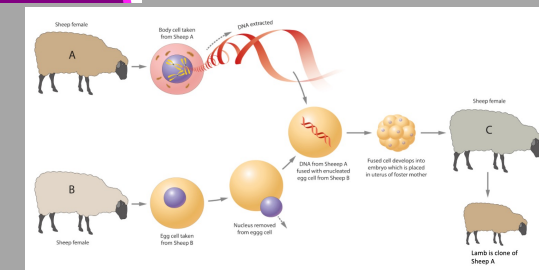
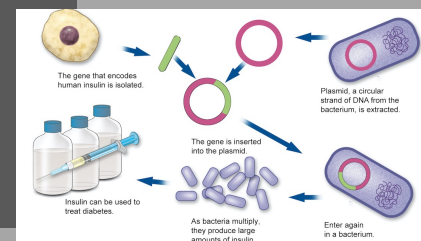
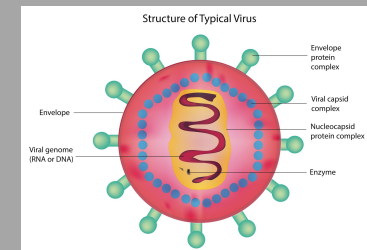
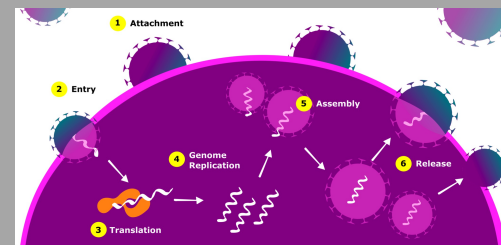
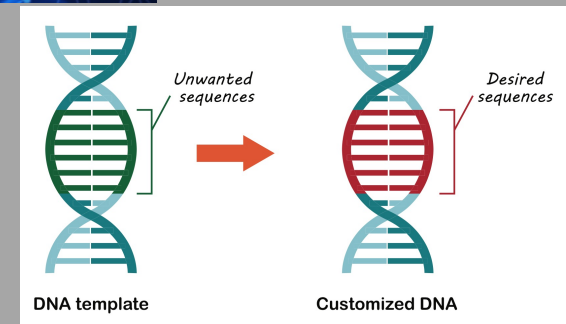
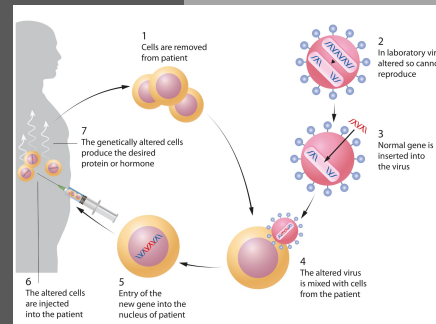


Genetic Engineering and Gene Therapy

- What Genetic Engineering is
- Case Study – Insulin Production
- CRISPR Technology
- Biopharming
- Transgenic Organisms
- Viruses and Gene Therapy
- Creating Vaccines using Viral Vectors
- Cloning



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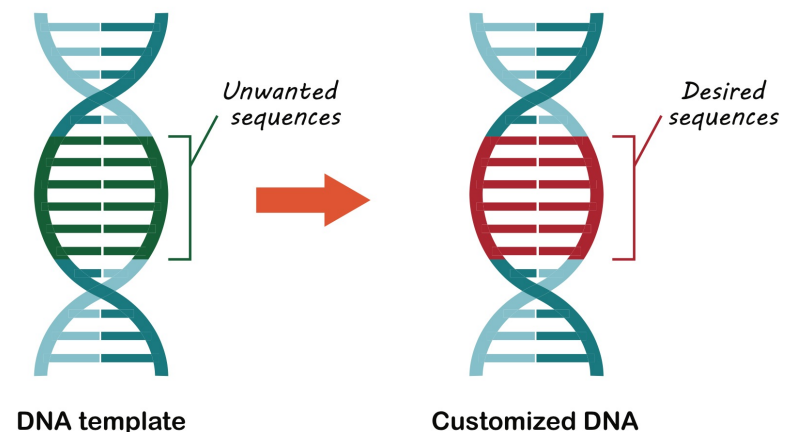
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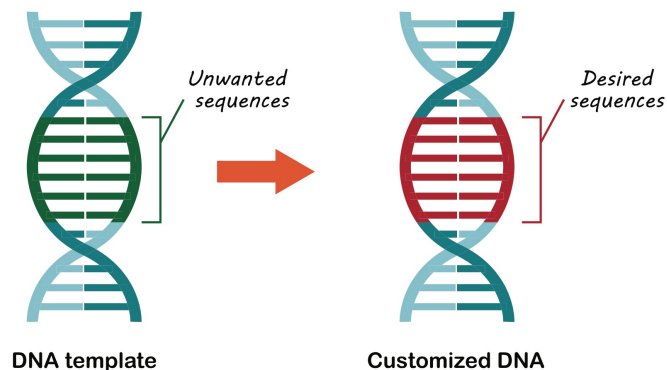
Genetic Engineering and Gene Therapy

- _____
- Genetic engineering involves the direct manipulation of one or more genes either by changing them directly or by adding a gene from another species to give it a desired result



Genetic Engineering and Gene Therapy

- _____
- This technique can either replace a disease-causing gene with a healthy copy of the gene or inactivate a disease-causing gene
- Additionally, a faulty gene can be altered inside the body to make it functional again – i.e. CRISPR



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VIDEO.**



1) Genetic Engineering

Example: Mass Producing Insulin to Treat Diabetes

- _____
- Many people require insulin injections to survive
- Insulin allows glucose to be transferred from the blood into cell
- Diabetes kills millions of people every year

DIABETES



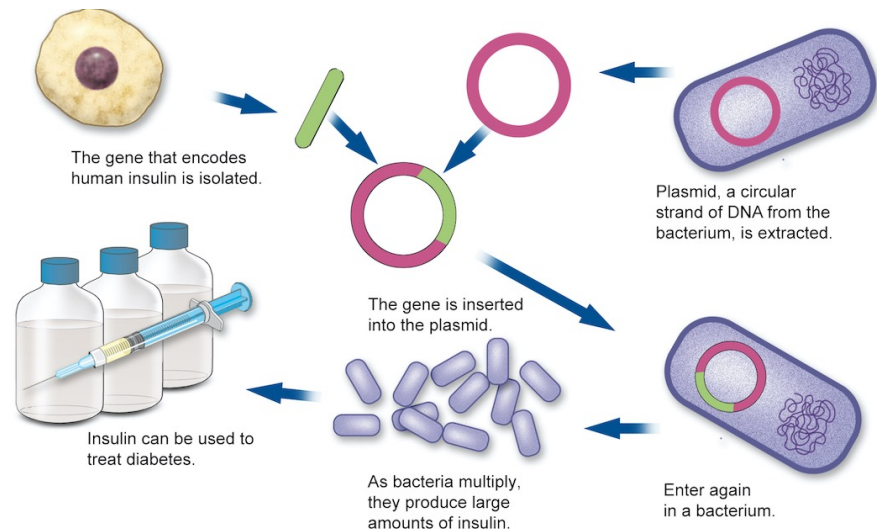
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Bacteria Insulin Production

- Due to the need, human insulin is now mass-produced
- To produce it, scientists insert the human insulin gene into the genome of bacteria
- The bacteria multiply and produce large amounts of insulin

- _____

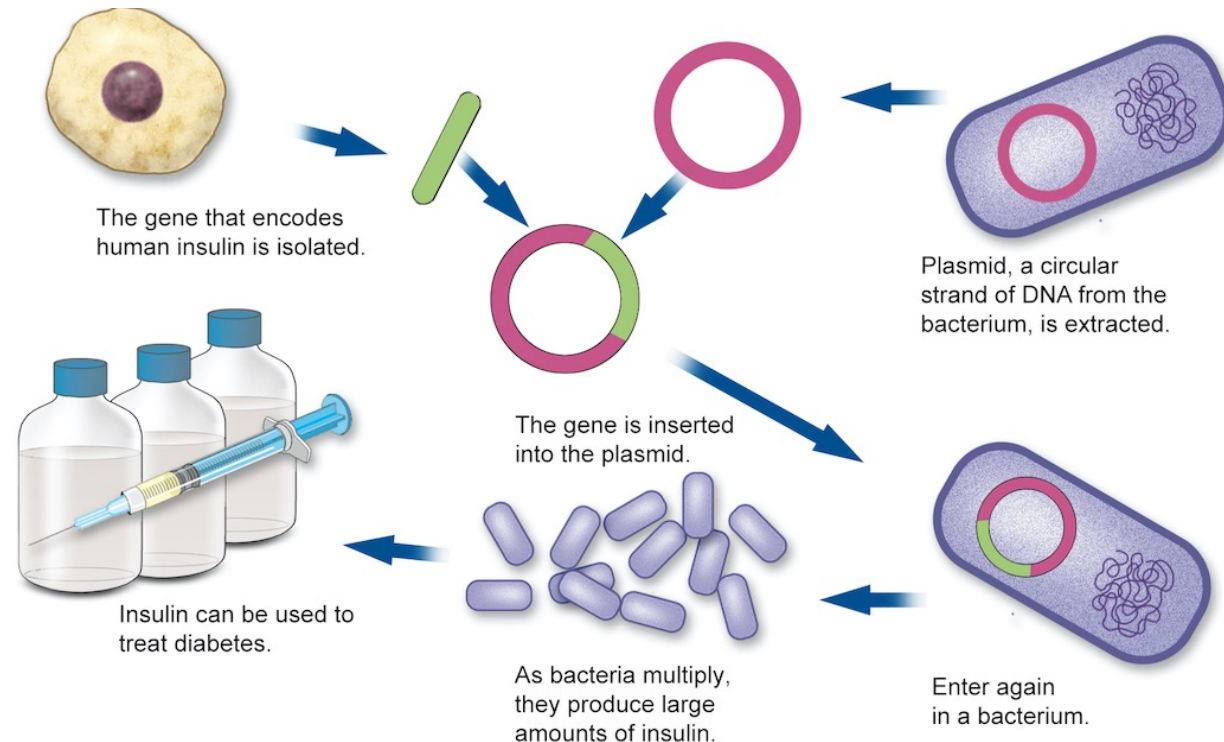


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Bacteria Insulin Production

- The DNA segment is then inserted into a bacterial plasmid using DNA ligase

- _____



CRISPR

- The “Holy Grail” of genetic engineering
- CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeats
- It was initially found in bacteria as part of their immune system

- _____

- _____

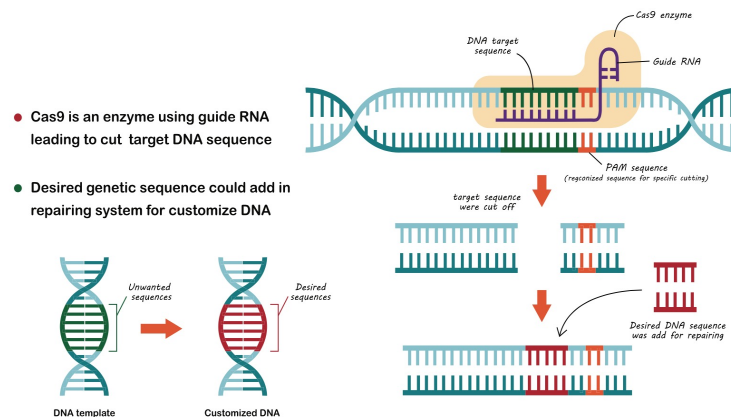


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CRISPR

- CRISPR uses two main components, short segments of DNA segments (CRISPR) and Cas proteins
- The

- This DNA is then copied into RNA which attaches to a different Cas9 protein which then moves around the cell

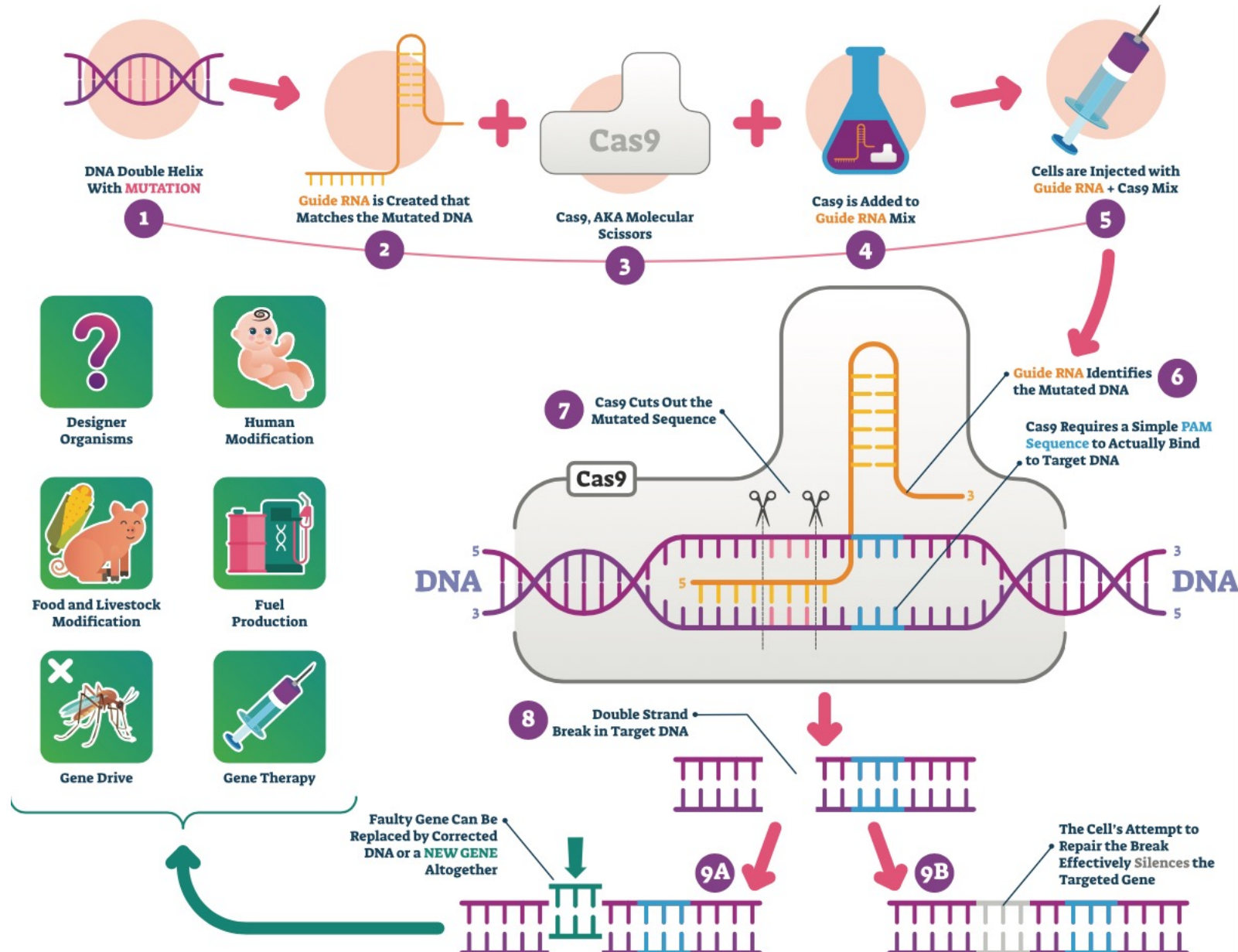


CRISPR

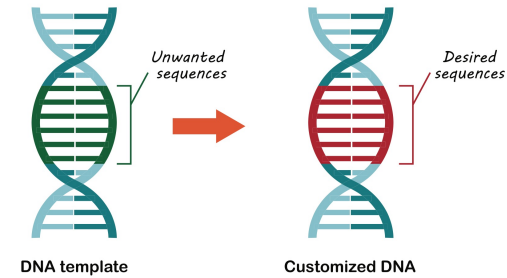
- We can use this technology to target any DNA in any organism
- _____
- This can mean eliminating a segment of DNA that causes diseases or enhancing a region to produce a particular protein we want created



CRISPR Technology



Biopharming



- “**Biopharming**,” involves the insertion of foreign genes into plant cells that code for medically important proteins such as therapeutic drugs or the ability to grow larger, produce required vitamins and minerals, or resist pests

- _____

- Scientists can use CRISPR technology to replace a segment of DNA with the desired one to produce these traits



Corn is the most commonly grown crop in the United States, and most of it is genetically modified to resist insect pests or tolerate herbicides.

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Transgenic Organisms

- If these genes are from another organism, the GMO now has genes from two different organisms
- An organism that has been changed by scientists to _____



- GMO crop examples include:



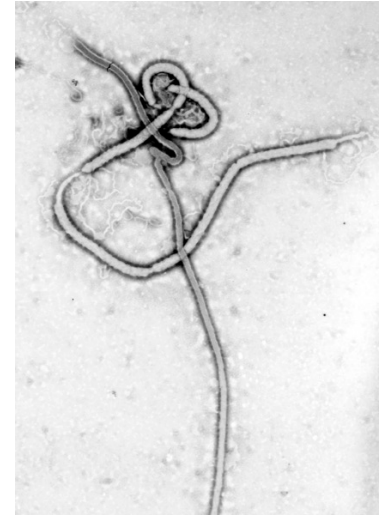
GMO	Benefit
Tomatoes	Better travel durability and flavor
Corn	Resistance to pests
Rice	Better vitamin content

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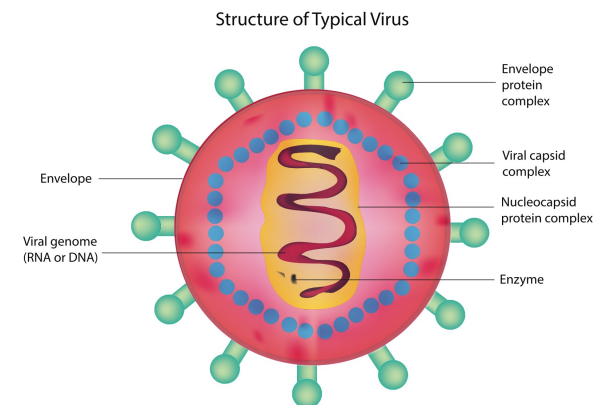
Viruses

- _____

- In addition to the capsid, some viruses are surrounded by an envelope
- The envelope is created when a virus

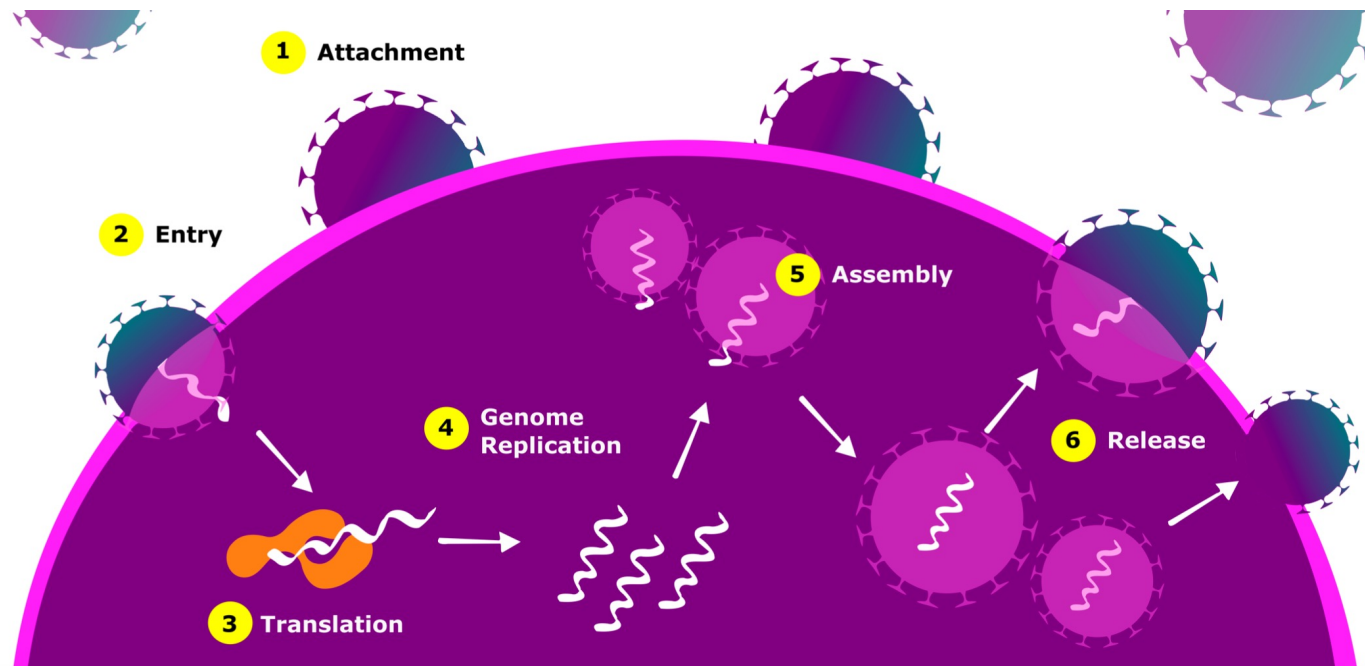


An electron micrograph of an Ebola virus



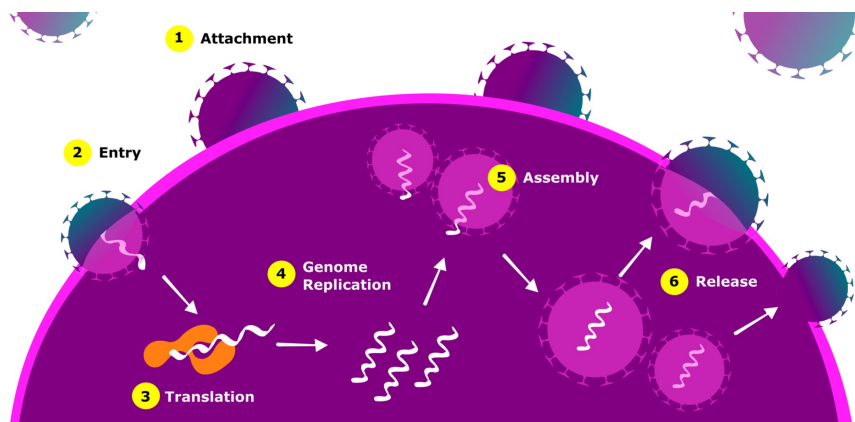
Viruses

- _____
- The viruses that use this enzyme are called retroviruses
- When a retrovirus infects a host cell, it injects its RNA genome along with the reverse transcriptase



- Using the cell's supply of materials, the reverse transcriptase copies the viral RNA to make a complementary molecule of single-stranded DNA
- The reverse transcriptase then directs the synthesis of a second DNA strand that is complementary to the first strand

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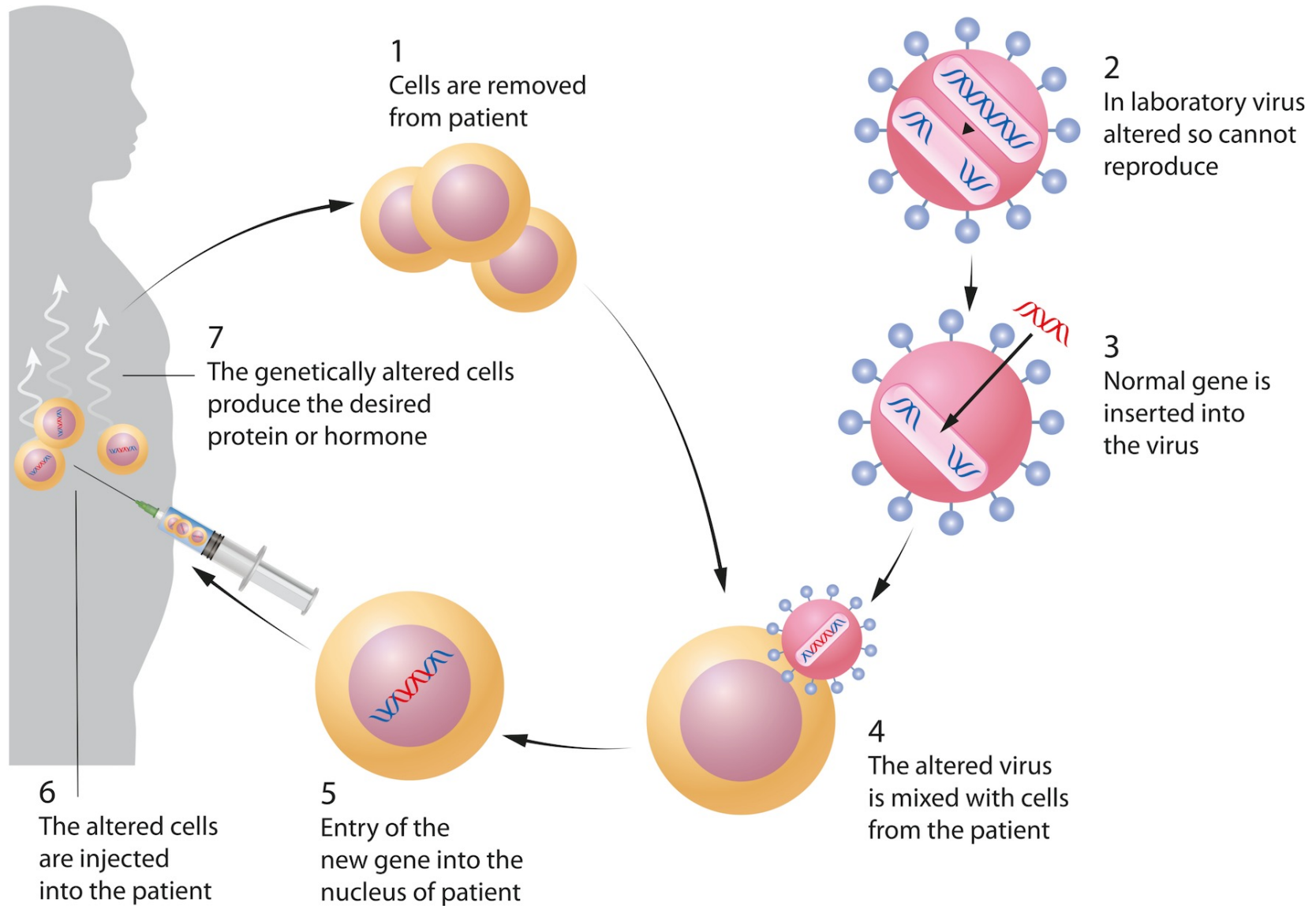
6) Retrovirus Replication

Viruses and Gene Therapy

- A gene can't simply be inserted directly into your cells
- It has to be delivered using a carrier called a vector
- A viral vector is a virus that is used to transfer the DNA from a donor to a host
- _____
- The most common gene therapy vectors are viruses because

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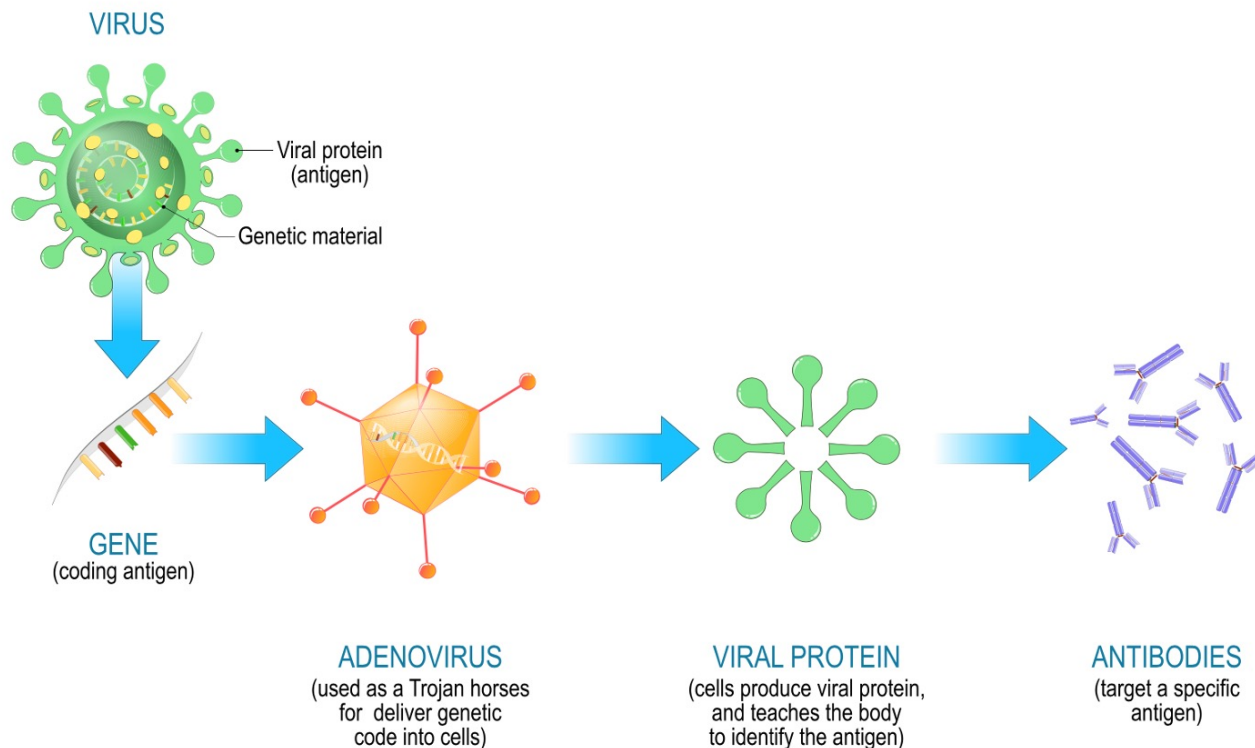
Viral Vector



Viral Vector Vaccine Creation

- Viral vectors can also be used to create vaccines

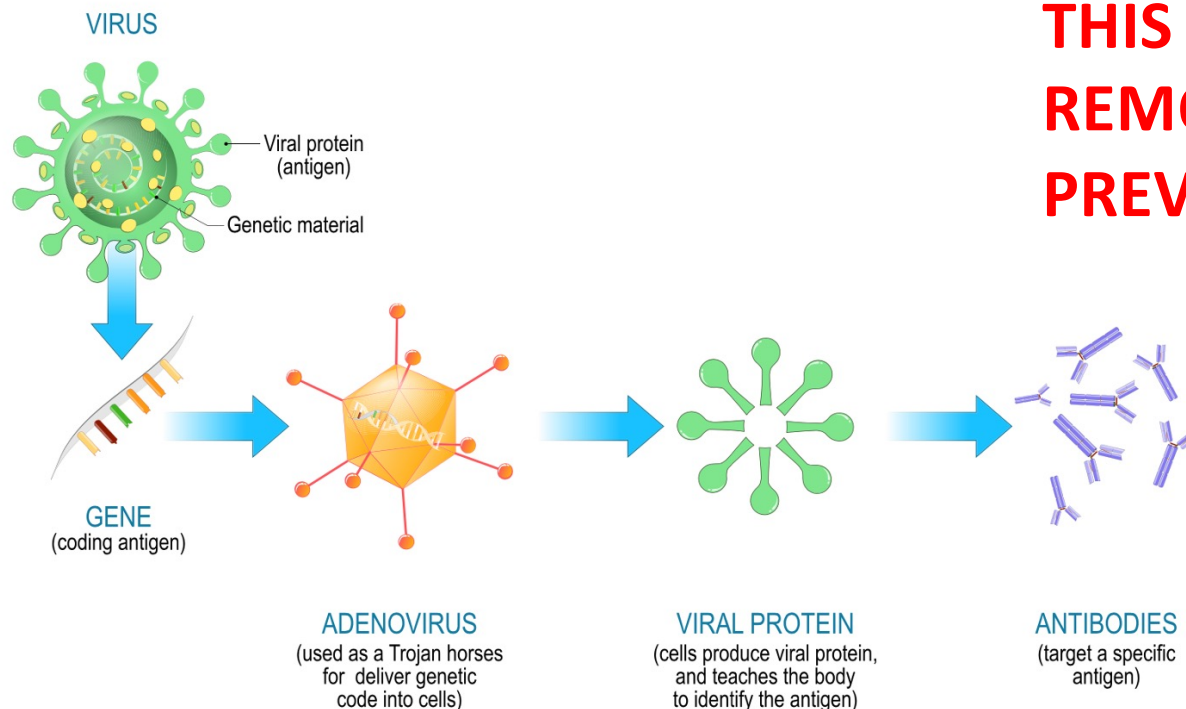
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Viral Vector Vaccine Creation

- Viral vectors are harmless and are simply used to produce the immune response before the body is exposed to the real pathogen

- _____



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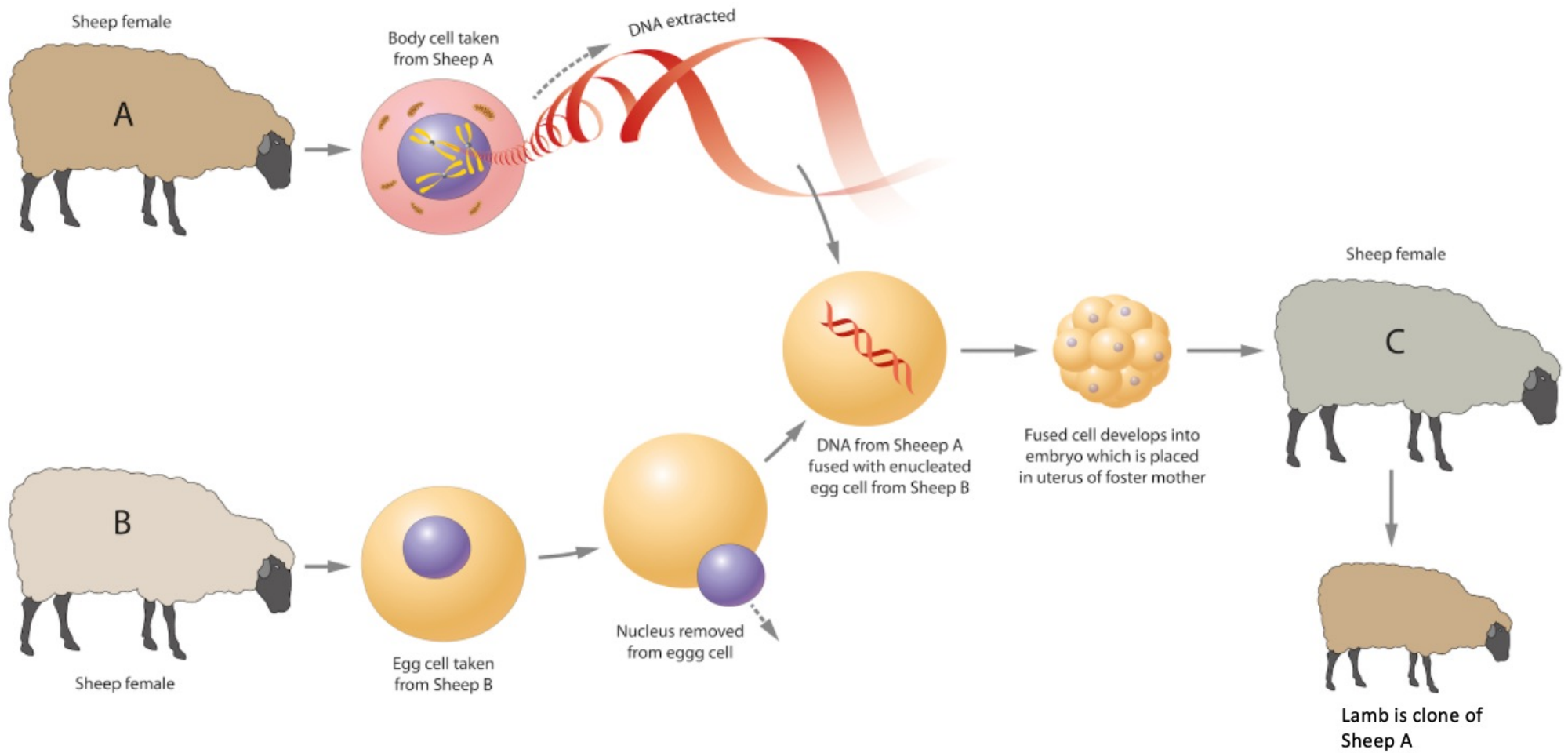
Cloning

- _____

- It has been used for many years to produce plants
- The first cloned mammal (Dolly) was born in 1997
- Since Dolly, scientists have cloned other animals, including cows, dogs, and mice



Cloning



Why Clone?

- The main reason to clone plants or animals is to mass produce organisms with desired qualities, such as prize-winning apples or a genetically engineered animal that produces greater amounts of milk, beef, etc.

- _____