
ISAAA Inc.
BIOTECH
ALL ABOUT GENE EDITING
SQUIZBOX

Hello, _____ !
(please write your name here)

Do you want to know what gene editing is? You got the suitable material in your hands. This sQuizBox answers that question. We also included some fun tasks that you can do to appreciate gene editing more. Hope you learn something new. Enjoy!

How to use this booklet?

1. Read pages A to H to know the answers to common questions about gene editing.
2. Flip the booklet and get ready for a fun challenge.
3. Do the tasks on pages 1 to 8.

Do you want to know more?

Use your smartphone to scan the QR codes and get additional resources on gene editing for free!

How can we help plants provide our needs?

As the world population grows, we continue to search for ways to improve crops, animals, and other living organisms to provide food and improve life. From the time when people started domesticating crops, wild plants have changed significantly. At present, scientists can modify the characteristics of crops with more precision and come up with better varieties in less time. One of the new techniques for crop improvement is called gene editing.

A

What is gene editing?

Gene editing is the process of making a targeted change in the DNA of a living organism. It's like editing a word document on your computer. You can change a portion of that document by finding a certain word or phrase. You can either delete that word, replace it with a better word, or add another word to improve your document. This find-and-replace function is similar to how experts edit genomes.

B

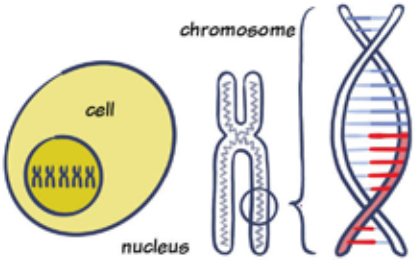
CRISPR, what?

Gene editing uses different tools and processes. The most famous tool is CRISPR, which stands for Clustered Regularly Interspaced Short Palindromic Repeats. It was designed based on the natural gene editing system that the bacteria use in response to invading pathogens. It works like molecular scissors that cut target DNA sequences to improve the traits of living organisms. Other tools such as TALENs, zinc-finger nucleases (ZFNs), and meganucleases are also available.

C

How does gene editing work?

It all starts with a desired change in mind of the researcher. Then he identifies the exact sequence of the DNA that needs to be changed.



A protein combo containing a guide molecule, a molecular cutter, and healthy DNA copy is inserted into a cell.

The guide molecule finds the target DNA strand where the change is needed to happen.

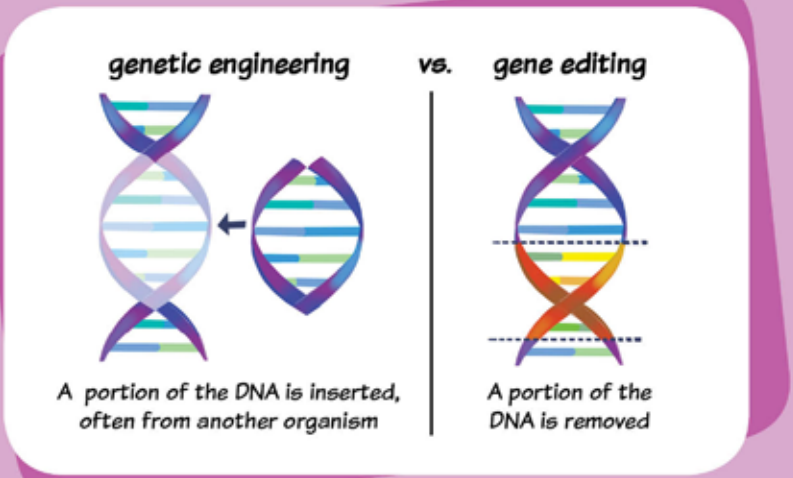
The molecular cutter chops off the target DNA strand. The damaged DNA strand can either repair by itself

or be replaced with a healthy DNA copy that can be attached to the protein combo before it is inserted into the cell.

D

What is the difference between genetic engineering and gene editing?

Genetic engineering refers to the process of improving the traits of organisms using modern biotech tools. For example, a portion of organism A's DNA is inserted into organism B to improve organism B's qualities. Most applications of gene editing do not require the addition of another organism's DNA segment. Thus, there is no foreign material present in the gene-edited organism. For complicated transformations, both gene editing and genetic engineering can be used to achieve the target change.



E

Is gene editing safe?

Before a gene-edited product is released to a country, authorities make sure if it is safe to humans, animals, and to the environment. Countries have different ways to answer this question. Some countries apply the rules for checking the safety of genetically engineered organisms. There are also countries that exclude gene-edited products from the scope of genetic engineering, especially when there is no DNA segment added to the organism. Thus, the gene-edited products available in the market today have been verified to be helpful to us.

What are the gene-edited products in the market?

Because of its ease of use and versatility, gene editing has numerous applications. One of the first products of gene editing is the heart-healthy soybean oil called Calyno. Using TALENs, the researchers increased the oleic acid content of soybean oil by 80% and reduced saturated fat by 20%. It has been sold in the US market since 2019 and has been well-received by the food industry. More and more experts are using gene editing in their research, especially in improving plant quality traits.

Other products of gene editing include:

Reduced-browning banana

High-starch corn

Heart-healthy GABA tomato

Pinky-purple petunia

Boosted oil canola

Fast-growing tiger puffer

Meatier red sea bream

High oil camelina

Do you want to know more?

ISAAA, the same team who created this sQuizBox, has a newsletter on biotechnology with lots of articles on gene editing. Subscribe to Biotech Updates for free!
Go to www.isaaa.org/subscribe.

You may also check out the ISAAA Gene Editing Resource for more interesting reading materials!


Are you ready to take the challenge?

Guess the word

The Food and Agriculture Organization of the United Nations reported three top reasons why over a quarter of a billion do not have enough food. Name these three reasons by decoding the jumbled words below:

unpredictable

_____

(steven)

conflict or

_____

(awr)

_____

(meaticl)

extremes

One of the tools that we can use to increase food supply is gene editing! Scientists improve the yield of crops, make them resistant to diseases and pests, or make them resilient to stressful conditions.

Read more:

Answers: events, war, climate

Be a scientist!

Pretend to be a scientist and edit the following words to make them correct.

CRISPER

TALN

MEGANUCLESE

ZINK FINGER

Just like editing words, scientists can either delete a gene, insert a gene, or silence a gene in the DNA of an organism to make a targeted change.

Read more:

Answers: CRISPR, TALEN, meganuclease, zinc finger

Future chef

It's time to wear an apron and be a chef for today! In the Philippines, Tropic's reduced browning banana is now available! This can be used to bake banana bread! If this is unavailable in your place, you may use Cavendish banana. After mashing them, record how long it takes for the flesh to turn brown.

Some people throw away brown-colored bananas, turning them into waste! Scientists developed reduced-browning bananas so that there will be less food waste.

Read more:

Bake a Banana Bread

Banana Bread Recipe

Ingredients

3 large ripe bananas
1/2 cup butter
3/4 cup granulated sugar
2 large eggs
1 1/2 cups all-purpose flour
1 tsp baking soda
1/2 tsp salt
1/4 tsp vanilla powder
1 cup walnuts
1/2 cup chocolate chips

Procedure

1. Preheat oven to 350 degrees F (175 degrees C). Grease and flour the loaf pan.
2. Lightly roast walnuts in a skillet over medium heat, stirring constantly, until fragrant and lightly browned. Let cool slightly, then chop coarsely.
3. Cream the butter and sugar until light and fluffy in a large bowl. Beat in the bananas and eggs one at a time, then stir in the vanilla.
4. Whisk together the flour, baking soda, and salt in a separate bowl. Gradually add to the wet ingredients, mixing until just combined. Stir in the walnuts and raisins.
5. Pour the batter into the prepared loaf pan and bake for 55-60 minutes, or until a toothpick inserted into the center comes out clean. Let it cool in the pan for 10 minutes before removing to a wire rack to cool completely.

Spot the difference

Check out the following images and spot five differences.

Name five (5) differences that you observed:

_____

_____

_____

_____

_____

_____

These differences are the big changes happening on our planet over time that impact our way of life. Scientists use gene editing to help plants and animals cope with these changes.

Read more:

Answers: mosquitoes, less animals, less plants, hotter temperature, dry soils/drought

Citizen science

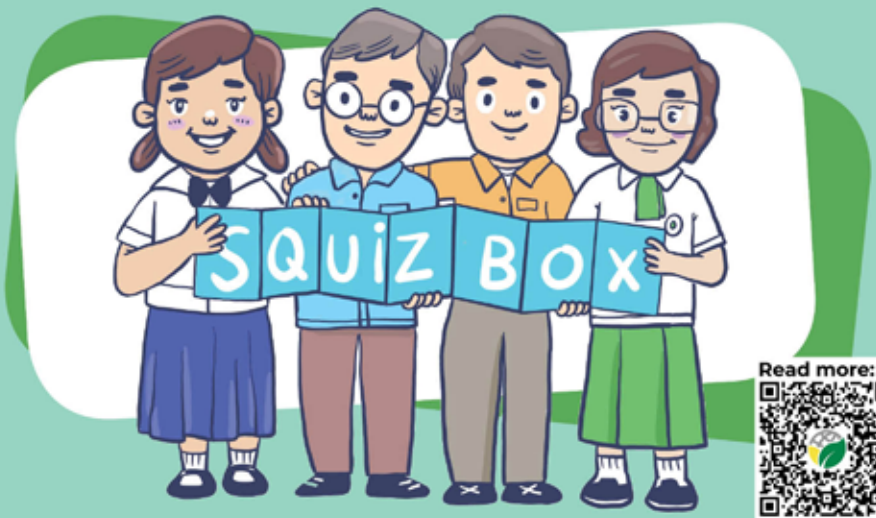
Doing scientific research can be hard, but scientists also say that it is fun!!! Why don't you enter the world of science by joining a research team for a day? Here's how you can do this:

1. *Contact a nearby research lab and ask if you could visit to find out more about their research.*
2. *Ask the researchers if you could try out any of their lab equipment or field instrument.*
3. *Share your experience on Facebook, Instagram, Youtube or any social media platform, tag ISAAA, and get the chance to be featured in one of our campaigns!*

Read more:

Be a science champion

Are you interested to do more activities to learn more about gene editing? Check out the Double Helix magazine and the activities we have prepared for you there. Ask your friends to perform the activities with you so that you can also share the fun and lessons with them. Enjoy!



Read more:

Let's keep connected

Don't forget to like and share our social media accounts to get more updates on gene editing!

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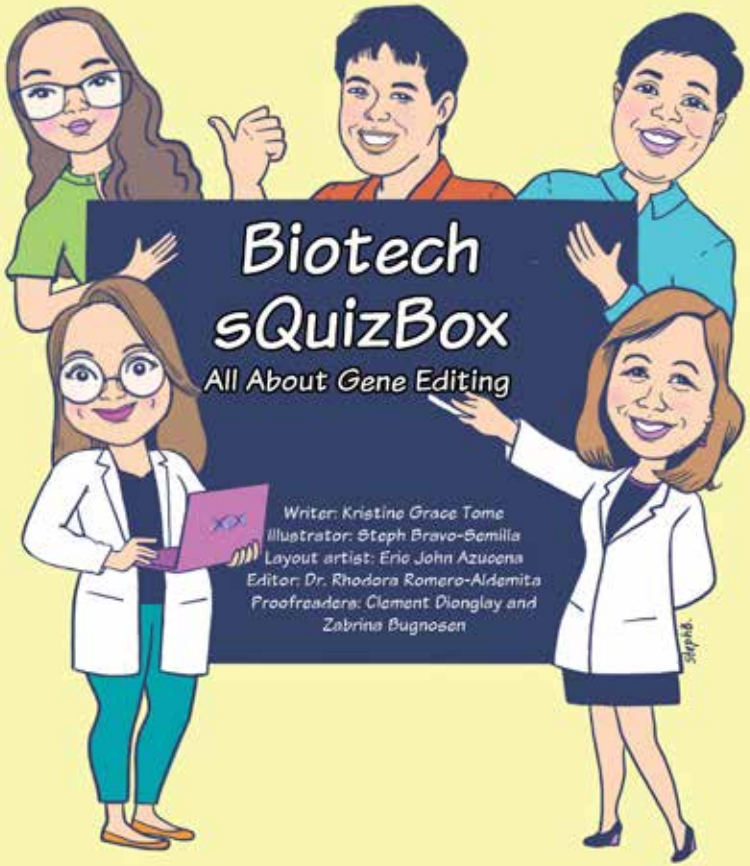
Biotech
sQuizBox
All About Gene Editing
Writer: Kristine Grace Tome
Illustrator: Steph Bravo-Semilla
Layout artist: Eric John Azucena
Editor: Dr. Rhodora Romero-Aldemita
Proofreaders: Clement Dionglay and
Zabrina Bugnosen