

A detailed 3D molecular model showing the Cas9 protein (tan) bound to a DNA double helix (blue and purple spheres). The protein is shown in a surface representation, and the DNA is shown as a space-filling model. Two bright yellow-orange spots are visible on the DNA, indicating the sites of Cas9-mediated cleavage. The background is dark purple.

CRISPR/Cas9 & Genome-wide CRISPR Screens

Harris Hunter & Franky Shi



What is gene editing?

Gene editing is the use of technology to change an organism's DNA.

Why is gene editing important?



Cystic Fibrosis



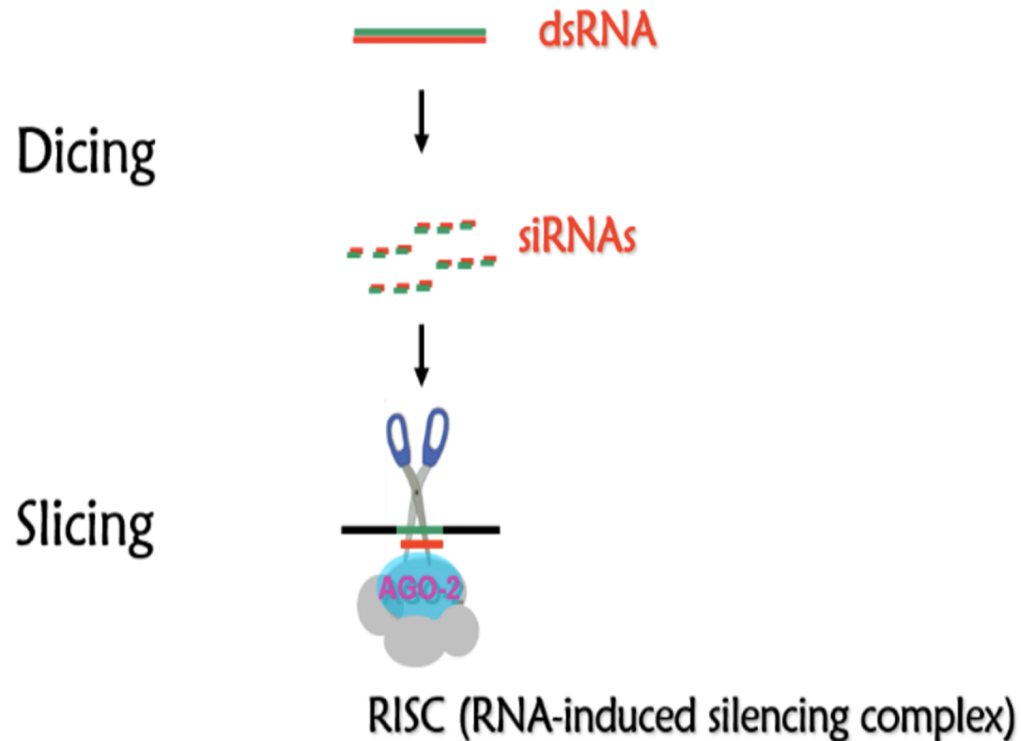
Huntington's Disease



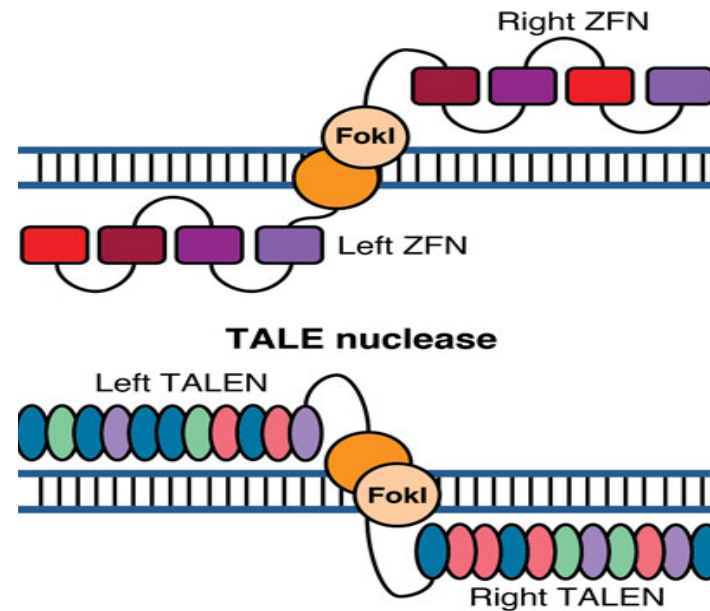
Hemophilia

Many researchers are currently using gene editing to cure disorders.

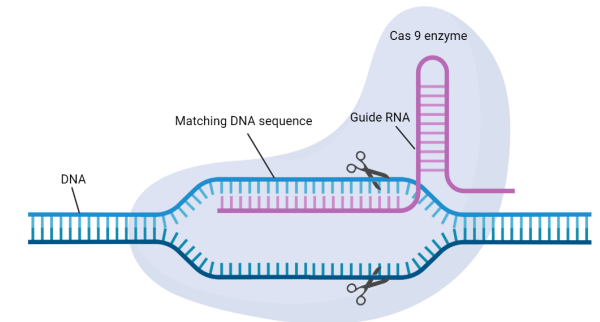
What are some ways to perform gene editing?



RNAi



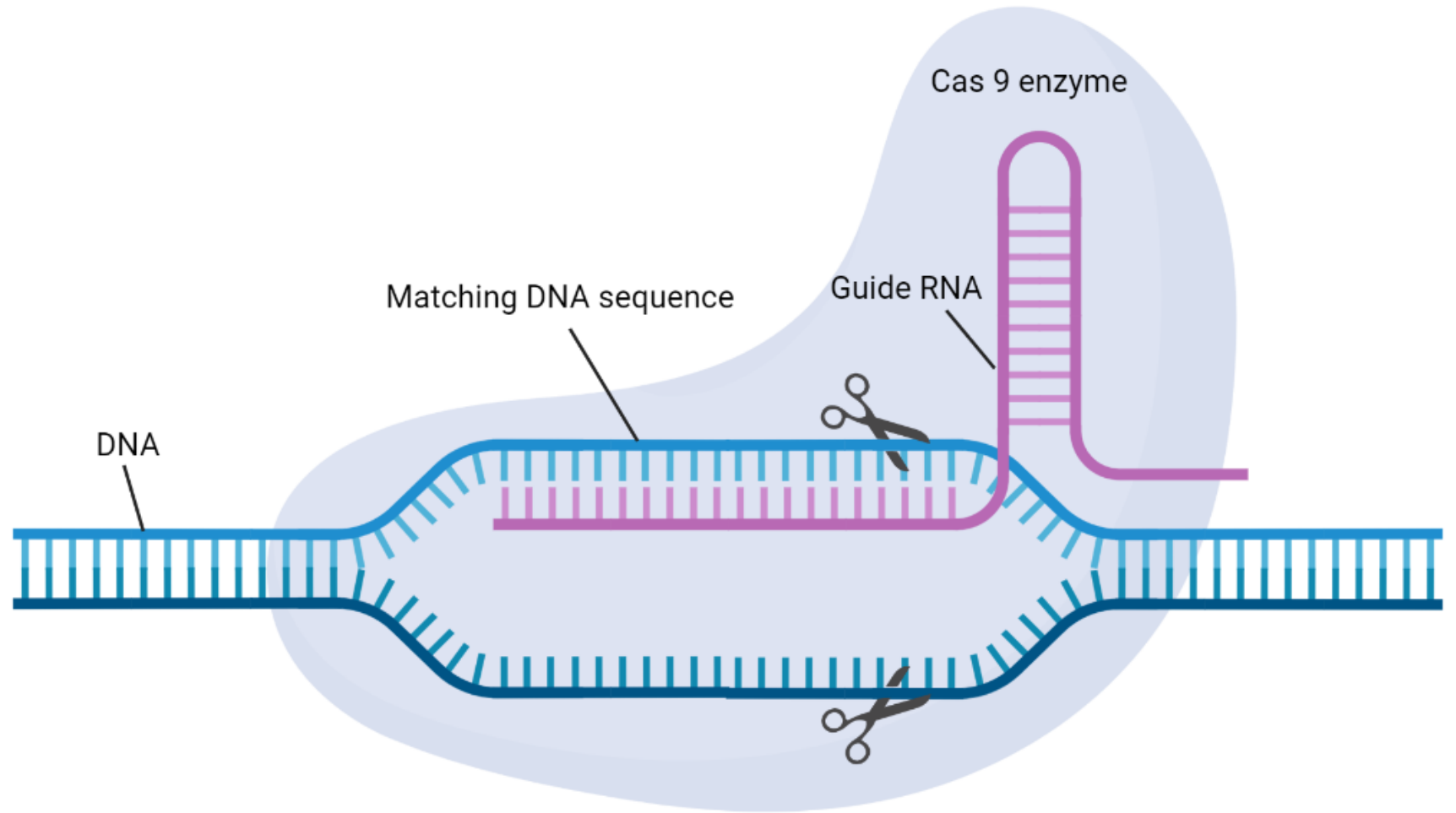
ZFNs/TALENs



CRISPR/CAS9

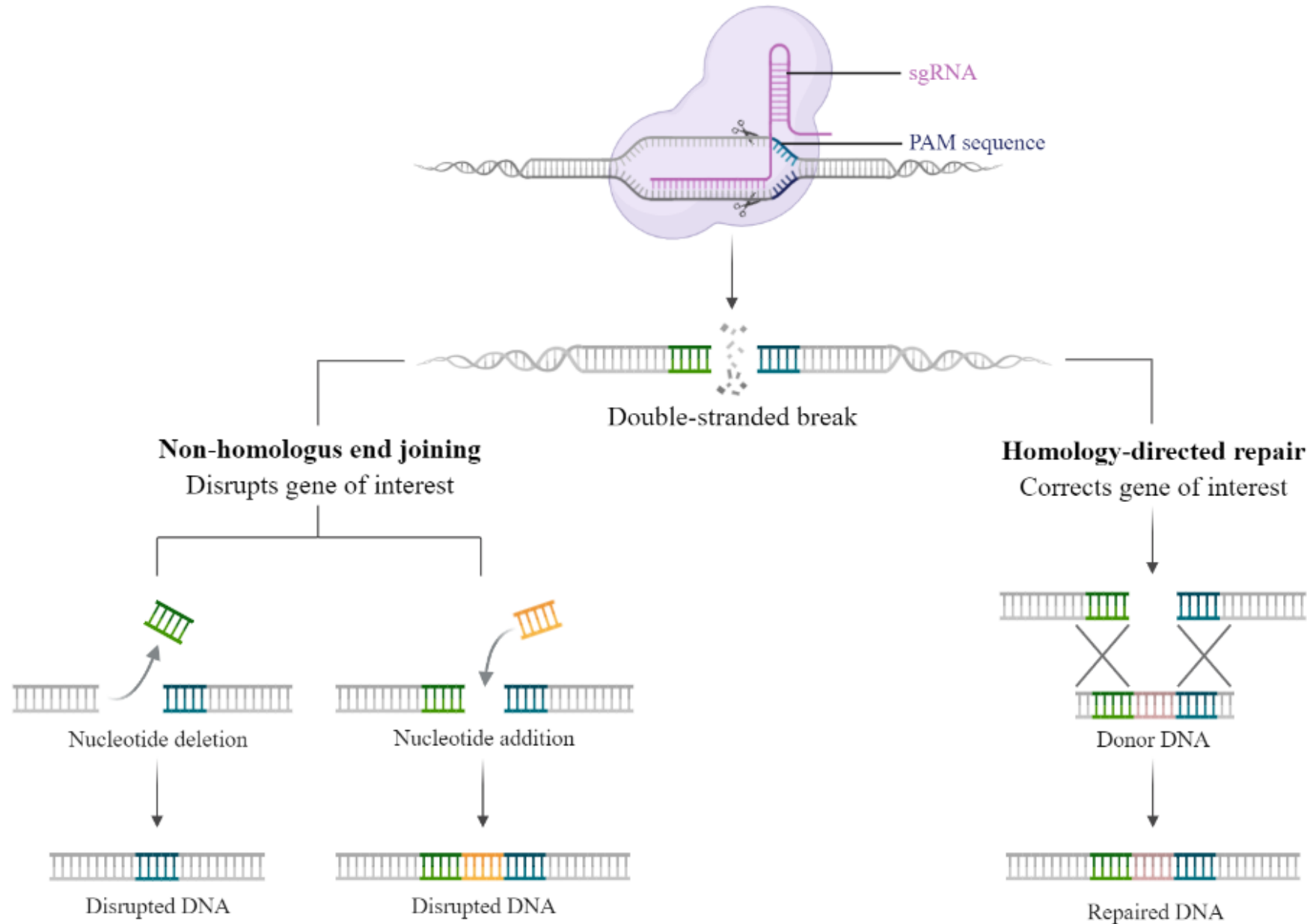
What is CRISPR/Cas9?

Clustered
Regularly
Interspaced
Short
Palindromic
Repeats



This technique uses CRISPR and the Cas 9 protein nuclease to edit the genome.

How does the CRISPR-CAS9 gene editing system work?

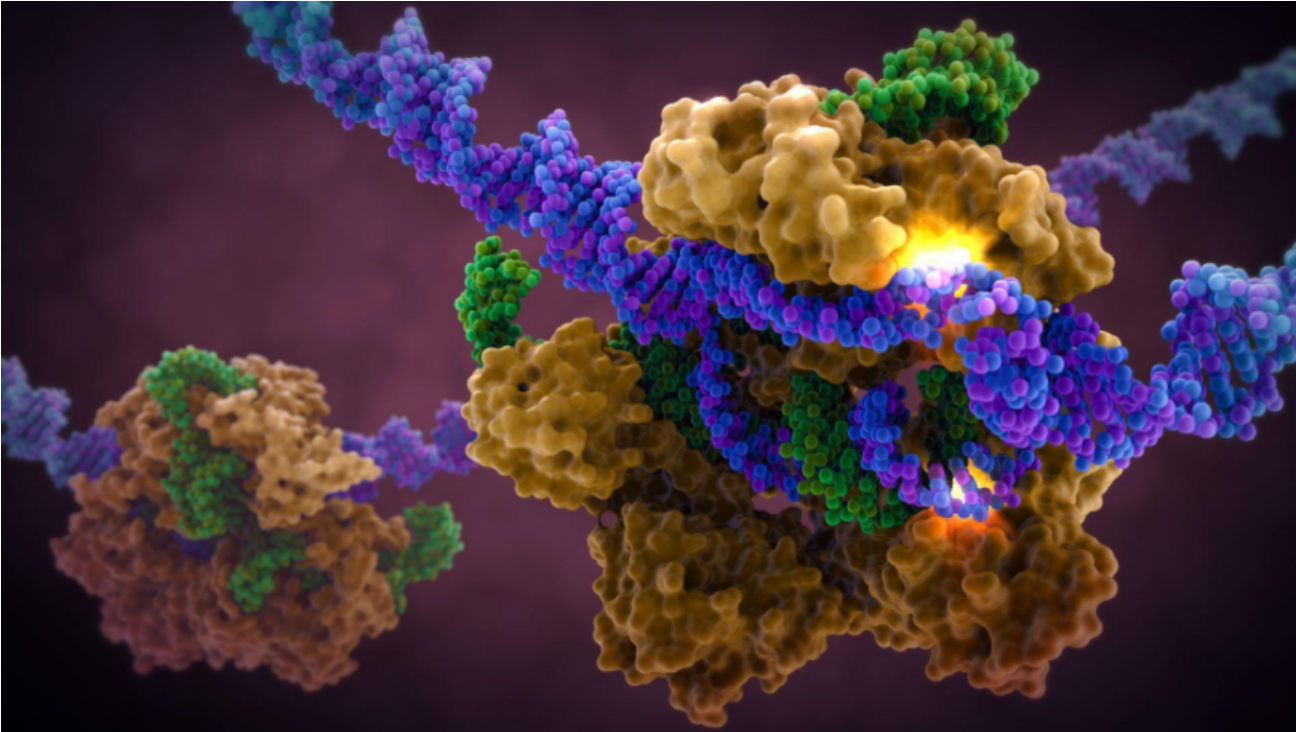


Who discovered CRISPR/Cas9?

nature

Oct. 2020, Jennifer Doudna and Emmanuelle Charpentier receive Nobel Prize for discovery of CRISPR/Cas 9

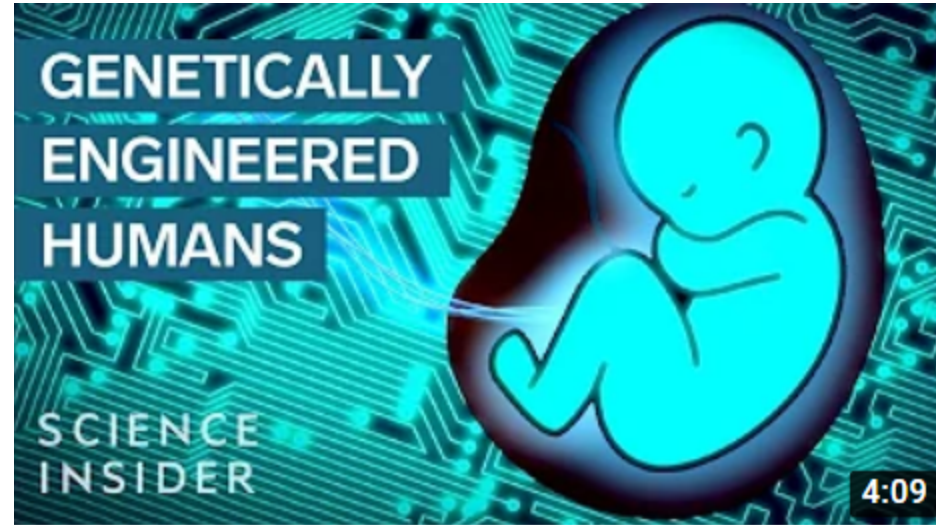
Why has CRISPR revolutionized science?



It allows us to manipulate genetic sequences in any species

We can perform genome wide editing and screens

What can CRISPR do in humans? movie



YouTube video: 4min

<https://www.youtube.com/watch?v=kkvslrfaCLY>

What are the pros and cons of CRISPR/Cas9?



Advantages:

Fast

Affordable

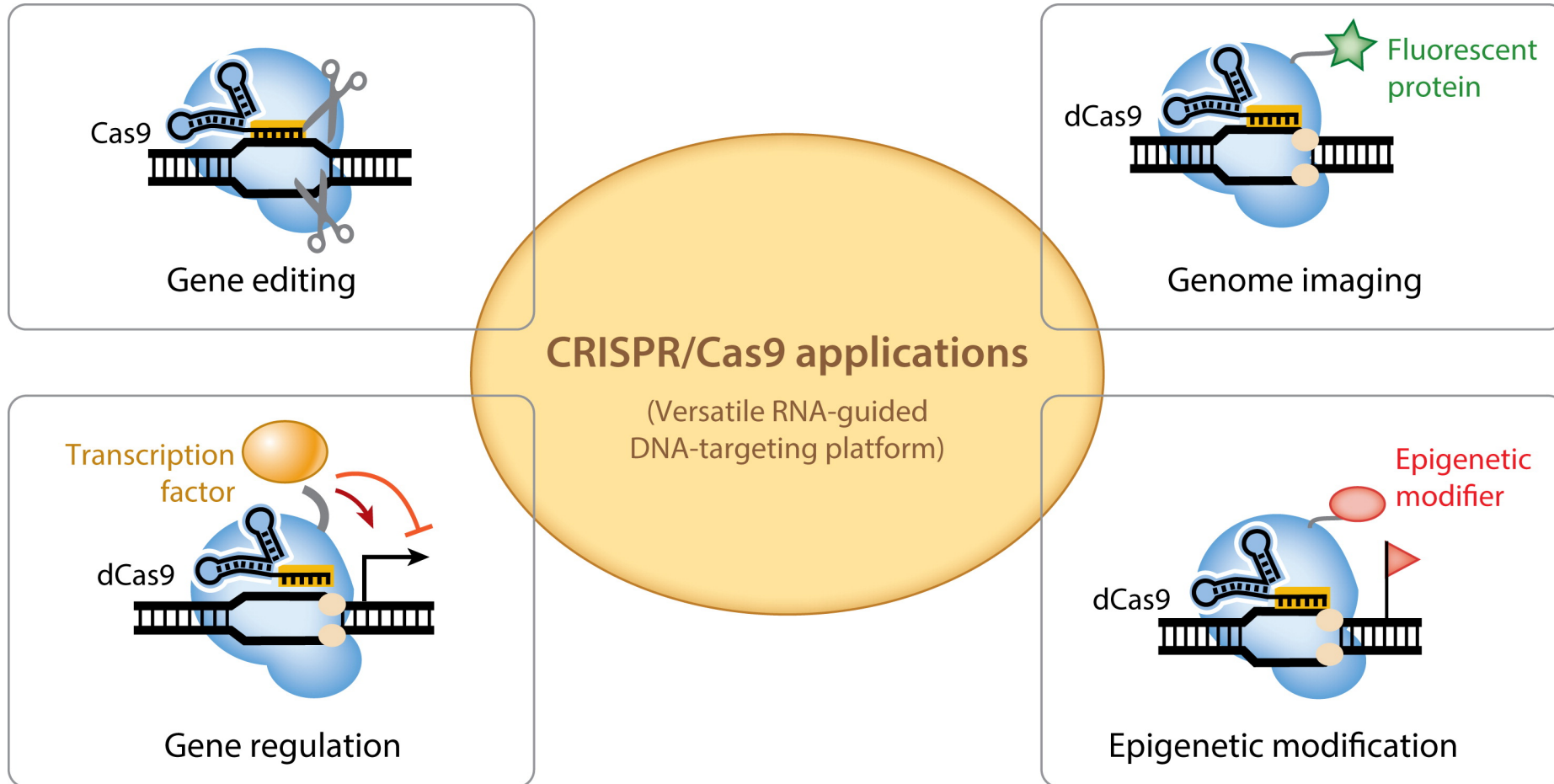
More accurate and efficient

Disadvantages:

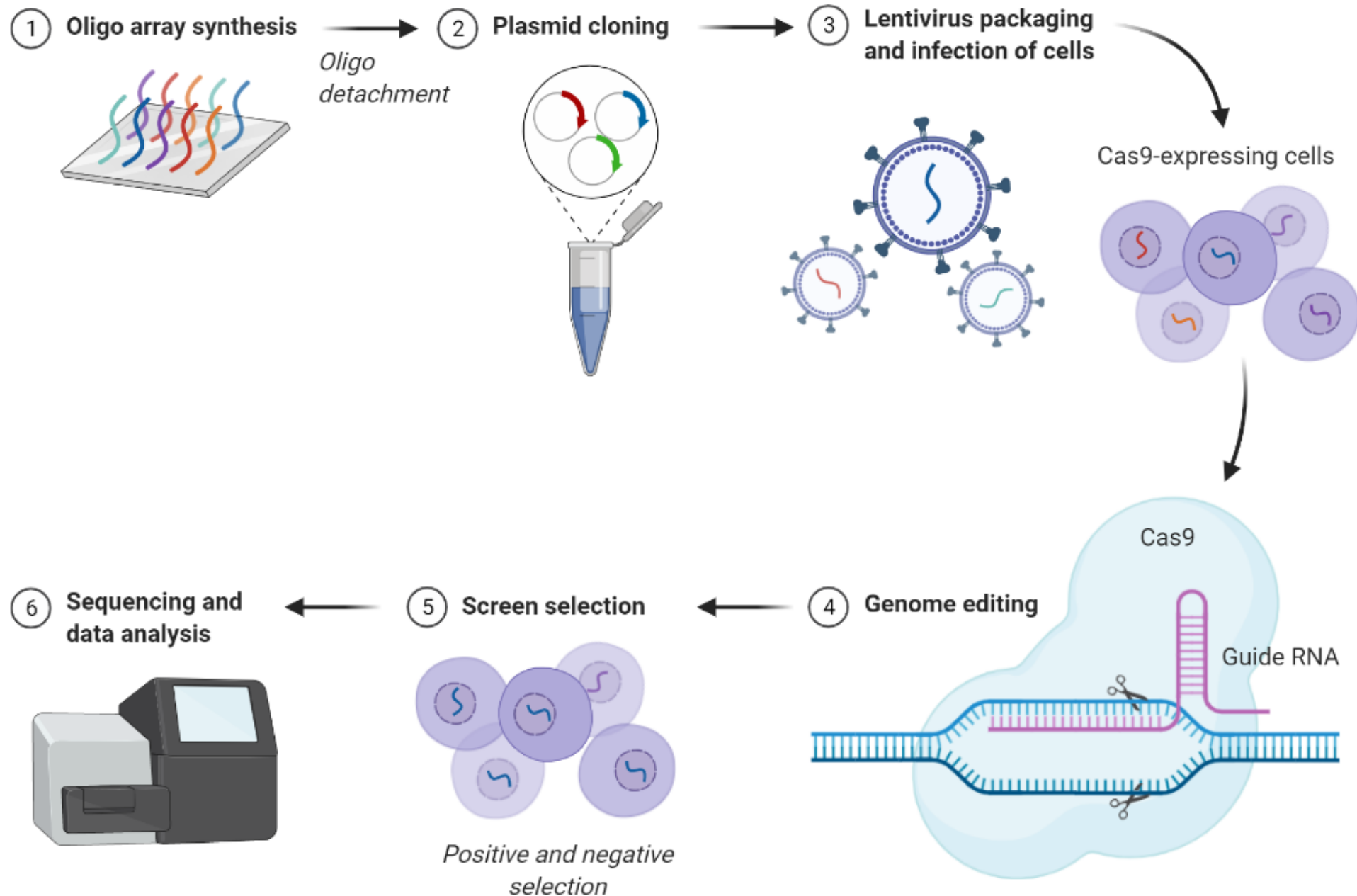
Can cause unintended mutations or loss of genomic sequence

Unethical

What are some other applications of CRISPR/Cas9?

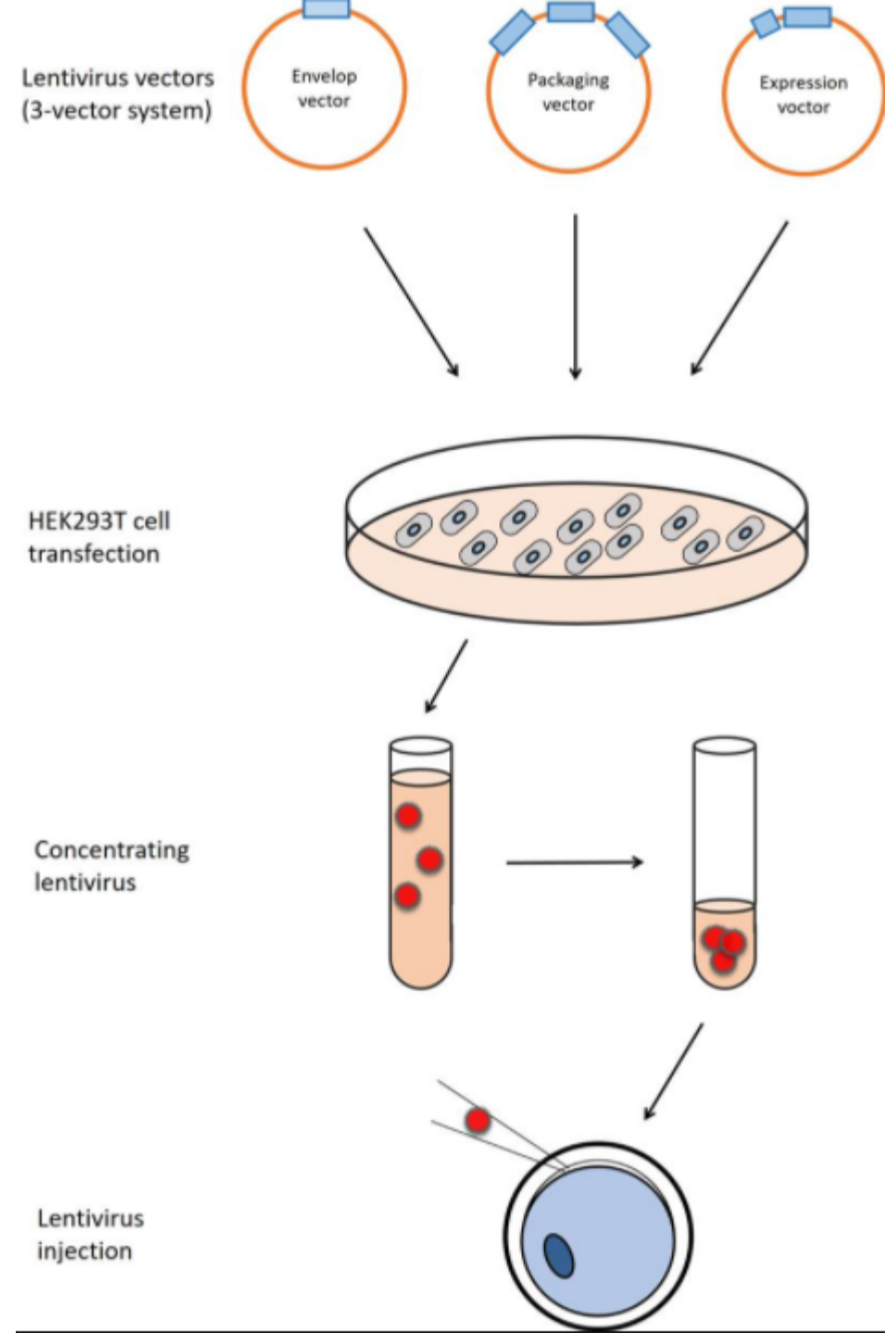


How can CRISPR be used in a genome-wide screen?

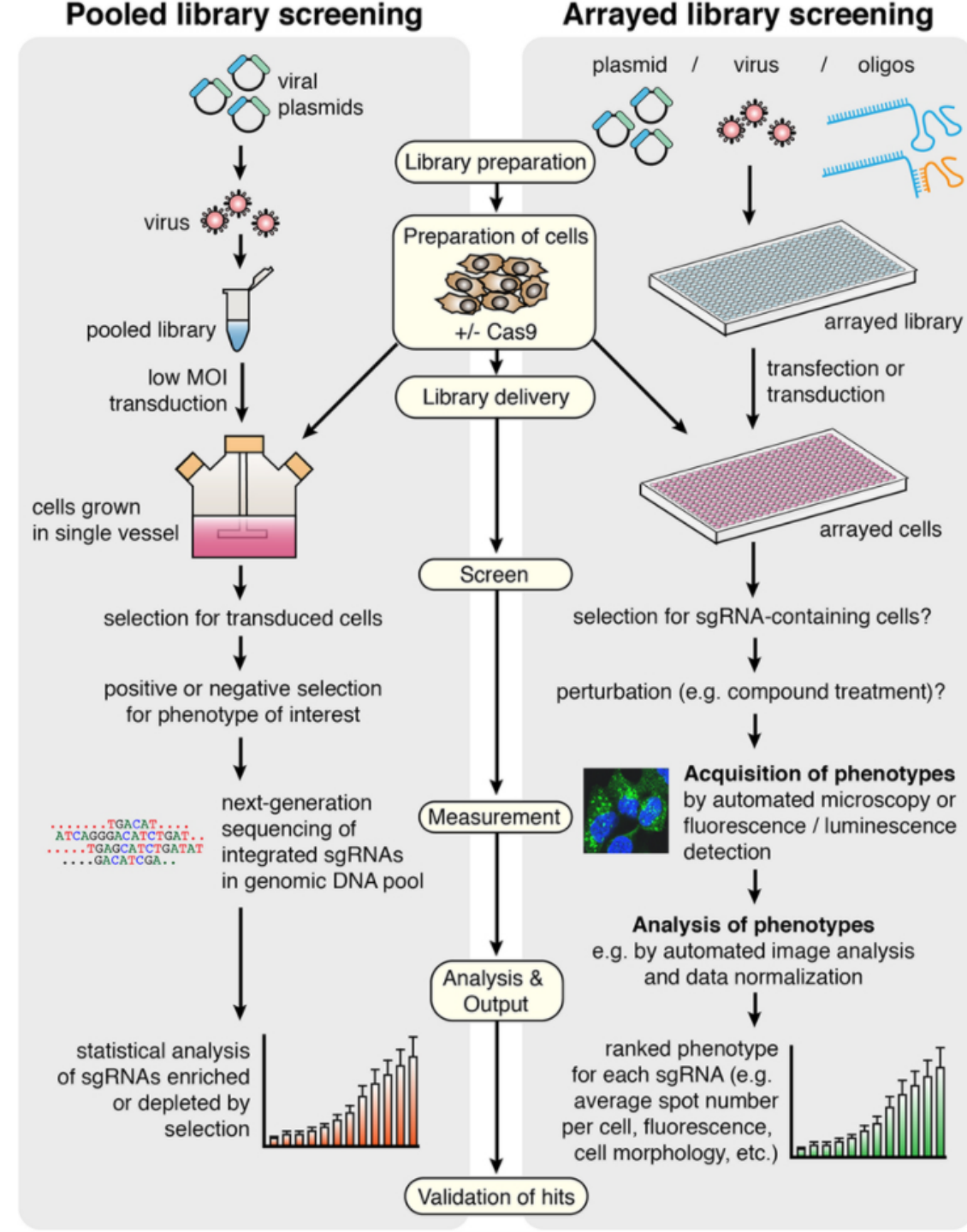


What are lentiviruses and how are they moved into the cell?

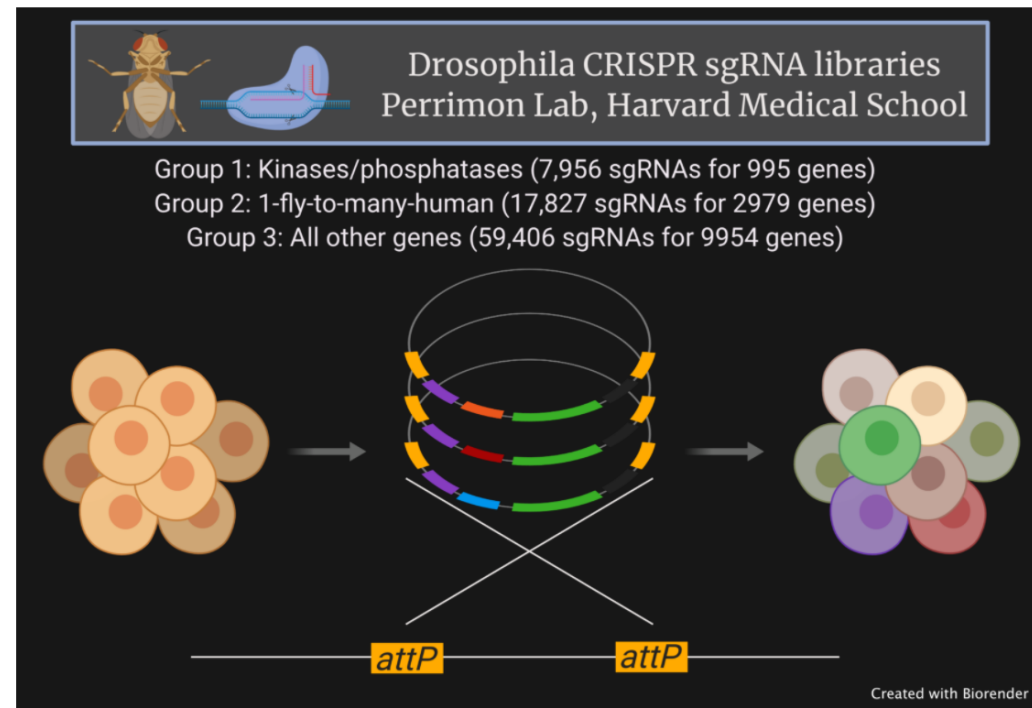
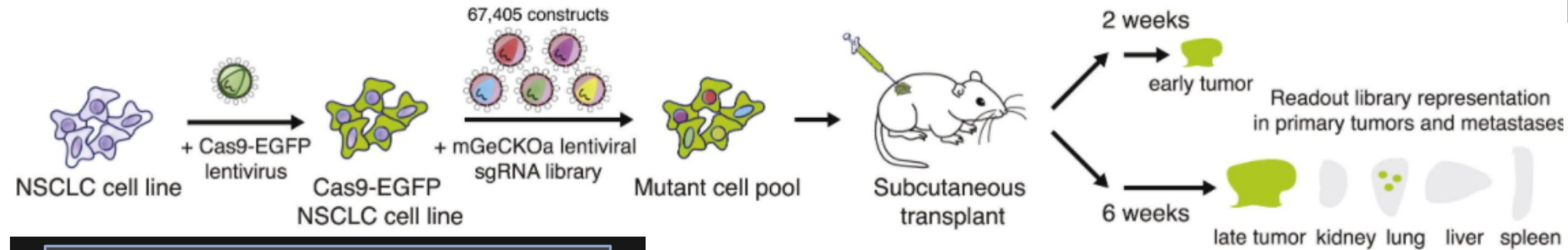
Lentiviruses are viral RNA that is converted to DNA by transfection and transduction.



There are two types of genome-wide CRISPR screens



What model organisms do genome wide CRISPR screens use?



Mice and drosophila are common model organisms used in genome wide screens.

How has CRISPR been used to understand SARS-CoV-2 biology?

Cell

Leading Edge

Preview

A Crisp(r) New Perspective on SARS-CoV-2 Biology

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<https://doi.org/10.1016/j.cell.2020.12.003>

Complementary genome-wide CRISPR-Cas9 screens performed by multiple groups reveal new insights into SARS-CoV-2 biology including aspects of viral entry, translation, replication, egress, and the genes regulating these processes. Comparisons with other coronaviruses enhances our understanding of the cellular life cycle of this medically important family of emerging viruses.

CellPress

JOURNAL OF DRUG TARGETING
<https://doi.org/10.1080/1061186X.2020.1769637>

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REVIEW

CRISPR-cas systems based molecular diagnostic tool for infectious diseases and emerging 2019 novel coronavirus (COVID-19) pneumonia

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ABSTRACT

Emerging infectious diseases, the persistent potential for destabilising pandemics, remain a global threat leading to excessive morbidity and mortality. The current outbreak of pneumonia caused by 2019 novel coronavirus (COVID-19) illustrated difficulties in lack of effective drugs for treatment. Accurate and rapid diagnostic tools are essential for early recognition and treatment of infectious diseases, allowing timely implementation of infection control, improved clinical care and other public health measures to stop the spread of the disease. CRISPR-Cas technology speed up the development of infectious disease diagnostics with high rapid and accurate. In this review, we summarise current advance regarding diverse CRISPR-Cas systems, including CRISPR-Cas9, CRISPR-Cas12 and CRISPR-Cas13, in the development of fast, accurate and portable diagnostic tests and highlight the potential of CRISPR-Cas13 in COVID-19 Pneumonia and other emerging infectious diseases diagnosis.

ARTICLE HISTORY

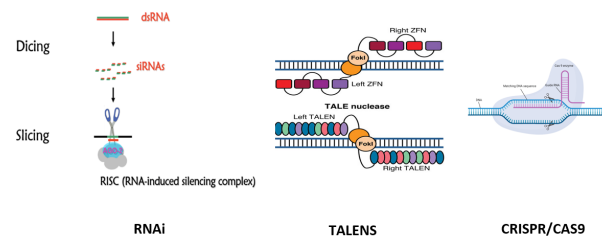
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KEYWORDS

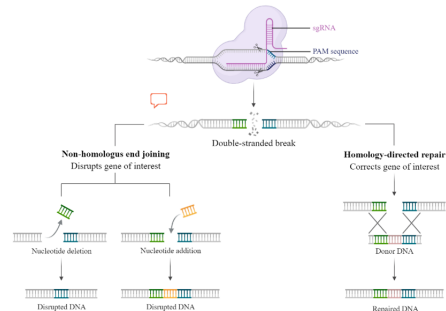
CRISPR-Cas; diagnostics;
infectious diseases;
COVID-19

CRISPR/Cas9 Summary

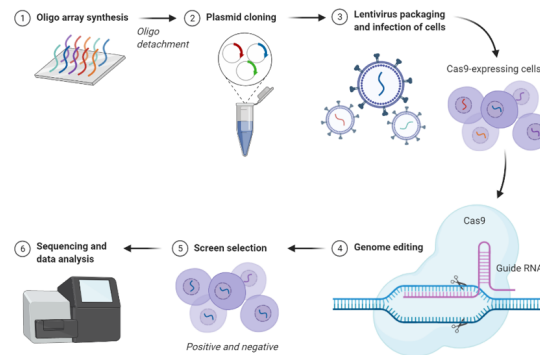
What are some ways to perform gene editing?



How does the CRISPR-CAS9 gene editing system work?



How can CRISPR be used in a genome-wide screen?



Gene editing is used to modify DNA

CRISPR/Cas9 is a gene editing tool that targets and cleaves DNA to edit and regulate genes

CRISPR is used for genome-wide screens to analyze gene functions

Recent advancements?

News & Views | Published: 12 February 2021

XENO-ORGAN TRANSPLANTATION

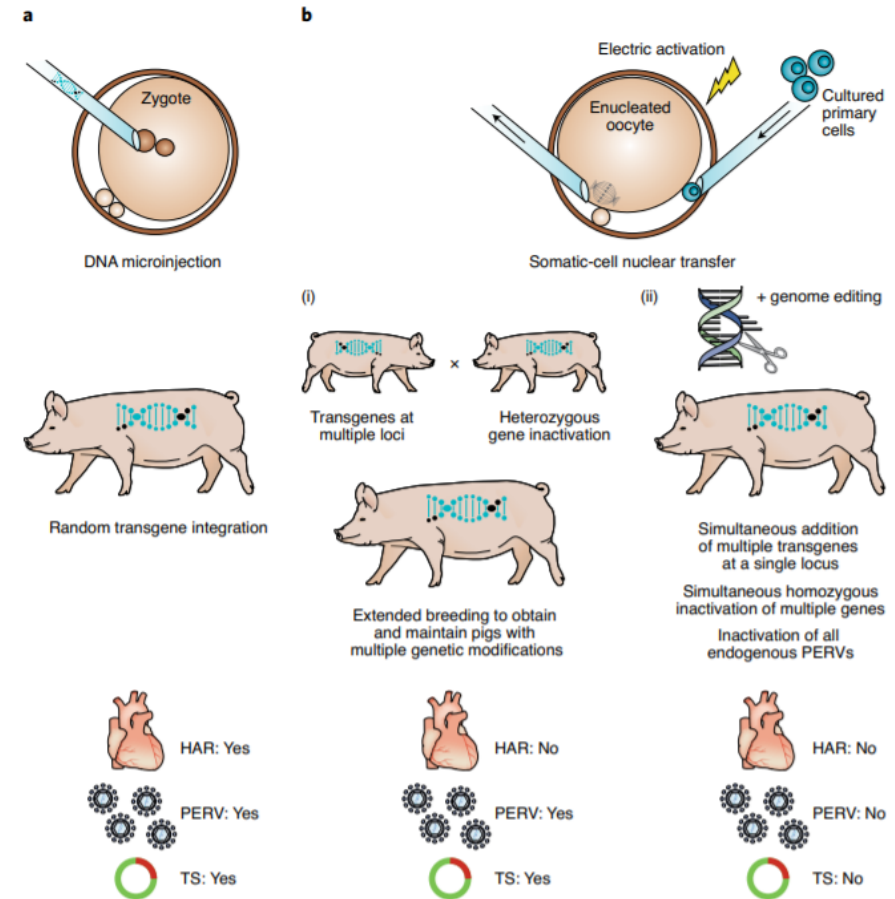
Extensively edited pigs

Konrad Fischer & Angelika Schnieke ✉

Nature Biomedical Engineering 5, 128–129(2021) | [Cite this article](#)

207 Accesses | 10 Altmetric | [Metrics](#)

By using CRISPR and transposon constructs, pigs have been genetically modified to inactivate endogenous retroviruses and to enhance the compatibility of their organs with the human immune and coagulation systems.



CRISPR is being used to modify pigs so that their organs have more compatibility with human organs.

References

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<https://doi.org/10.1038/s41551-021-00684-2>

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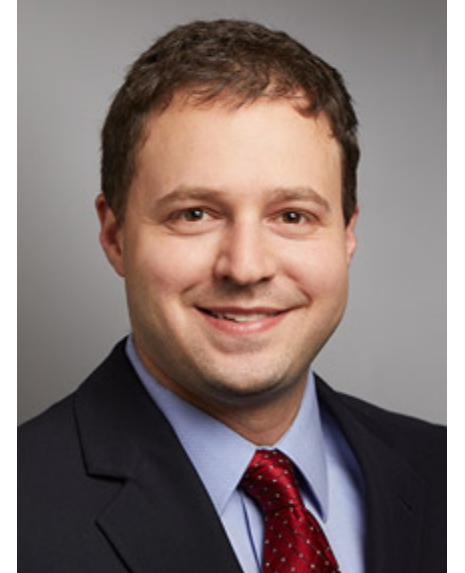


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