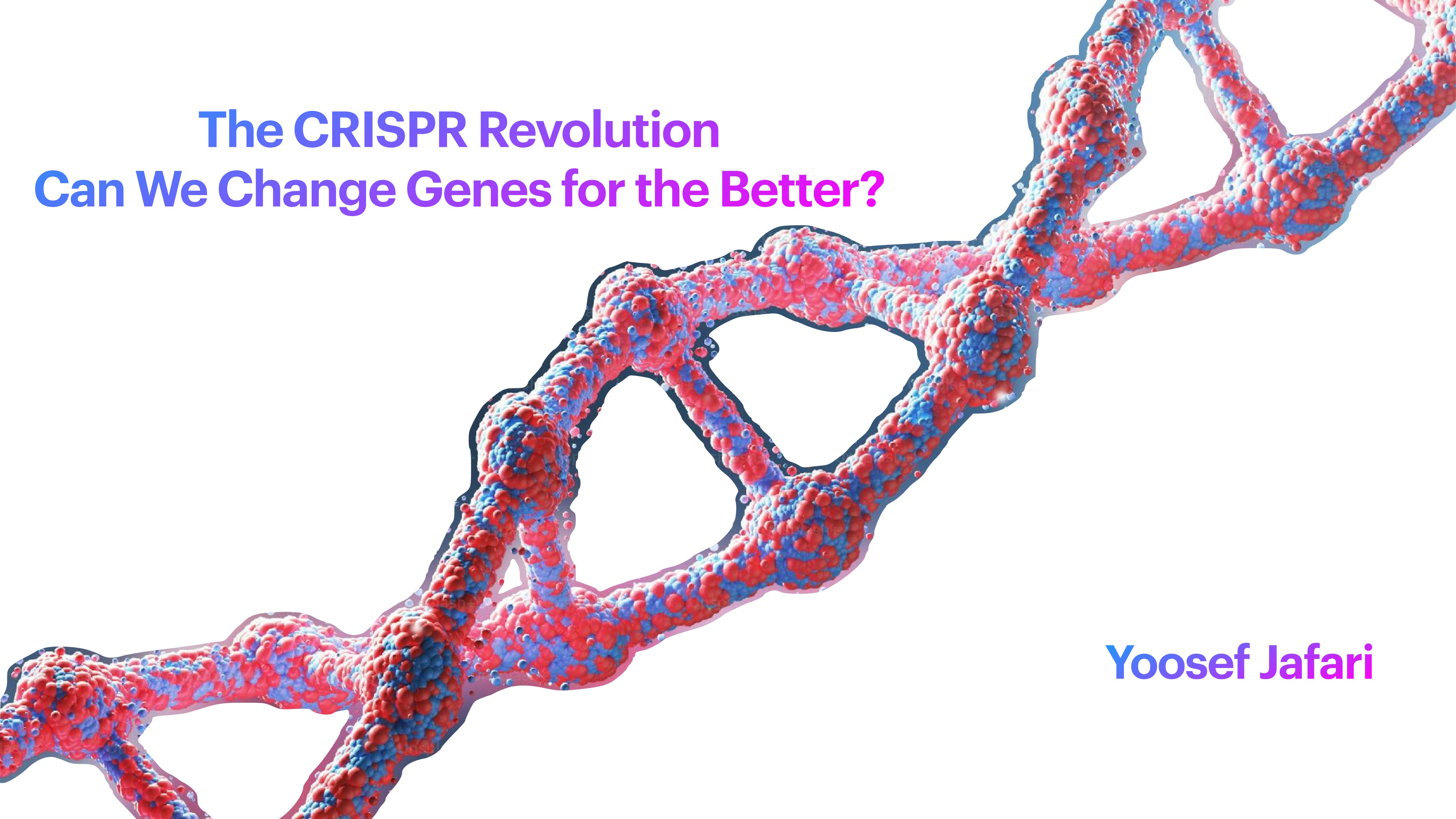


The CRISPR Revolution

Can We Change Genes for the Better?



Yoosef Jafari

What is DNA?

- DNA (Deoxyribonucleic Acid) carries genetic information.
- It acts as an instruction manual for cells.
- Made of two strands forming a double helix.
- Composed of nucleotides (A, T, C, G) that code for proteins.



What is RNA?

- RNA (Ribonucleic Acid) is a single-stranded molecule.
- Acts as a messenger carrying DNA instructions.
- Uses uracil (U) instead of thymine (T).
- Some RNA types help regulate genes and fight viruses.



DNA vs. RNA

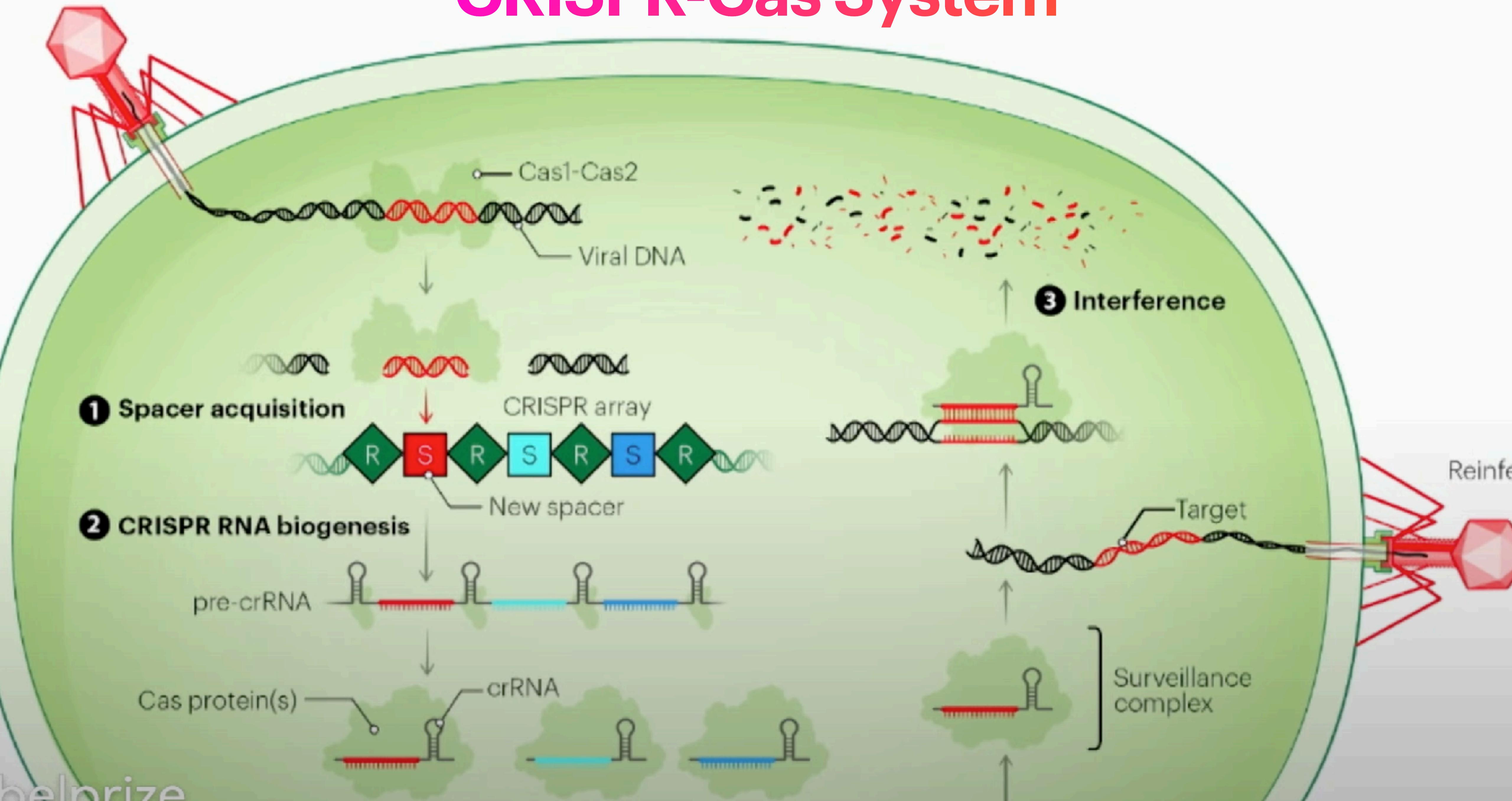
Feature	DNA	RNA
Structure	Double-stranded	Single-stranded
Sugar Type	Deoxyribose	Ribose
Base Pairs	A-T, C-G	A-U, C-G
Location	Nucleus	Nucleus & Cytoplasm

What is CRISPR?

- CRISPR: Clustered Regularly Interspaced Short Palindromic Repeats.
- A natural defense system in bacteria against viruses.
- Stores genetic “memories” of viruses to recognize future attacks.
- Scientists adapted it for gene editing.

Bacteriophage

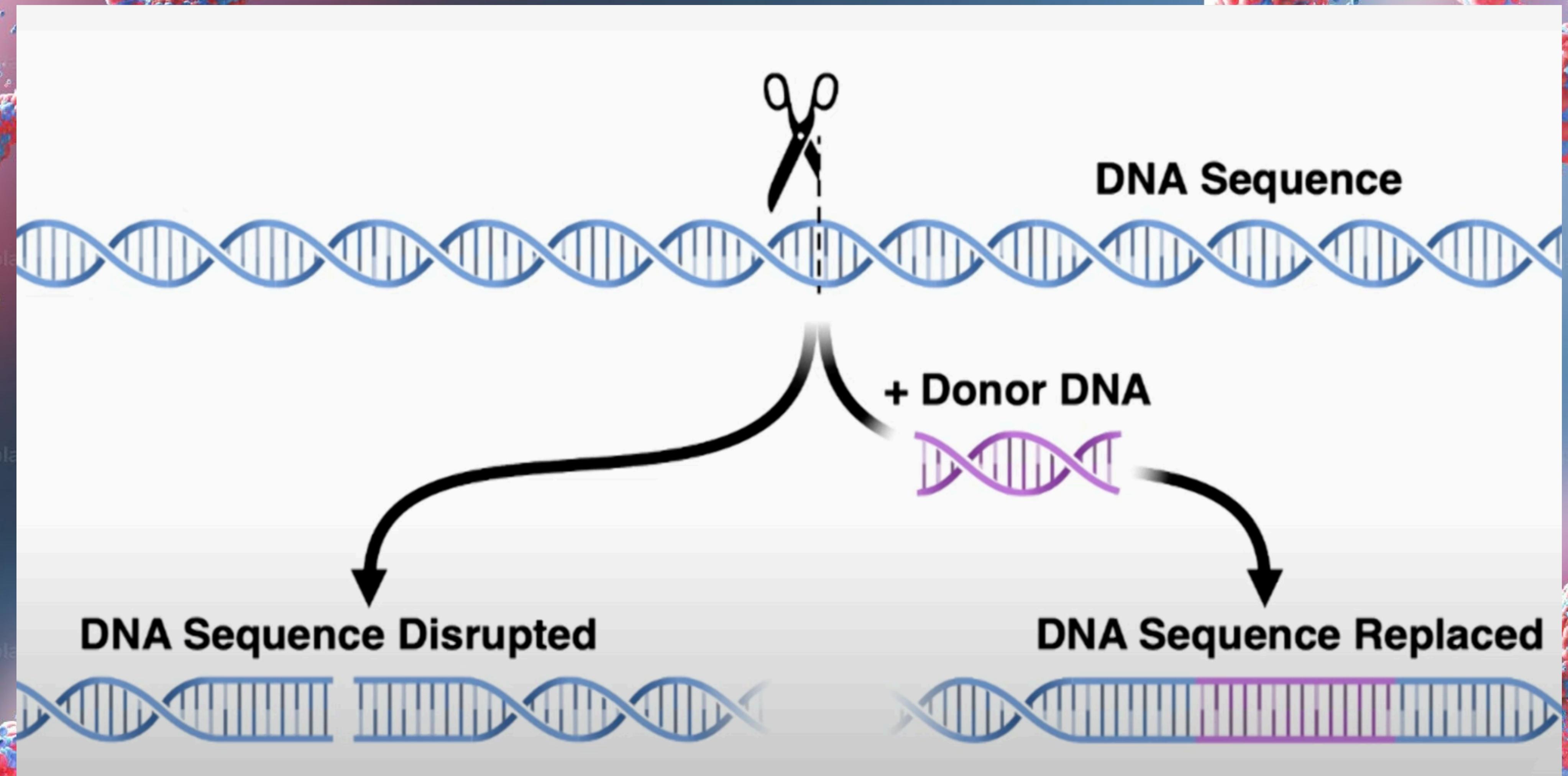
CRISPR-Cas System



How CRISPR Works

1. **Guide RNA (gRNA)** finds the target DNA sequence.
2. **Cas9 protein** acts as molecular scissors to cut the DNA.
3. **DNA Repair** allows scientists to delete, replace, or modify genes.

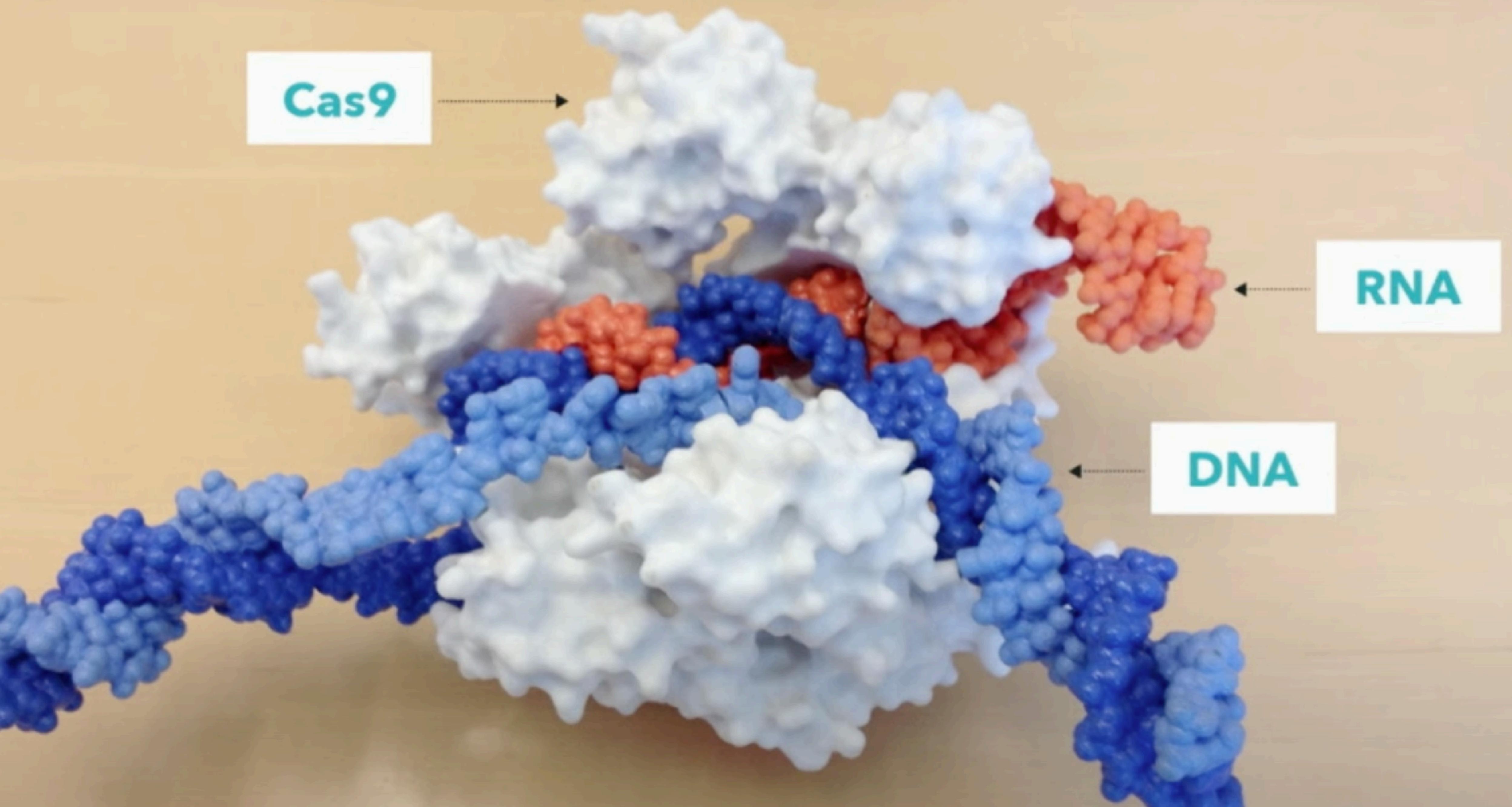




Cas9

RNA

DNA





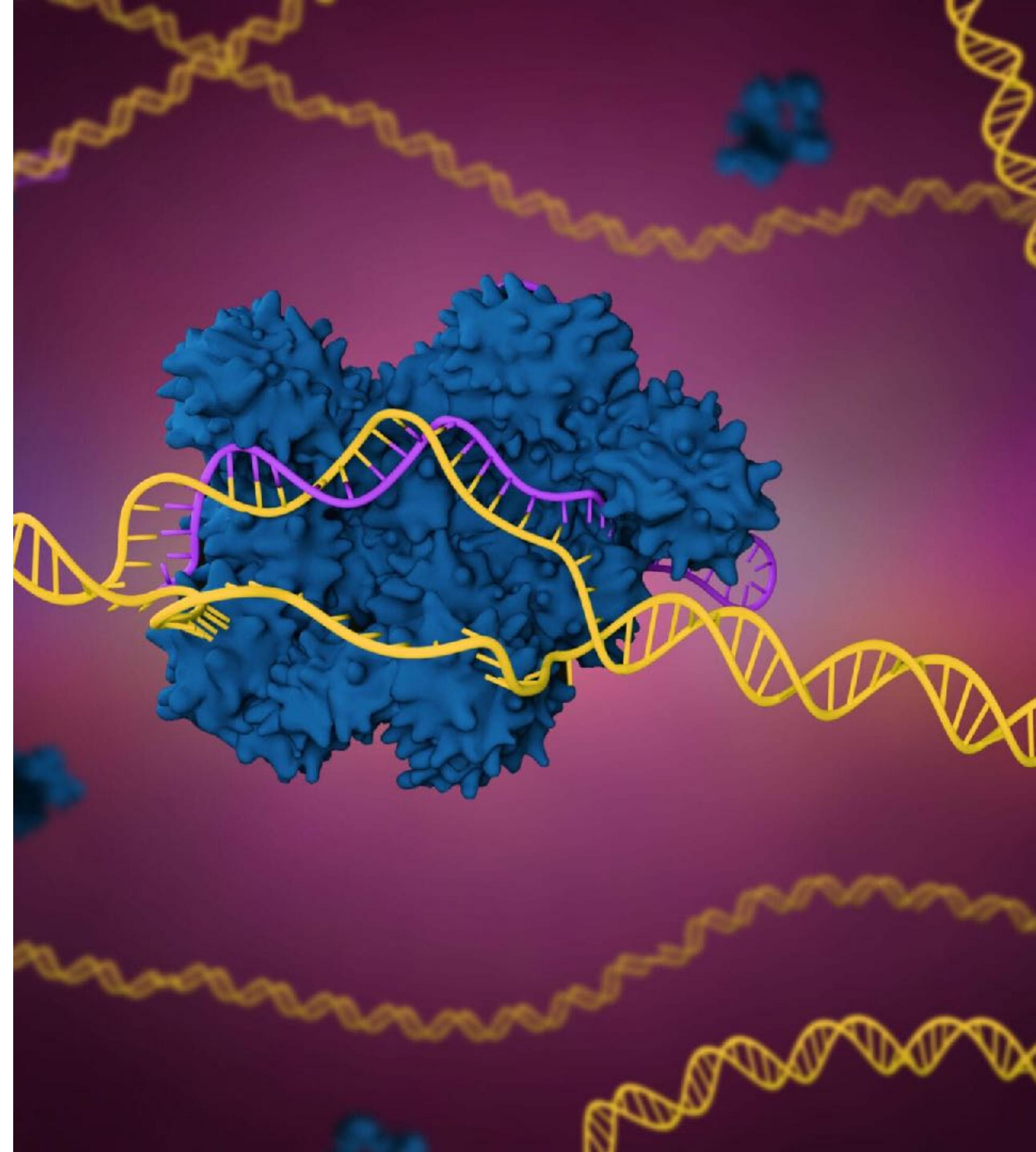
CRISPR vs. Traditional Gene Editing



Feature	Traditional Gene Editing	CRISPR-Cas9
Accuracy	Less precise	Highly precise
Speed	Slow	Fast
Cost	Expensive	Affordable
Application	Limited	Broad (Medicine, Agriculture, Environment)

CRISPR in Medicine

- **Treating Genetic Disorders:** Sickle cell anemia, cystic fibrosis.
- **Fighting Viruses:** CRISPR can remove HIV from infected cells.
- **Cancer Therapy:** Enhances immune cells to fight cancer.



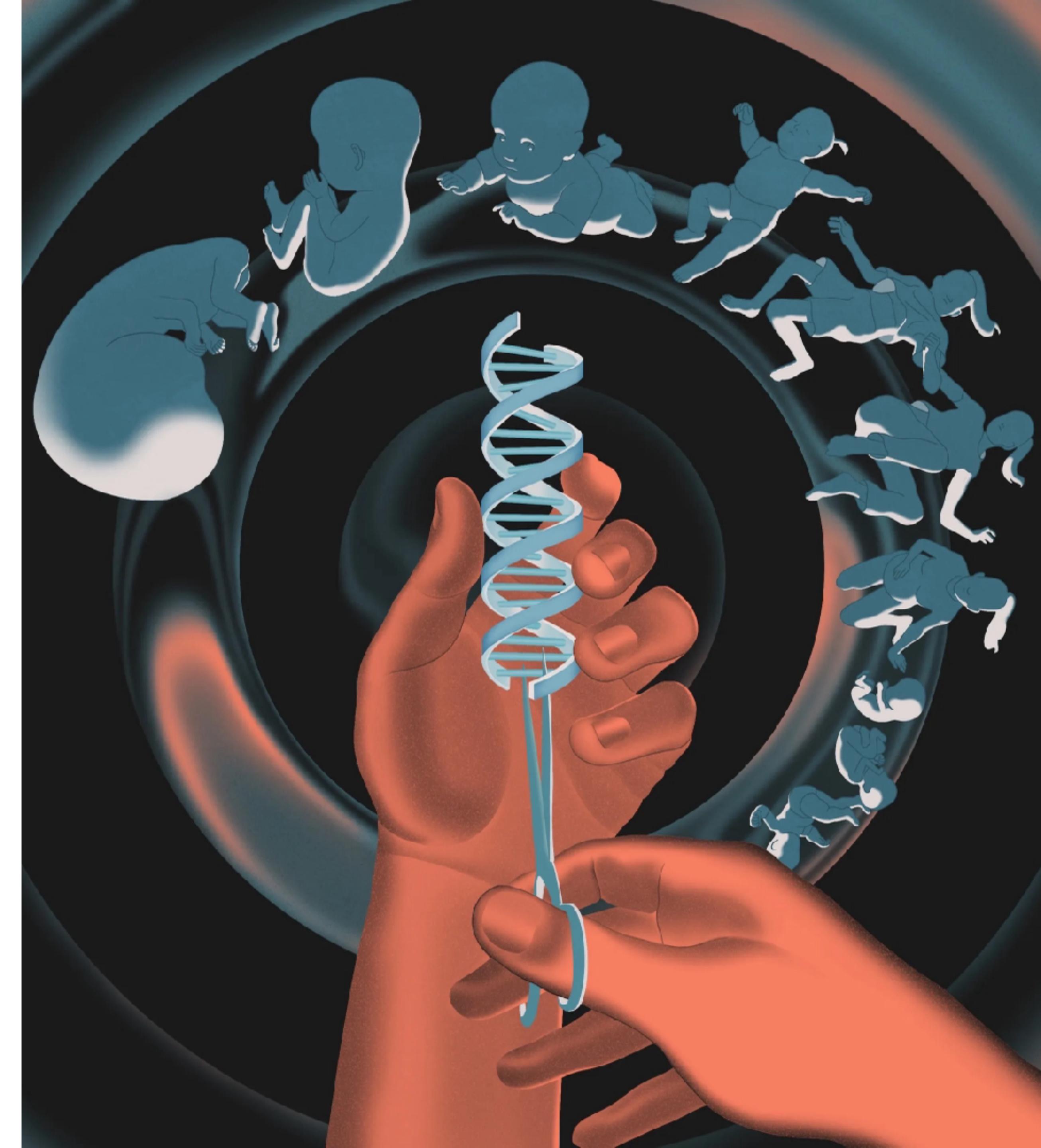
CRISPR in Agriculture

- **Enhancing Crops:** Makes plants resistant to drought, pests, and diseases.
- **Reducing Allergens:** Removes allergy-causing proteins from foods.
- **Climate Impact:** Can help modify plants to absorb more CO₂.



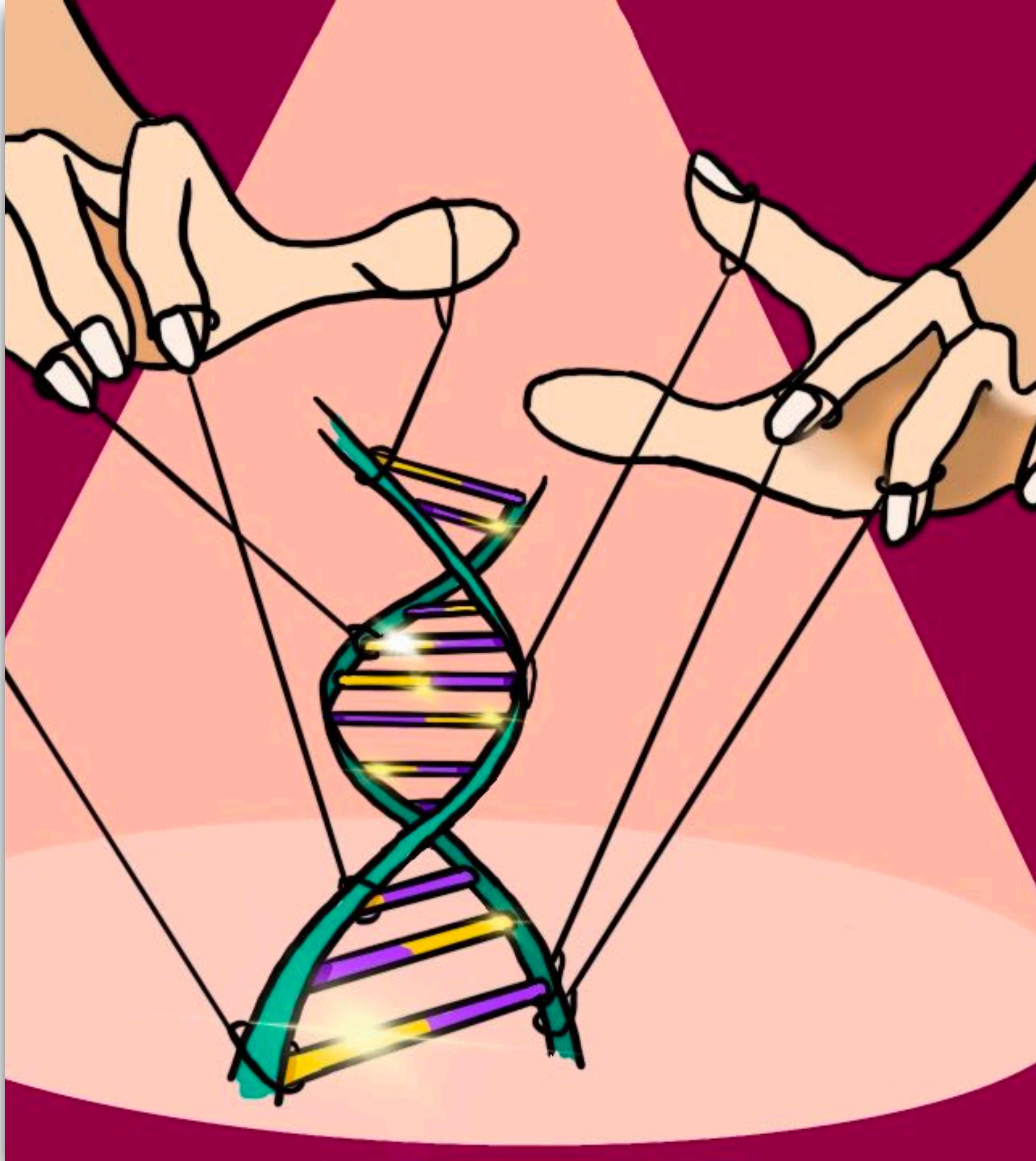
CRISPR and Disease Prevention

- Can prevent genetic diseases before birth.
- Modifies mosquito genes to reduce malaria transmission.
- Helps diagnose and remove viral DNA from infected cells.



Ethical Concerns of CRISPR

- Should we edit human embryos?
- Risk of unintended genetic changes.
- Could lead to social inequality (e.g., "designer babies").
- Need for ethical regulations and responsible use.



The Future of CRISPR

- CRISPR research continues to improve accuracy and efficiency.
- Potential applications in biofuels and carbon capture.
- Scientists must ensure safe and ethical use.



