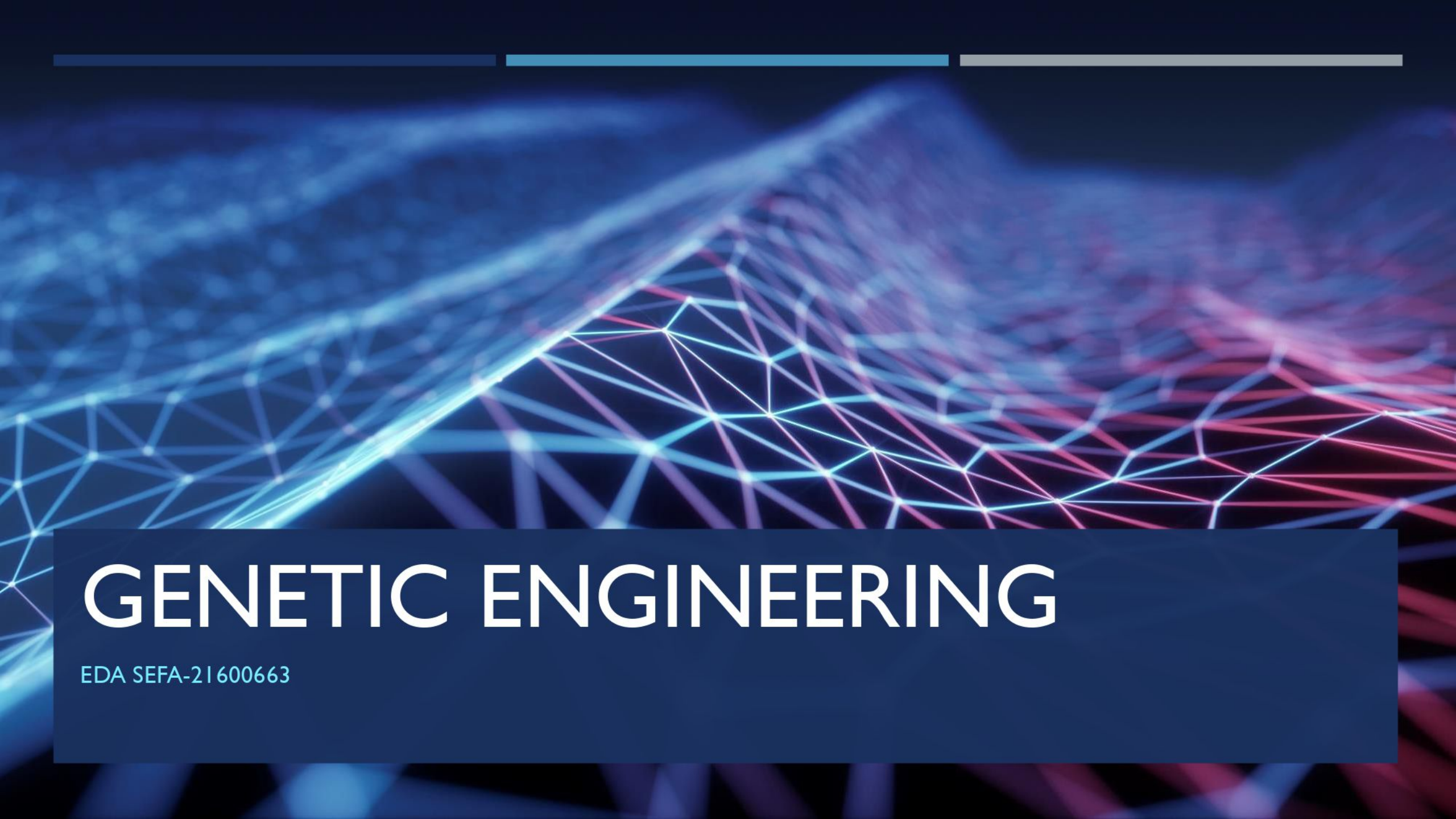


GENETIC ENGINEERING

EDA SEFA-21600663

WHAT IS GENETIC ENGINEERING?

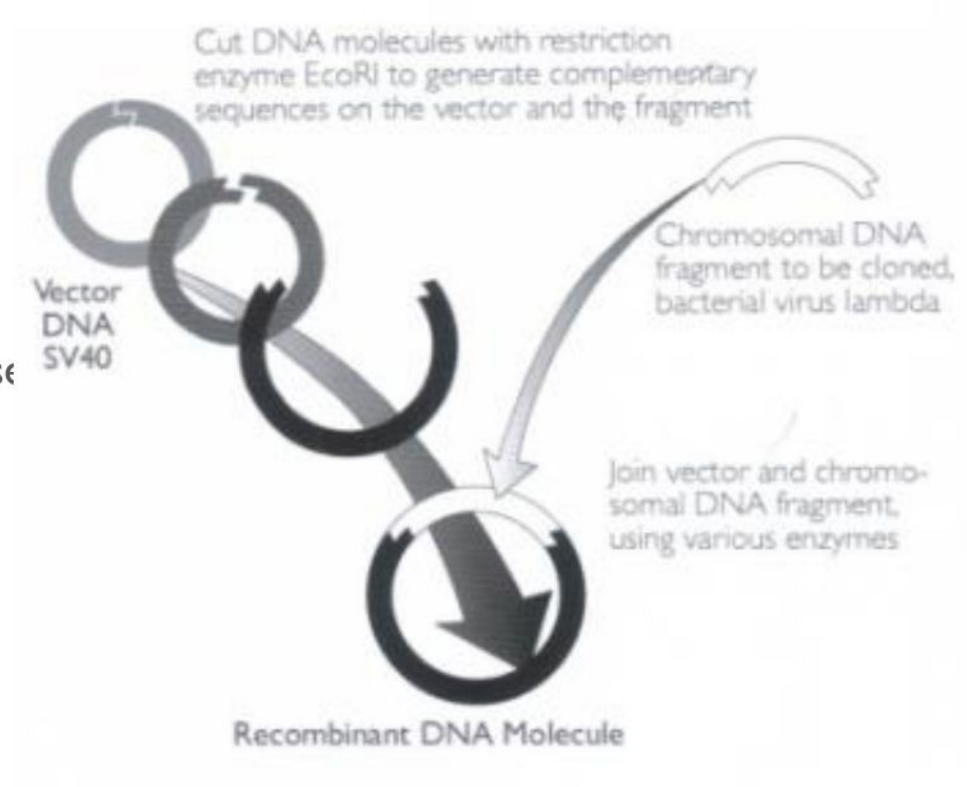
-The artificial manipulation, modification, and recombination of DNA or other nucleic acid molecules in order to modify an organism or population of organisms.
-A set of technologies is used to change the genetic makeup of cells, including the transfer of genes within and across species boundaries to produce improved organisms.

-The first recombinant DNA molecule was made by Paul Berg in 1972 by combining DNA from the monkey virus SV40 with the lambda virus. Berg began studying genes of the monkey tumor virus SV40 as a model for understanding how mammalian genes work. After mapping out where on the DNA the various viral genes occurred, he identified the specific sequences of nucleotides in the genes, and discovered how the SV40 genes affect the DNA of host organisms they infect.

- He also was trying to understand how normal cells seemed spontaneously to become cancerous. He hypothesized that cells turned cancerous because of some unknown interaction between genes and cellular biochemistry.

HOW DID IT START?

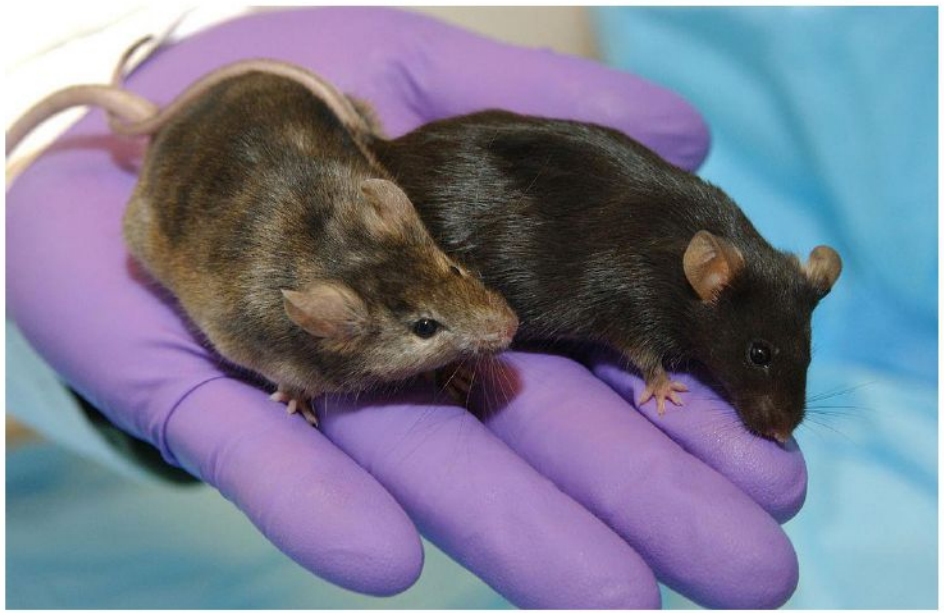
-He formed a chain that extended out from the double-stranded portion.
This new and powerful technique offered the means to put genes into rapidly multiplying cells, such as **bacteria** , which would then use the genes to make the corresponding protein.
-Berg had planned to inject the monkey virus SV40-bacteriophage DNA hybrid molecule into *E. coli*. But he realized the potential danger of inserting a mammalian tumor gene into a bacterium that exists universally in the environment.



HOW DID IT START?

HOW DID IT START?

-An organism that is generated through genetic engineering is considered to be genetically modified (GM) and the resulting entity is a genetically modified organism (GMO).
-The first GMO was a bacterium generated by Herbert Boyer and Stanley Cohen in 1973.
Rudolf Jaenisch created the first GM animal when he inserted foreign DNA into a mouse in 1974.



-Genetic engineering has been applied in numerous fields including research, medicine, industrial biotechnology and agriculture.

-In research GMOs are used to study gene function and expression through loss of function, gain of function, tracking and expression experiments.

-By knocking out genes responsible for certain conditions it is possible to create animal model organisms of human diseases. As well as producing hormones, vaccines and other drugs genetic engineering has the potential to cure genetic diseases through gene therapy.

-Unlike traditional animal and plant breeding, which involves doing multiple crosses and then selecting for the organism with the desired phenotype, genetic engineering takes the gene directly from one organism and inserts it in the other. This is much faster, can be used to insert any genes from any organism (even ones from different domains) and prevents other undesirable genes from also being added.

-Genetic engineering could potentially fix severe genetic disorders in humans by replacing the defective gene with a functioning one

-Drugs, vaccines and other products have been harvested from organisms engineered to produce them. Ex: Crops have been developed that aid food security by increasing yield, nutritional value and tolerance to environmental stresses.

AGRICULTURE

-Crops developed by genetic engineering are used to enhance yields, nutritional quality and tolerance to various biotic and abiotic stresses

-Genetically modified plants have minerals and vitamins added to them via modification processes. Thus it provides great nutritive benefits to the consumers. This is particularly important for developing countries where they have the least access to the needed resources.

-GMO are more resistant to unexpected diseases and can withstand harsh climate

-GMO crops demand fewer chemicals, land, and machinery, which helps to lessen environmental pollution and greenhouse gas emissions. Farmers will have enhanced productivity without the use of chemicals. Ex: potatoes, corn, and cotton can grow without spraying bacterial insecticides..

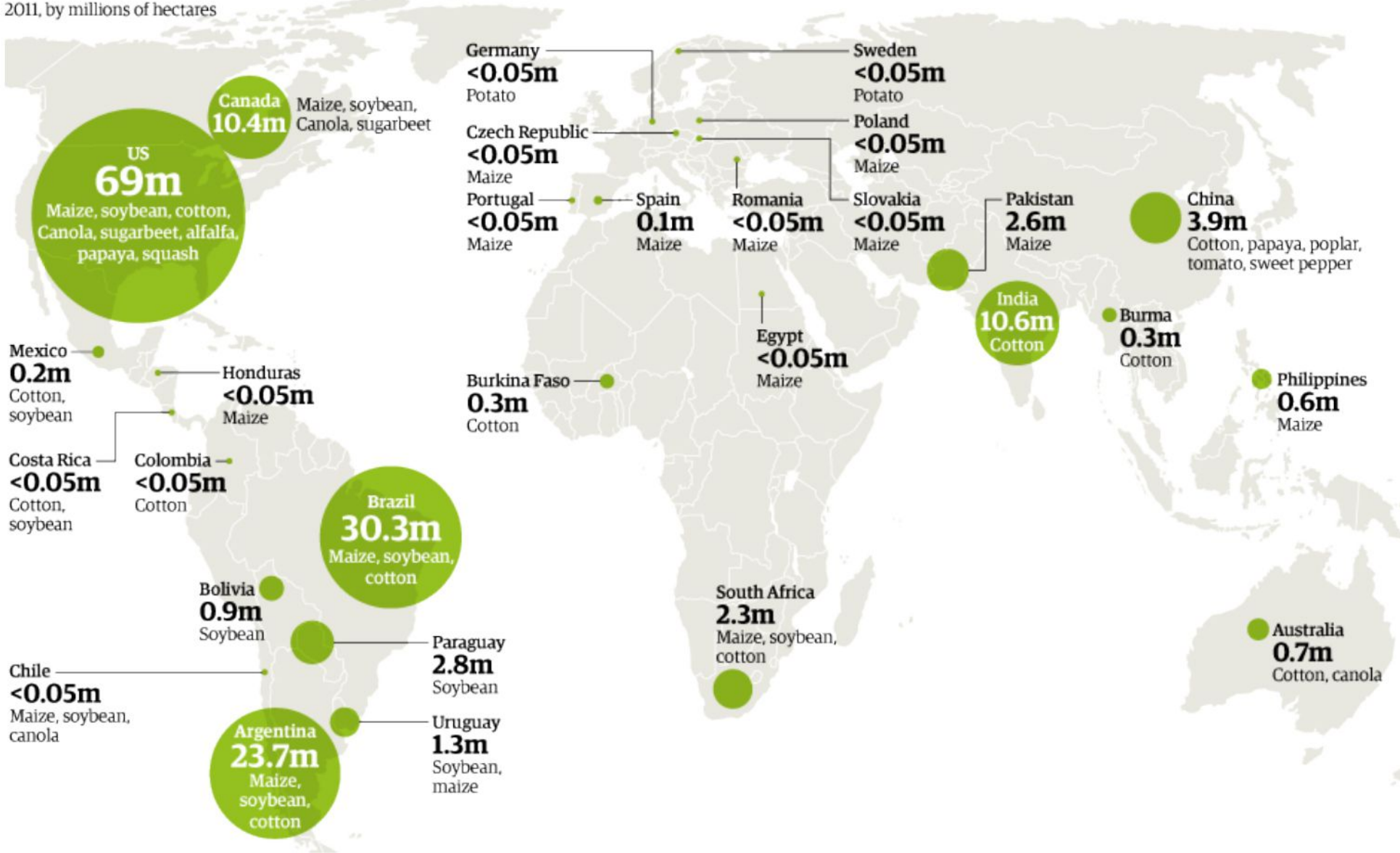
IS IT SAFE?

Genetically modified organisms (GMOs) can spread through nature and interbreed with natural organisms, thereby contaminating natural organisms in an unforeseeable and uncontrollable way.

Their release is 'genetic pollution' and is a major threat because GE foods cannot be recalled once released into the environment.

Global status of commercial GM crops

2011, by millions of hectares

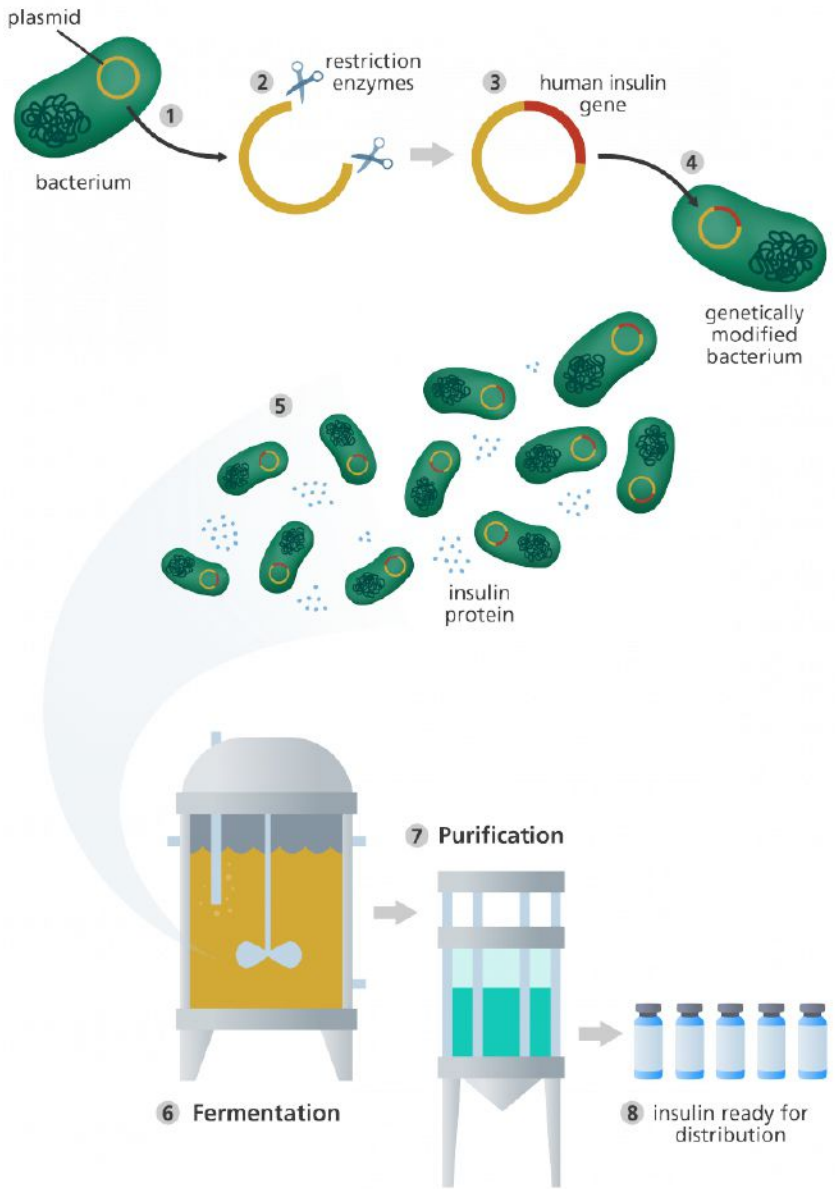


MEDICINE

Genetic engineering has many applications to medicine that include the manufacturing of drugs, creation of model animals that mimic human conditions and gene therapy.

- One of the earliest uses of genetic engineering was to mass-produce human insulin in bacteria. This application has now been applied to, human growth hormones, follicle stimulating hormones (for treating infertility), human albumin, monoclonal antibodies, vaccines and many other drugs.

Genetic engineering is also used to create animal models of human diseases. Genetically modified mice are the most common genetically engineered animal model. They have been used to study and model cancer, obesity, heart disease, diabetes, arthritis, substance abuse, anxiety, aging and Parkinson disease. Potential cures can be tested against these mouse models.



Some animals are genetically engineered to create human antibodies and proteins that are then extracted and given to a sick person who cannot produce these substances on their own. People that suffer from Type 1 diabetes cannot produce their own insulin. Through genetic engineering, scientists are able to create yeast or bacterial cells that can produce it instead.

ANIMALS

-Livestock are modified with the intention of improving economically important traits such as growth-rate, quality of meat, milk composition, disease resistance and survival. Animals have been engineered to grow faster, be healthier and resist diseases.

-Modifications have also improved the wool production of sheep and udder health of cows.

-Goats have been genetically engineered to produce milk with strong spiderweb-like silk proteins in their milk.

-The goat gene sequence has been modified, using fresh umbilical cords taken from kids, in order to code for the human enzyme lysozyme.

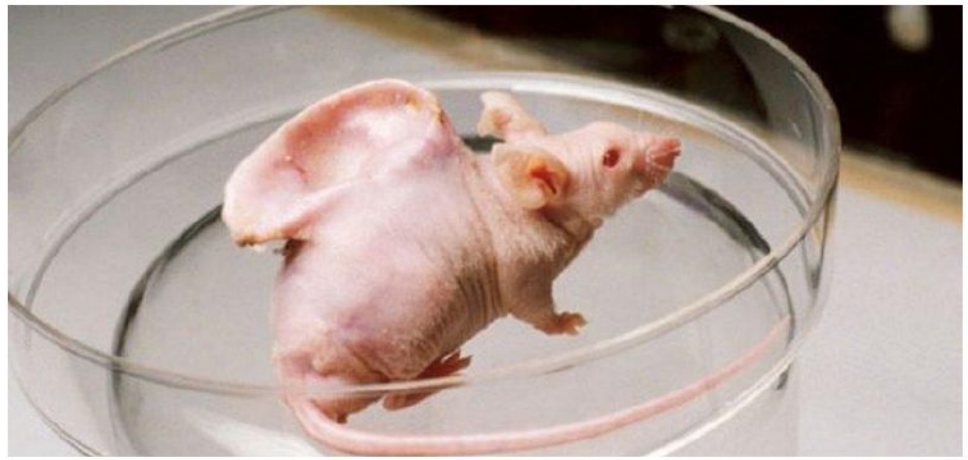
-Researchers wanted to alter the milk produced by the goats, to contain lysozyme in order to fight off bacteria causing diarrhea in humans.

Cows

Scientists in both China and Argentina have genetically engineered cows to produce milk similar in composition to that made by humans. After modifying embryos, an Argentinian cow – Rosita Isa – was born that expressed milk containing proteins present in human milk but lacking in cow milk.

Mosquitoes

British company Oxitec has created genetically modified male mosquitoes that carry a "self-limiting gene". When they are released into the wild and mate with females their offspring do not reach adulthood, so crucially do not contribute to the spread of the Zika virus. Other researchers are looking at using genetic modification to curb the spread of malaria.



CAN IT BE USED ON HUMANS?

LETS CONSIDER WHERE WE ARE TODAY:

- Humans have been genetically engineering organisms for hundred of years using selective breeding (as opposed to natural selection).
- Starting in the 1970's, humans started modifying the DNA directly of plants and animals, creating GMO foods.
- Half a million babies are born each year using in vitro fertilization (IVF). Increasingly, this includes sequencing the embryos to screen them for diseases, and bringing the most viable embryo to term (a form of genetic engineering, without actually making edits).
- In 2018, He Jiankui created the first genetically modified babies in China.
- In 2019, a number of FDA approved clinical trials for gene therapies have begun.

Genetic modification can be applied in two very different ways: *somatic* genetic modification and *germline* genetic modification.

-Somatic genetic modification adds, cuts, or changes the genes in some of the cells of an existing person, typically to alleviate a medical condition. These gene therapy techniques are approaching clinical practice, but only for a few conditions, and at a very high cost.

-Germline genetic modification would change the genes in eggs, sperm, or early embryos. Often referred to as "inheritable genetic modification" or "gene editing for reproduction," these alterations would appear in every cell of the person who developed from that gamete or embryo, and also in all subsequent generations.

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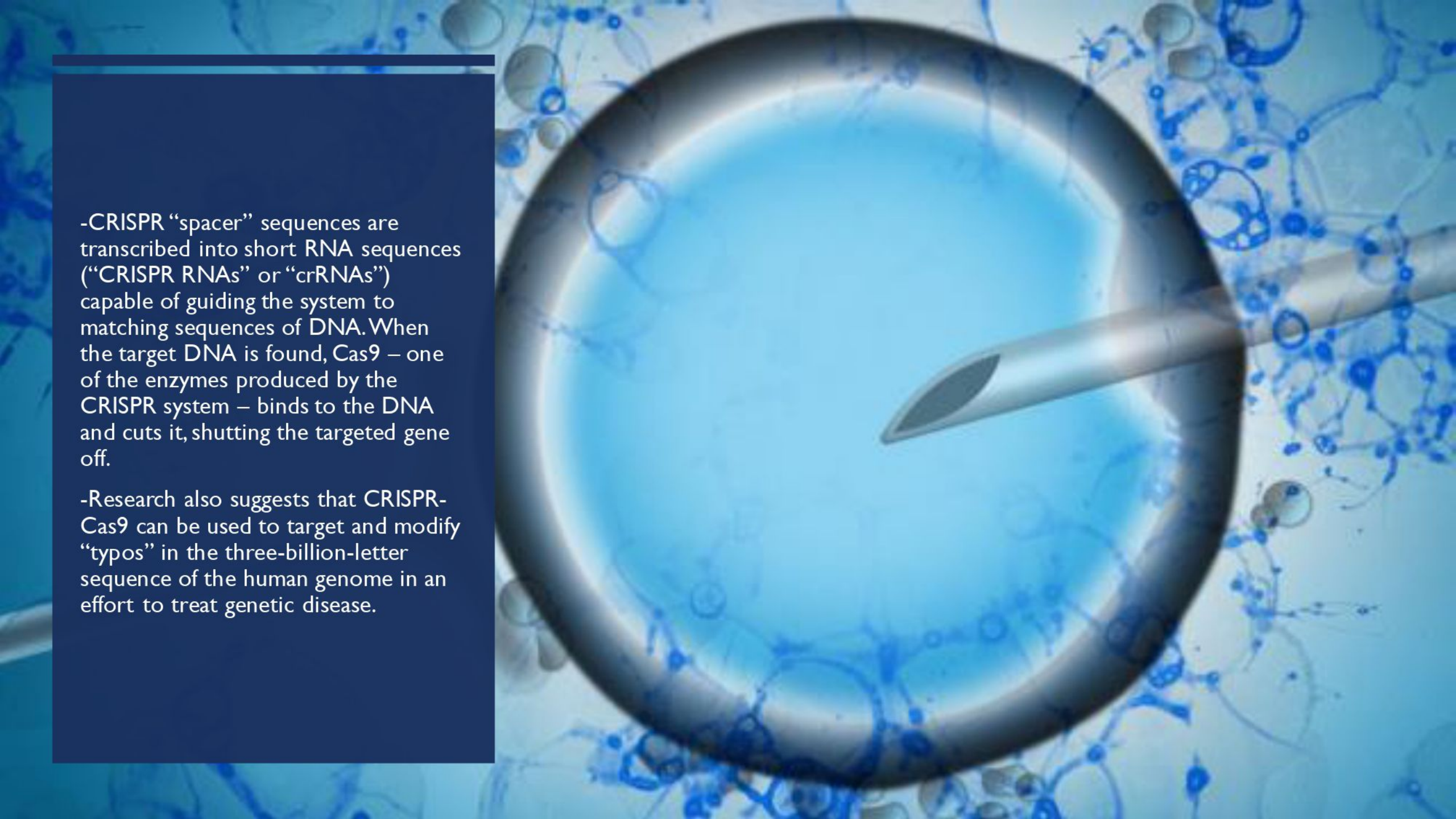
CRISPR

HOW DOES IT WORK?

- CRISPR- systems that can be programmed to target specific stretches of genetic code and to edit DNA at precise locations.
- Researchers can permanently modify genes in living cells and organisms and, in the future, may make it possible to correct mutations at precise locations in the human genome in order to treat genetic causes of disease.



-CRISPR "spacer" sequences are transcribed into short RNA sequences ("CRISPR RNAs" or "crRNAs") capable of guiding the system to matching sequences of DNA. When the target DNA is found, Cas9 – one of the enzymes produced by the CRISPR system – binds to the DNA and cuts it, shutting the targeted gene off.

-Research also suggests that CRISPR-Cas9 can be used to target and modify "typos" in the three-billion-letter sequence of the human genome in an effort to treat genetic disease.

DESIGNER BABIES

DESIGNER BABIES

Traits s.a: eye color, hair color, height, intellegence can be altered.

IS IT ETHICAL?

DESIGNER BABIES

IS IT ETHICAL?

WILL IT BE AVAILABLE TO EVERYONE?

WILL IT BE FAIR?

WILL IT BE USED FOR THE RIGHT PURPOSES?

QUESTIONS?

THANK YOU!

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