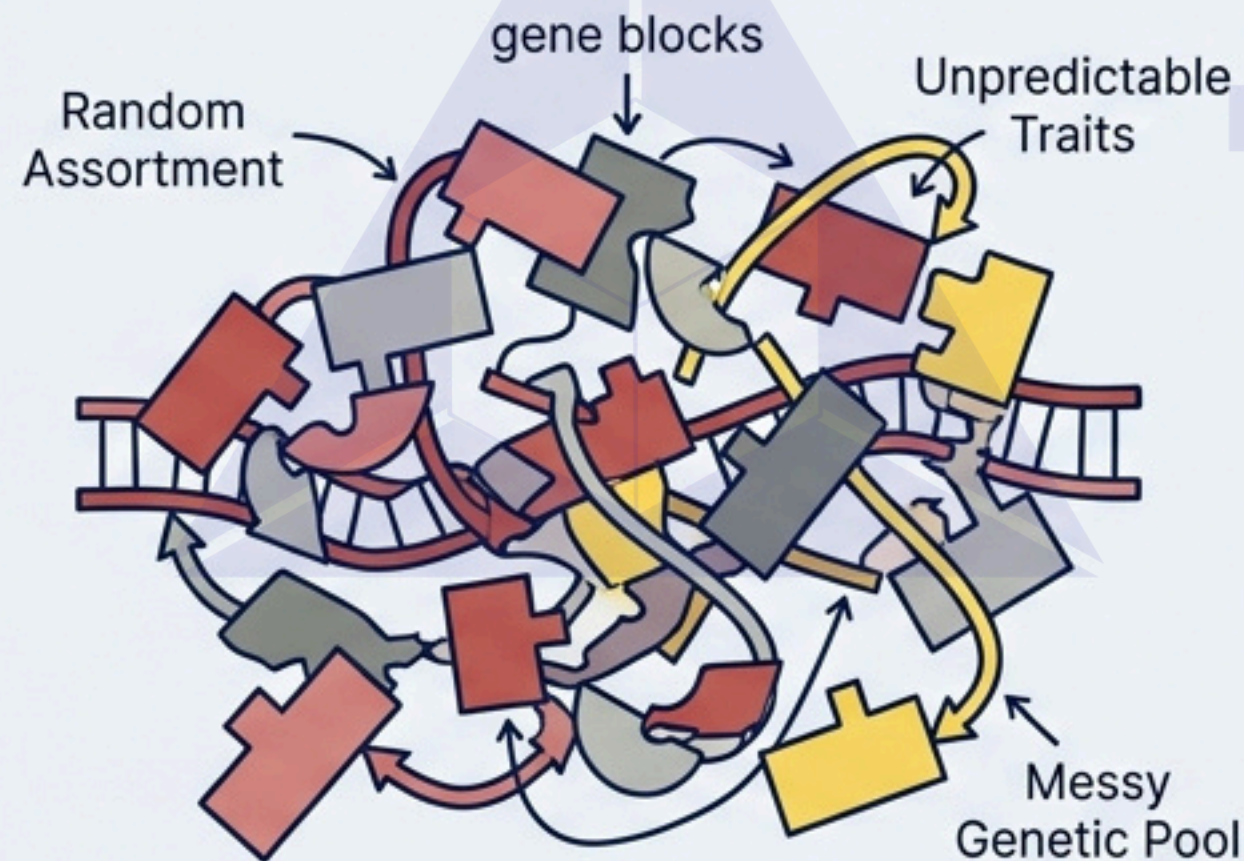


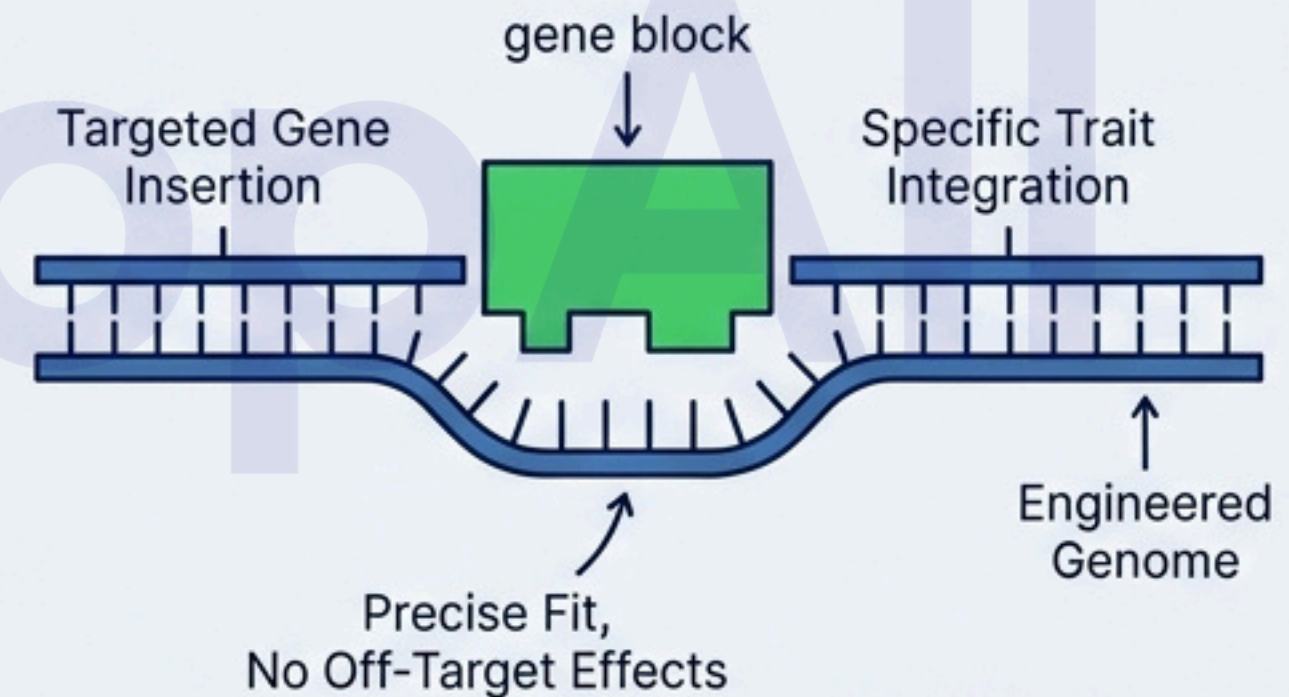
Genetic Engineering vs. Hybridisation

The Evolution of Precision in Biotechnology

Hybridisation: Traditional, Imprecise Methods



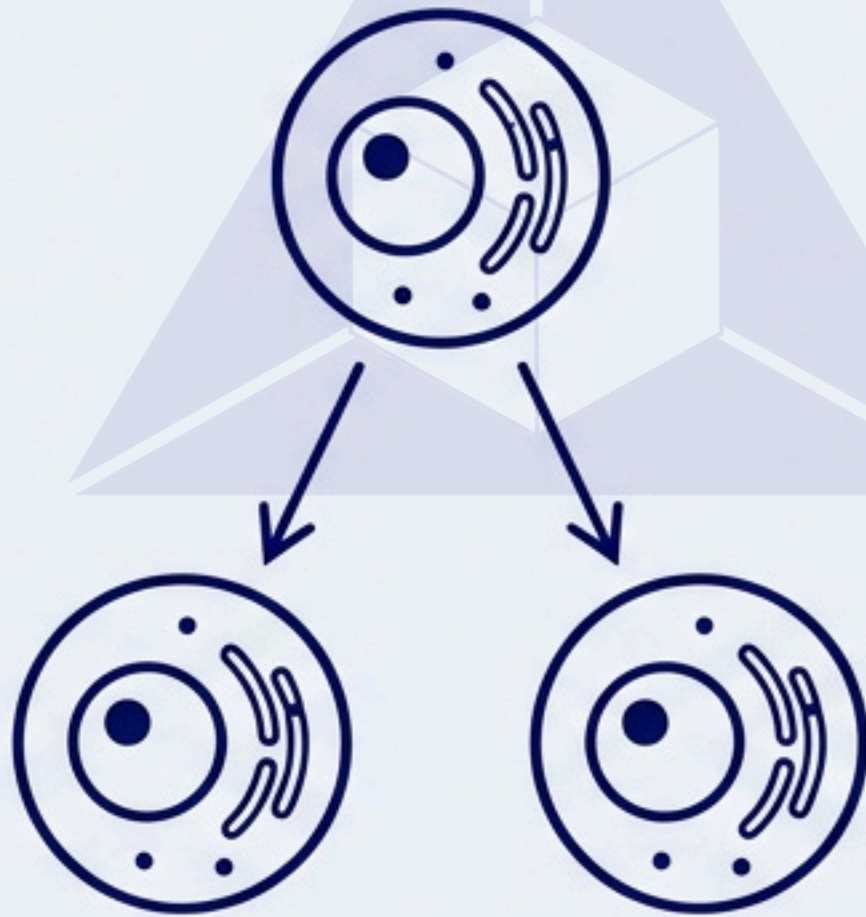
Genetic Engineering: Clinical Precision and Targeted Editing



The Baseline: Sexual Reproduction Creates Variation

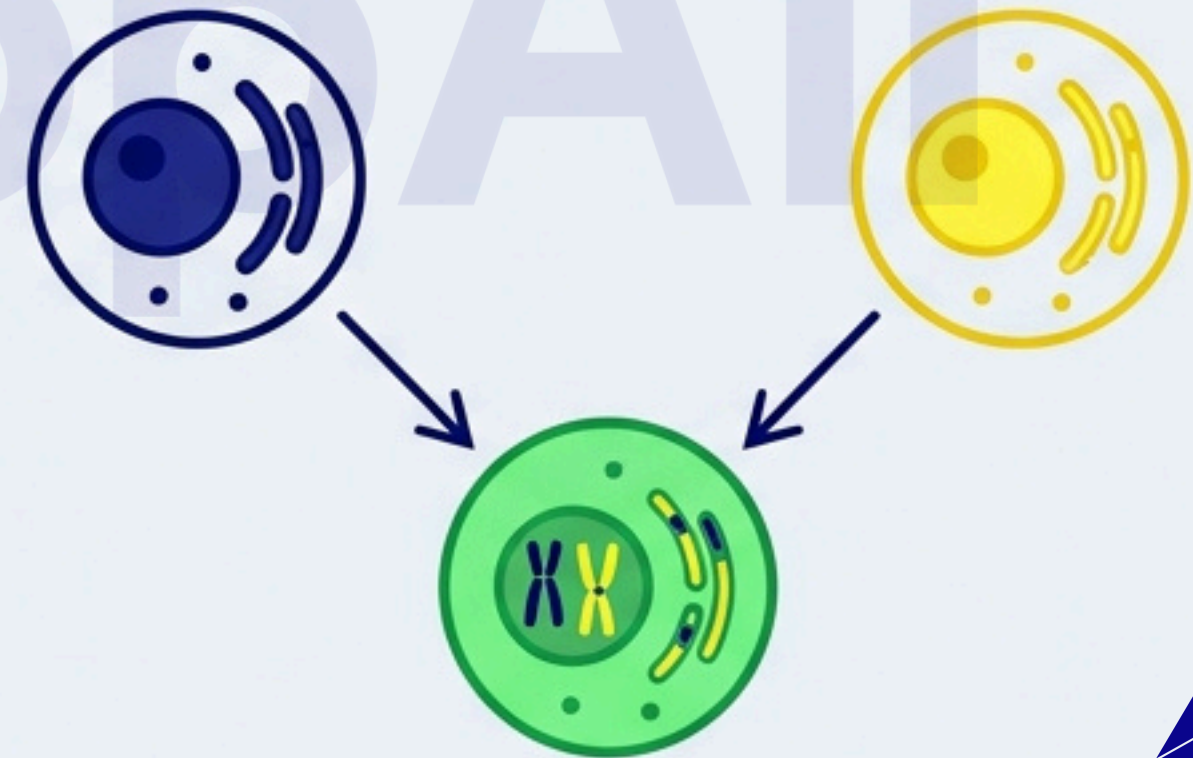
Asexual Reproduction

- Preserves exact genetic information.
- No variation.



Sexual Reproduction

- Formulates unique combinations of genetic setups.
- Permits variation (beneficial to organism and population).



The Problem: Traditional Hybridisation Adds Unwanted Genes

Traditional procedures used in plant and animal breeding lack isolation.



You cannot multiply the desired traits without simultaneously including and multiplying undesirable genes.



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$$E=mc^2$$



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The Solution: The Precision of Genetic Engineering

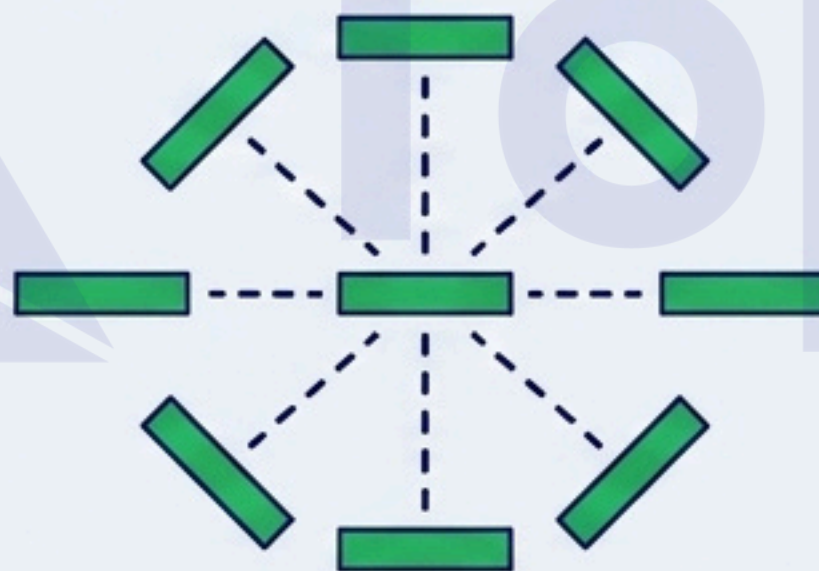
1. Cut

Recombinant DNA
(Isolating the specific gene)



2. Copy

Gene Cloning
(Creating multiple identical copies)



3. Paste

Gene Transfer
(Introducing it to the target)



*Overcomes traditional limitations—introduces one or a set of desirable **genes without introducing** undesirable ones.*

The Engine of Cloning: Origin of Replication

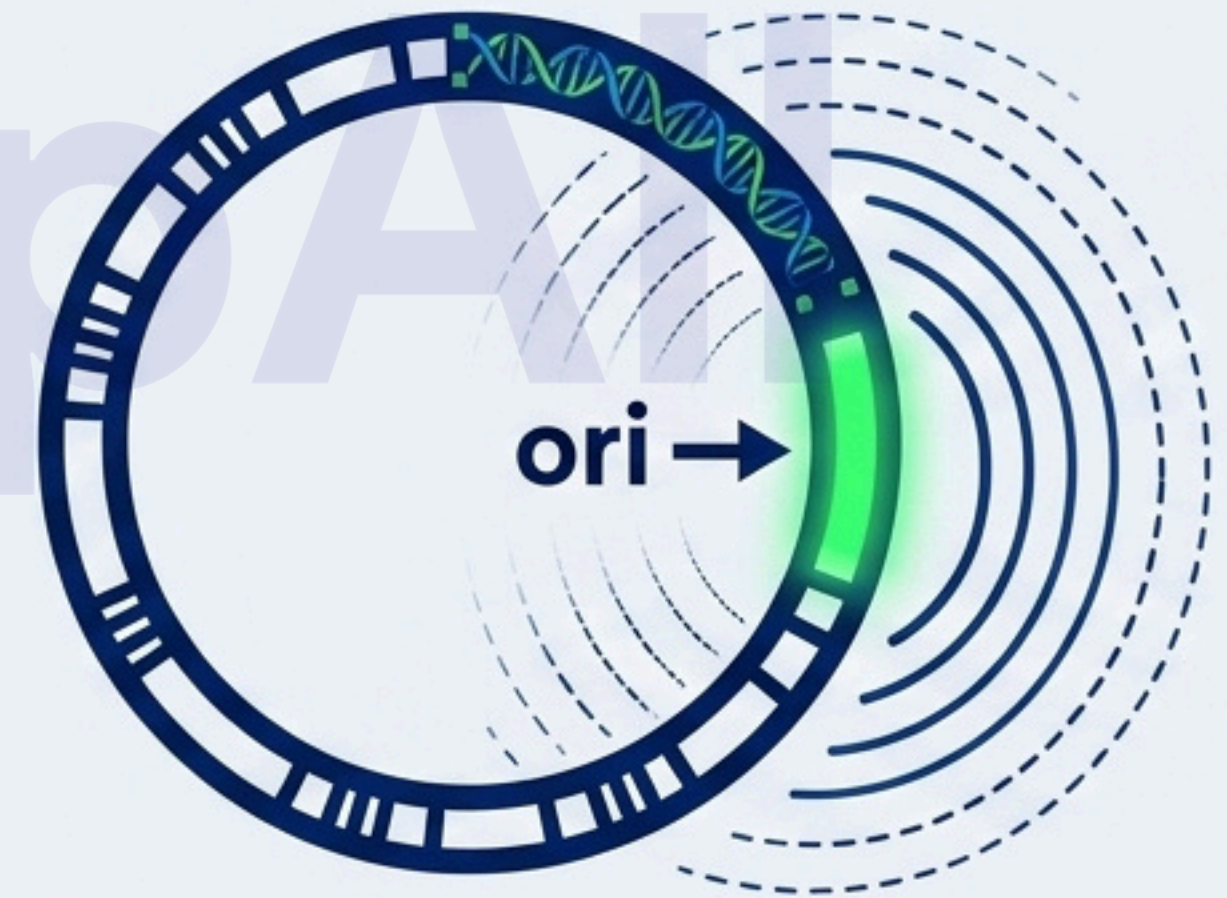


For an alien piece of DNA to multiply, it must become part of a chromosome with a specific DNA sequence called the **origin of replication** (initiates replication).

Alien DNA alone = Cannot multiply



Alien DNA + Origin of Replication
= Multiplication



Linking alien DNA to the 'ori' allows it to replicate and multiply in the host (Cloning)

Why Genetic Engineering is Precise

Feature	Traditional Hybridisation	Genetic Engineering
Gene Transfer	Entire genomes mixed	Specific genes isolated
Undesirable Genes	Included & multiplied 	Excluded completely 
Outcome	Unpredictable combinations	Predictable, precise insertion

The ultimate advantage of recombinant DNA technology is the ability to isolate and introduce ONLY desirable genes into a target organism.



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