Issue Overview: Gene editing

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TOP: DNA strand BOTTOM: Graphics courtesy of Bloomberg.

DEFINITIONS

germline cells
The cells that pass genes from parents to children

gene
A unit of information passed down from parent to child that determines some of the child's traits, or qualities

hereditary
Traits, or qualities, that are determined by genes and are passed down from parent to child

Humans have been experimenting with genes for a long time. Early people saw that some qualities of plants, animals and people were hereditary. They passed from parents to children. Today, scientists are learning

more about human genes. With this knowledge, they can change DNA. DNA is the building block of life. It tells a person's body how to learn and grow. For years, it was hard to change DNA. But a new technology is changing that.

Crispr is a tool that changes genes. It is very easy to use. Some people think it could help grow more food and get rid of diseases. Others worry that it could be used for the wrong reasons.
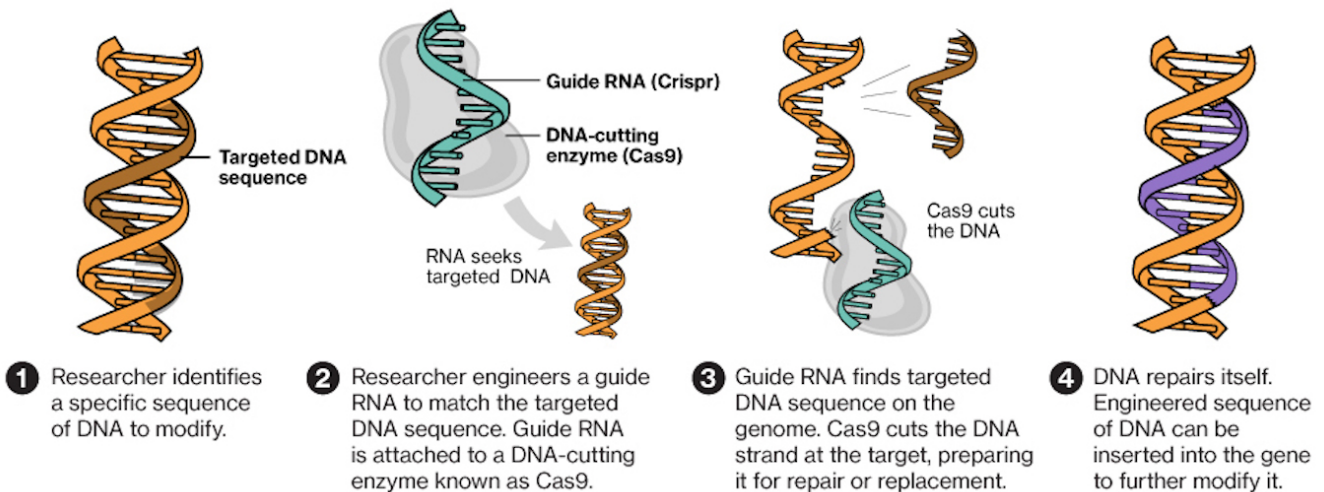
The Situation

People in more than 80 countries are using Crispr. Some of them want to kill off harmful bugs. Others want to grow stronger plants.

Many scientists want to get rid of diseases. Some have used Crispr to fix a gene mutation that causes blindness. Another group of scientists used Crispr to help sick mice. The mice had a gene that made their muscles weak. Scientists used Crispr to fix the gene. Then the mice became strong again. Scientists are very happy with these experiments. They believe they will be able to fix human genes soon.

Some labs are using Crispr to experiment with human germ-line cells. These are a special kind of cell. They pass DNA to children. Such experiments are very controversial. In 2017, a U.S. science group decided it was ok to use Crispr if it helped avoid serious diseases and disabilities.

How Crispr-Cas9 Works

Until a few years ago, altering an organism's genome was a cumbersome process, usually involving insertion of long strands of DNA or entire genes. Now scientists can cut and paste precise units of the genome.

Targeted DNA sequence

Guide RNA (Crispr)

DNA-cutting enzyme (Cas9)

RNA seeks targeted DNA

Cas9 cuts the DNA

1. Researcher identifies a specific sequence of DNA to modify.

2. Researcher engineers a guide RNA to match the targeted DNA sequence. Guide RNA is attached to a DNA-cutting enzyme known as Cas9.

3. Guide RNA finds targeted DNA sequence on the genome. Cas9 cuts the DNA strand at the target, preparing it for repair or replacement.

4. DNA repairs itself. Engineered sequence of DNA can be inserted into the gene to further modify it.

The Background

Scientists first discovered Crispr almost 30 years ago. At the time, they did not understand how it worked. In 2012, scientists found a way to make "guides" that help Crispr move along DNA. The "guides" tell Crispr where to change the DNA. Later, scientists found out how to use Crispr in humans.

There are still some problems with Crispr. Sometimes it makes mistakes and changes DNA in the wrong place.

The Argument

Should scientists use Crispr to treat people who are sick? Most people say yes. But changing germ-line cells is another question. Should scientists change DNA that is passed on to children? It might be the only way to get rid of some diseases. But if something goes wrong, the results last forever.

Some worry that people might change DNA for the wrong reasons. For example, scientists could make babies that are supersmart. Some people think this might be dangerous. Others think it could be a good thing. They say supersmart people could improve life for everyone.

Quiz

1   What is the article MOSTLY about?

(A)   killing deadly diseases

(B)   making supersmart humans

(C)   using a tool to change genes

(D)   learning what DNA is made of

2   Which sentence BEST states a main idea of the entire article?

(A)   Many countries use Crispr to change genes.

(B)   Crispr might help to grow better food.

(C)   Sometimes Crispr can make mistakes.

(D)   People are not sure if using Crispr is a good thing.

3   According to the graphic, what happens first when Crispr is used on genes?

(A)   The scientist makes a DNA sequence.

(B)   The scientist finds the gene that he or she wants to change.

(C)   The scientist inserts a long strand of new DNA.

(D)   The scientist makes a new RNA to put into the gene.

4   What is the MAIN reason why some people are not sure about using Crispr on humans?

(A)   because it could make mistakes

(B)   because it could get rid of diseases

(C)   because it could be used unfairly

(D)   because it could change how food grows