

Attack in the Body

Vaccinations train the immune defenses against dangerous pathogens. Various processes have already been established for many decades. In the future, genetically based vaccines could join them—in the fight against the coronavirus and beyond

INFOGRAPHIC MAXIMILIAN NERTINGER

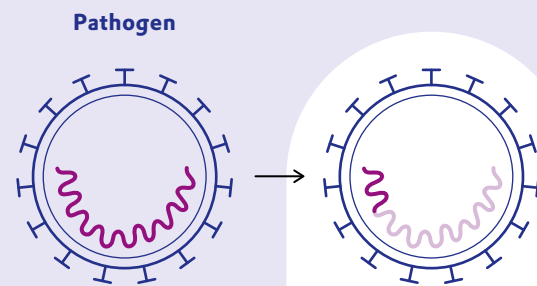
PROVEN PROCESSES

Current vaccines use viruses or bacteria that have been killed or attenuated, or use certain components or metabolic products of the pathogens.

ATTENUATED VACCINES

These contain small quantities of pathogens that are capable of reproduction but have been so attenuated that they are not capable of causing the disease.

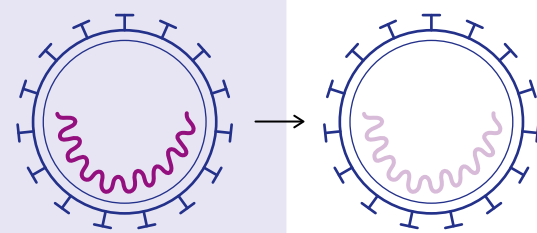
Examples: measles, mumps, rubella, and chickenpox



INACTIVATED VACCINES

Contain killed pathogens that stimulate the body's immune system to produce antibodies, without the disease itself breaking out.

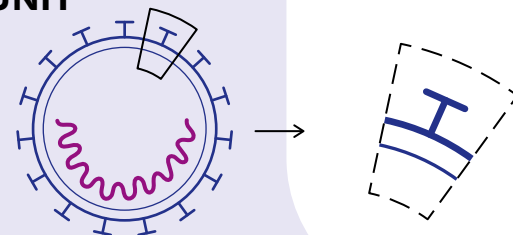
Examples: polio, TBE, hepatitis B



TOXOID AND SUBUNIT VACCINES

Contain only specific components of the pathogen such as proteins or sugars that are recognized by the immune system.

Examples: tetanus, diphtheria, pertussis, influenza, HPV



NEW PROCESSES

Gene-based vaccines contain part of the genetic information of a pathogen. The body cells of the vaccinated subject read this information and produce the proteins necessary for an immune response themselves.

VECTOR VACCINES

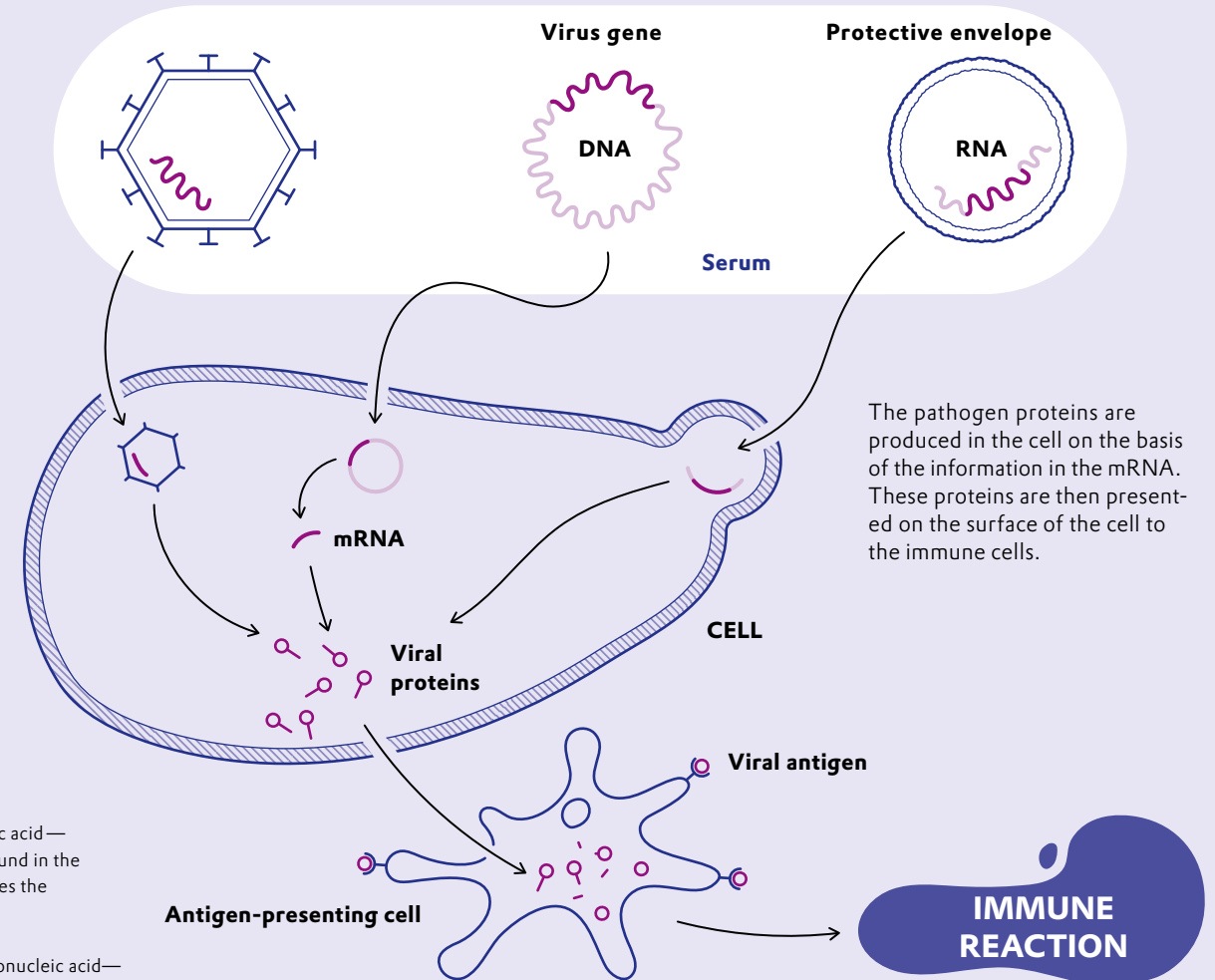
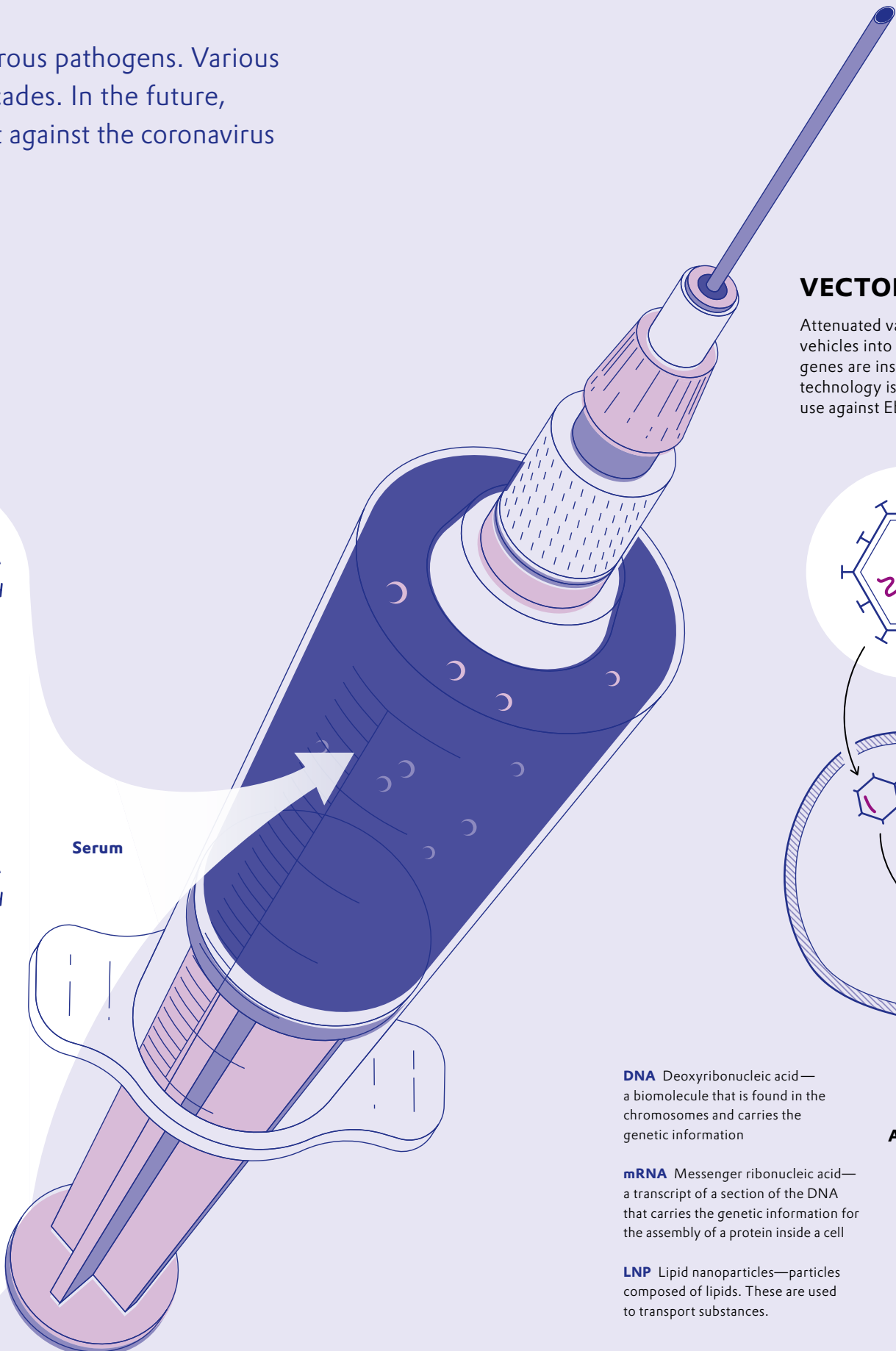
Attenuated vaccine viruses act as vehicles into which the pathogen genes are inserted. This new technology is already approved for use against Ebola and dengue fever.

DNA VACCINES*

The DNA sequence of an antigen is inserted into bacterial DNA. The DNA is injected and is converted into mRNA in the cell nucleus. This mRNA serves as a blueprint for the antibody.

RNA VACCINES*

The mRNA is read off directly in the cytoplasm. A protective envelope consisting of LNP protects it on its journey. The mRNA is released as soon as the LNPs have fused with the cell membrane.



DNA Deoxyribonucleic acid—a biomolecule that is found in the chromosomes and carries the genetic information

mRNA Messenger ribonucleic acid—a transcript of a section of the DNA that carries the genetic information for the assembly of a protein inside a cell

LNP Lipid nanoparticles—particles composed of lipids. These are used to transport substances.

When pathogens enter the body, special cells absorb them and present parts of the pathogens—known as antigens—on their surfaces. Other immune cells form antibodies against these antigens, and further immune cells destroy infected cells. In the event of a later contact with the same pathogen, memory cells ensure its rapid elimination.

* As of 10/2020: not yet approved