

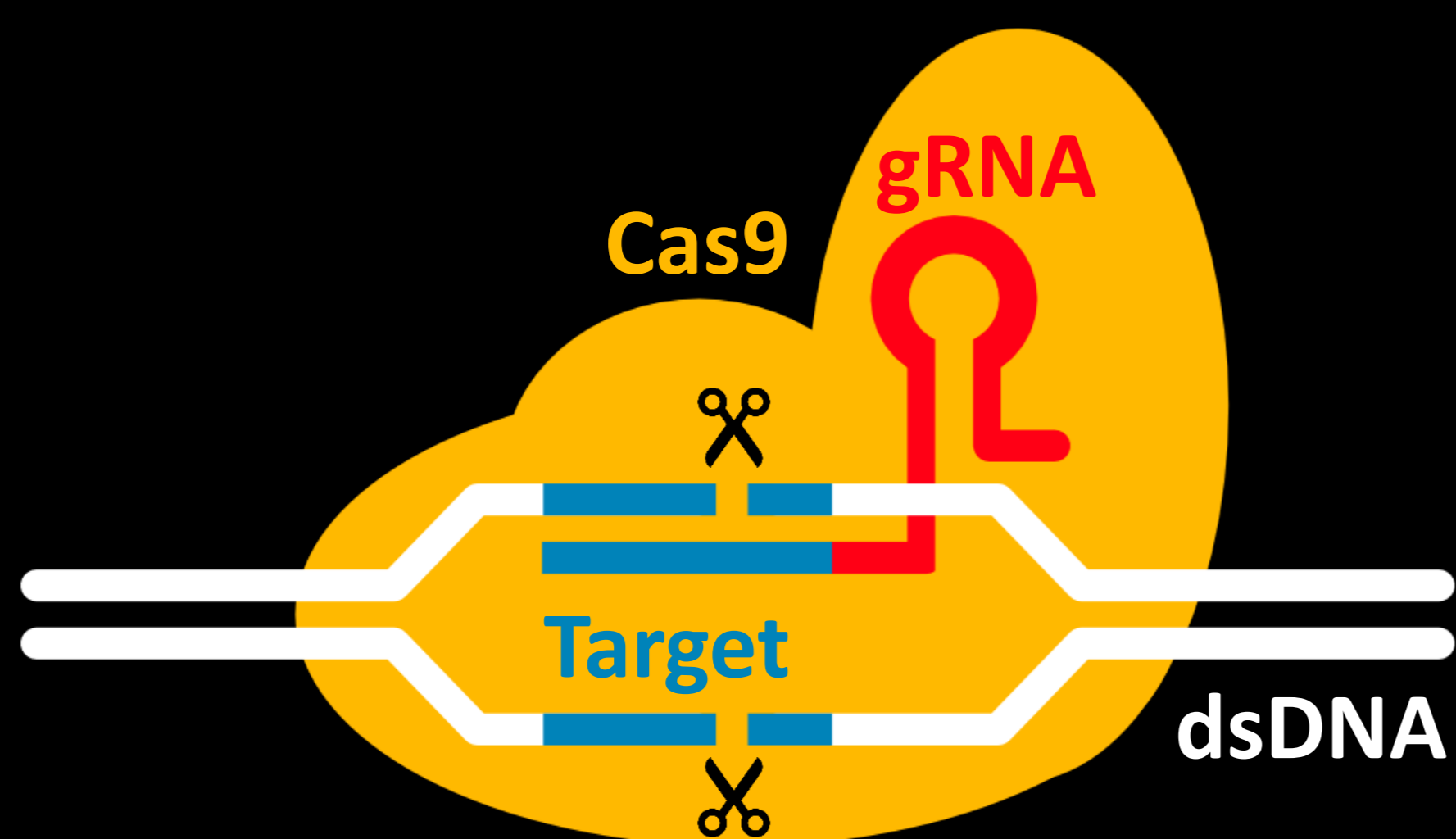
# CRISPR-Cas9

## A revolutionary DNA editing tool

### What is CRISPR-Cas9?

CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) are DNA sequences used by bacteria to defend themselves from attacks by viruses. These sequences are derived from viruses that have previously attacked the bacteria. Upon repeat infection by the same virus, the CRISPR DNA guides the Cas endonuclease to the viral genome and cleaves it, thereby preventing infection. In scientific research, it has been repurposed for gene editing in cells.

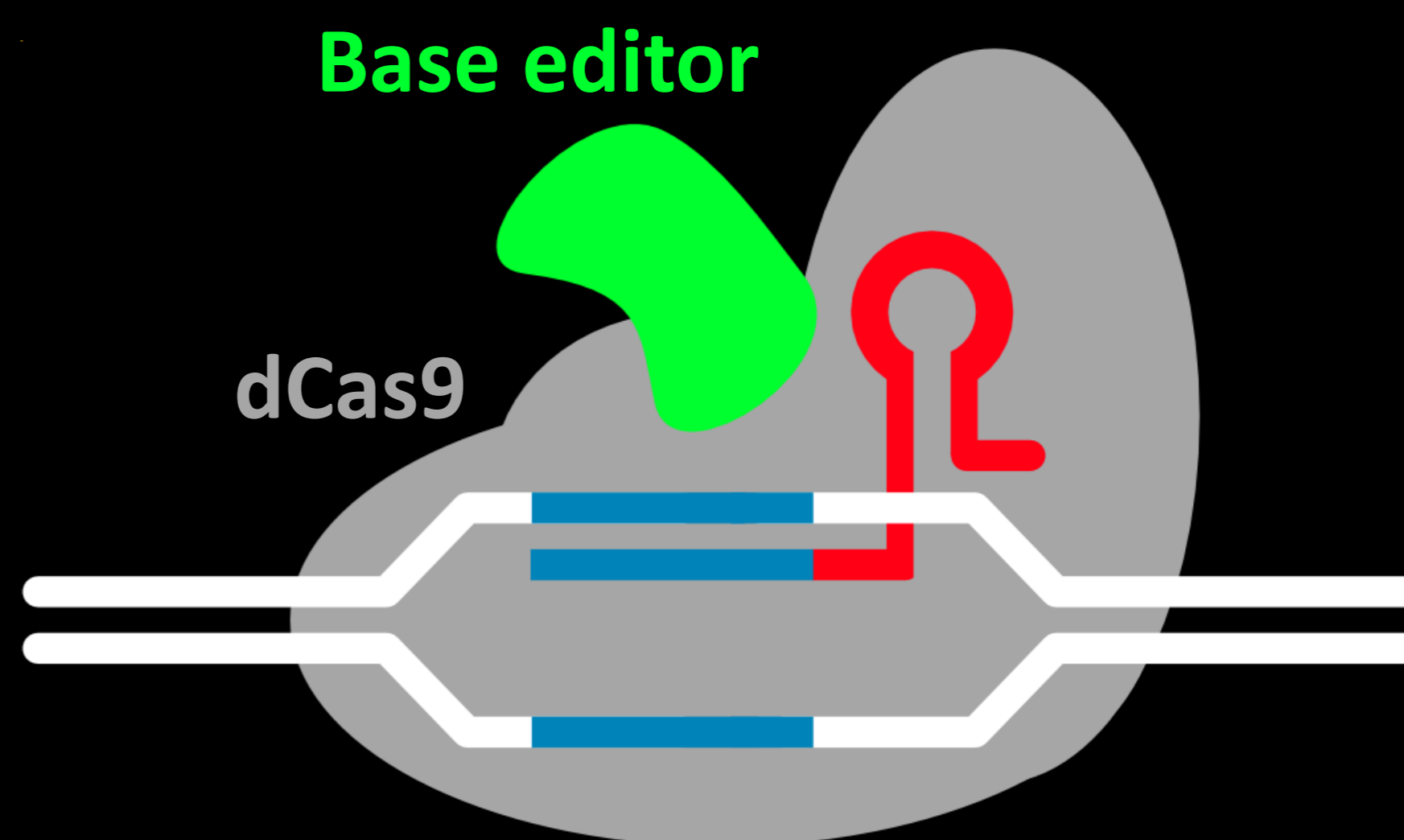
### Editing DNA with Cas9



1

Cas9 binds to a guide RNA strand that is complementary to the target DNA sequence.

Cas9 cuts the target DNA, and the cell repairs the cut. During the repair process, the gene is either disrupted or replaced if a template is provided.



2

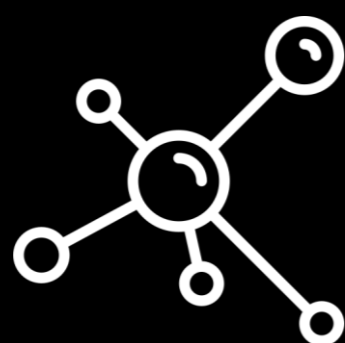
Catalytically inactive/dead Cas9 (dCas9) is fused to a DNA base editor. The fusion protein binds to a guide RNA strand which directs it to the target DNA sequence.

At the target DNA, the base editor converts one base into another base.

### DNA editing: The good...



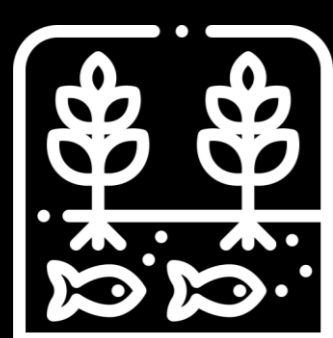
Cure genetic diseases



Study protein function



Screen for gene knockouts



Greater yields/better food and animal products



Understand cancer progression

### ...and the ugly



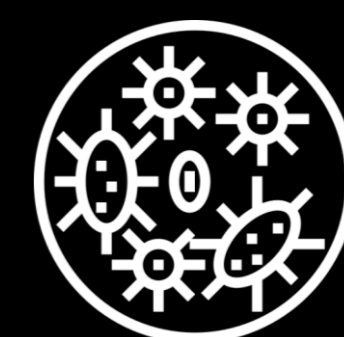
Permanent



Abuse of gene editing technology



Potentially dangerous imprecise editing



Adaptation by pathogens

References:

- [1] Eid, et al. (2018). *Biochem J.* 475(11): 1955-1964.
- [2] Hu, et al. (2018). *Nature.* 556(7699): 57-63.