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Hello, _____!
(write your name here)

Welcome to Biotech sQuizBox. This activity booklet will help you get to know crop biotechnology. This side of the booklet illustrates bite-sized stories about biotech crops and how people benefit from them. The other side of the booklet challenges the readers discover biotechnology in a fun and exciting manner, just like playing a squeezebox! **Enjoy the Biotech sQuizBox!**



How to use Biotech sQuizBox

Biotech Bites

Read each page and get to know basic information about crop biotechnology (see pages A to I).



Biotech Challenge

Answer questions and conduct exciting activities on biotechnology (see pages 1 to 9).



Guide Links

Know more about the topic you are reading by following the suggested links. Jump to the page given beside the icon to



read a trivia



take a quiz



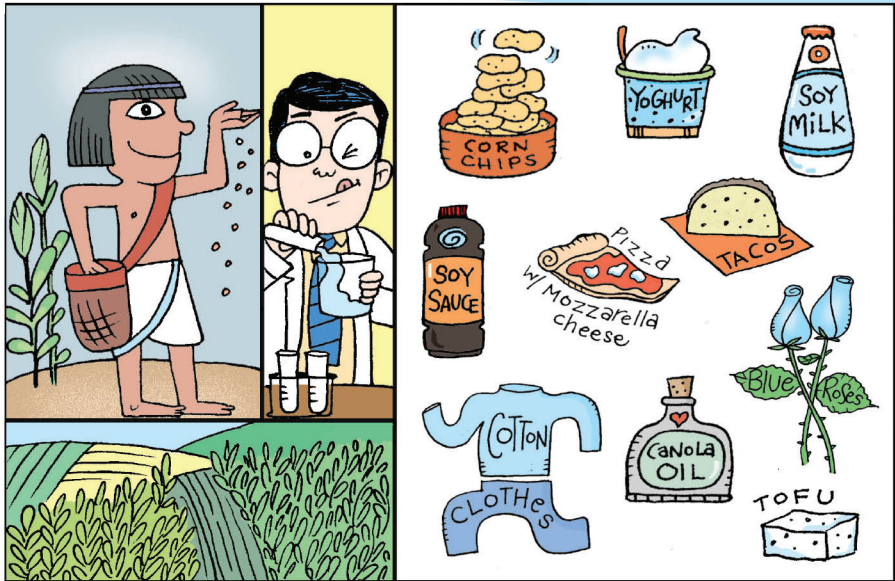
get the answers to a question



read more online

Biotech Bites

This section will help you know how crops were improved from the days of our ancestors to the present days to provide our basic needs such as food and clothing. You will also discover how biotech crops are used by farmers all over the world.



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Crops Then and Now

A lot of the things that we eat, use as clothing or fuel come from crops that were initially found in the wild. If these crops were not improved through the years, they would not meet our needs for food, clothing, and energy.



Do we have enough food for the future? 2

Can you guess what these wild crops are?



Answer: (left to right) tomato, corn, carrot. See how different these wild crops are from the present crops we use!

Defining Biotechnology

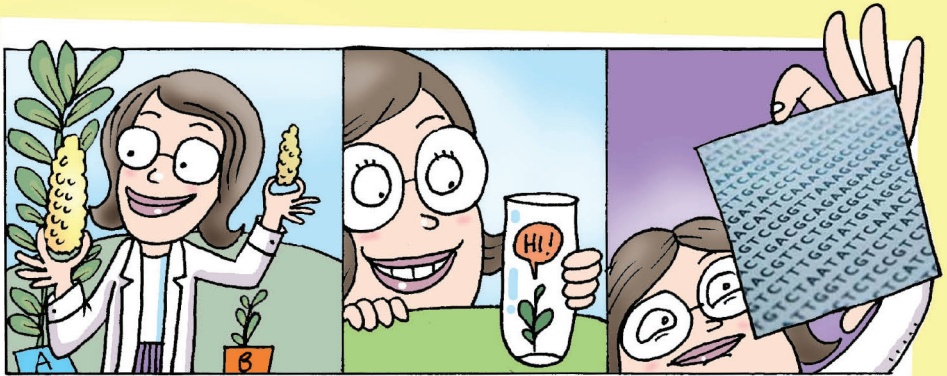
bios + techne + logia
life skill study
=
biotechnology

Biotechnology is defined as any process that uses living organisms or parts of living organisms to make or modify a product, improve plants, trees, animals, or microorganisms for specific purposes. The improvement of crops, making of bread, cheese, beer, and wine, was the earliest forms of biotechnology.



From Traditional to Modern Biotech: The Necessary Shift

With traditional biotechnologies, plant breeders were able to develop new and improved crops. However, those methods usually take long periods of time before breeders get the desired characteristics. Thus, scientists developed more precise techniques that require shorter time to come up with better products that suit man's needs.



Get to know a scientist


7



What are traditional biotechnologies?
bit.ly/PocketK13

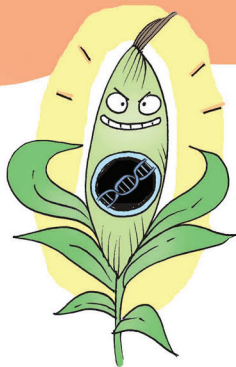
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Working on the Genes

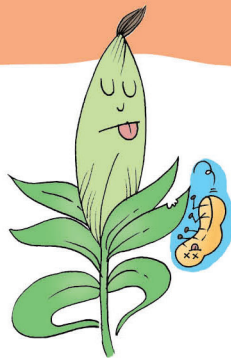
A gene is a building block of all organisms. It is made up of a substance called DNA  5. Through modern biotech, scientists can choose and isolate the gene for an important trait from a related or unrelated organism. The gene is transferred into another organism that needs the trait. For example, a gene of a small organism in the soil can be transferred to corn plants so that it would be resistant to insects.



Corn is infested by Asian corn borer



Gene from *Bacillus thuringiensis* inserted into corn



Asian corn borer dies when feeding on any plant part

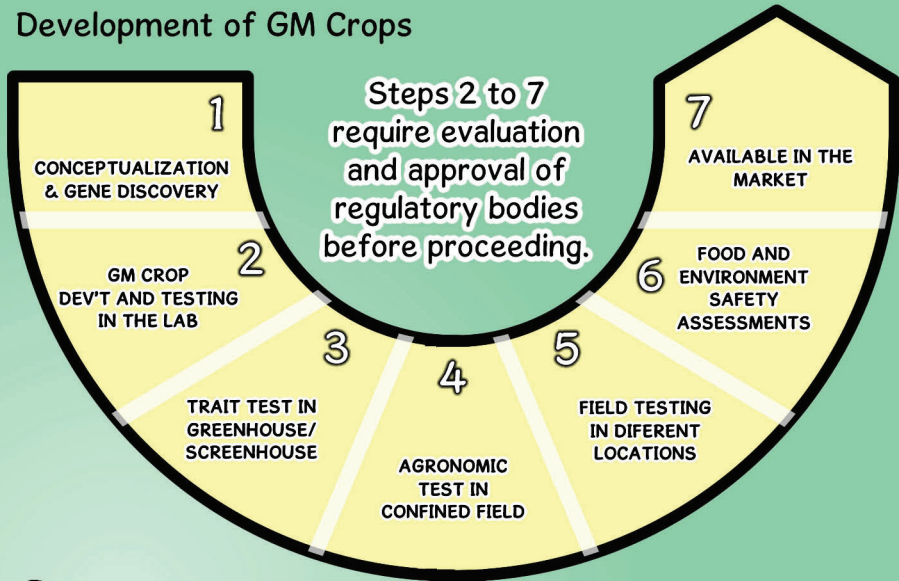
Scientists can also turn on or turn off a gene to improve the plant's own characteristics without inserting a gene from other organisms.



Ensuring Safety of Biotech Crops

After successful development in the lab, a genetically modified (GM) crop (a.k.a. transgenic crop or biotech crop) does not go instantly to the market. It must undergo a long rigorous process of tests to make sure that the GM crop is safe for humans, animals, and the environment. This process usually takes several years to finish.

Development of GM Crops



Help biotech corn, Betty, reach the Farmer's Field

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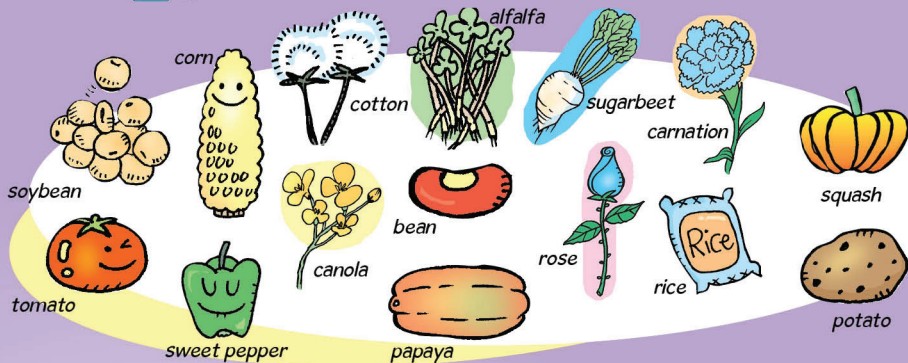


Genetic Engineering and GM Crops
bit.ly/PocketK17

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Biotech Crops All Over the World

As of today, a number of biotech crops are being planted in different countries. The most planted crops are biotech soybean, corn, cotton, and canola. 🦋 3



Aside from these biotech crops, there are still others that are being developed in the lab or tested on the field.



Benefits of Biotech Crops

Among the documented benefits of biotech crops are:



Increase in farm yield



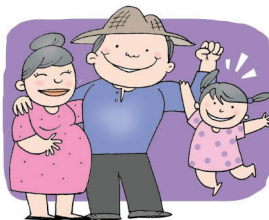
Increase in farm income



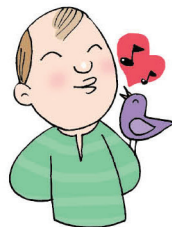
Less use of pesticides



Use of environment-friendly farming practices



Better health to farmers and their families



Peace of mind for farmers



Spot the difference between a conventional and a biotech farm

4



Documented Benefits of Biotech Crops
bit.ly/PocketK5

H

Farmers and Biotech Crops

As of 2017, **17** million farmers
in **24** countries
planted biotech crops
in **189.8** million hectares of
land.



Top 10 biotech crop producing countries



Solve the biotech country puzzle

10



Global status of biotech crops
bit.ly/Brief53Info

Biotech Challenge

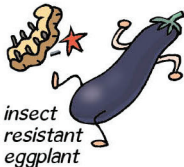
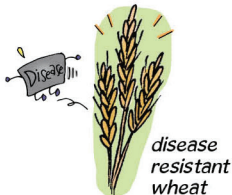
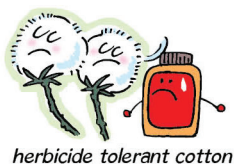
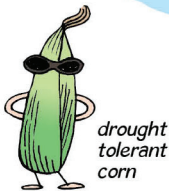
This section contains different activities that will help you know more about the importance of biotech crops. Here is the first challenge: can you spot where the biotech crops are in this picture?



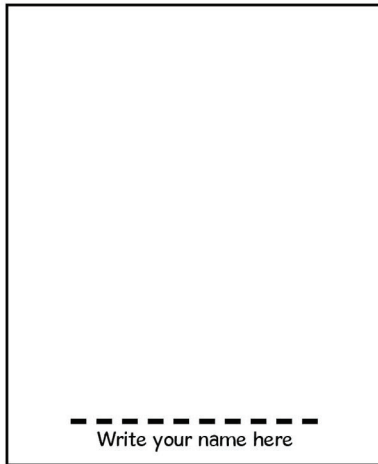
Do we have enough food in 2050?

As of 2018, the world population is about 7.63 billion. Feeding 7.63 billion mouths every single day is a huge task for our farmers. By 2050, the world population is expected to be 9.2 billion. Experts say that agriculture must double its food production to feed the world.

Which among these characters can help us have more food in the future? Encircle your answers.



Draw yourself here



Answer: All of the above, including you, must take part in ensuring we have enough food in the future.



How does biotech help lessen hunger?
bit.ly/PocketK30





What is inside the Biotech Foodbook?

Put a check on the like button if you eat any of the following:

The image displays seven food items, each with a label and a like button (a thumbs-up icon with a checkmark) for selection:

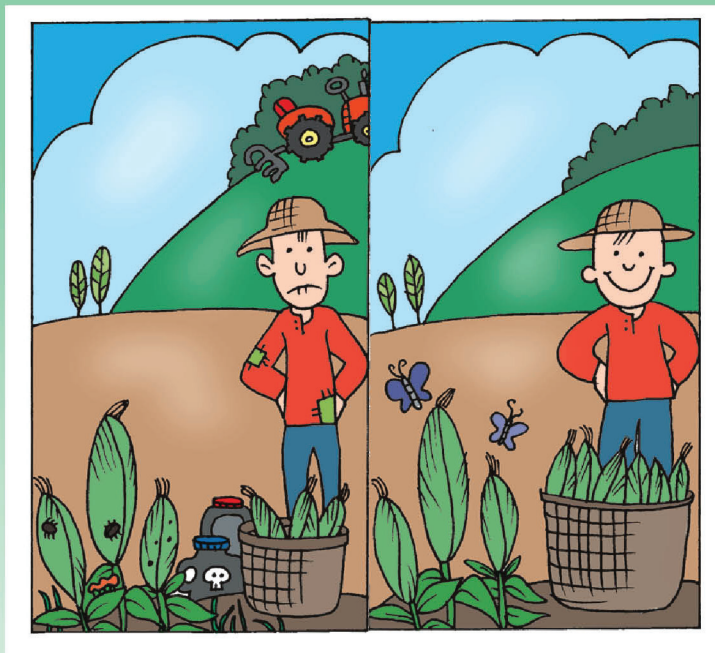
- TOFU**: A block of white tofu with a like button below it.
- CORN CHIPS**: A blue bowl filled with golden corn chips, with a like button below it.
- TACOS**: A single taco with a like button below it.
- SOY MILK**: A bottle of soy milk with a like button to its left.
- YOGHURT**: A blue yogurt container with a like button below it.
- PIZZA WITH MOZZARELLA CHEESE**: A slice of pizza with a like button to its right.

Which of these contain GM products?  





What is the difference between a conventional and a biotech farm?

Spot at least 6 differences between the two farms.





What is DNA?

Plants and animals have a chemical recipe in their cells that dictates the appearance and the role of each cell and thus, the organism as a whole. This recipe is called DNA, short for deoxyribonucleic acid. Biotechnology   is like changing one of the ingredients in this recipe to make the dish better.

DNA contains two strands wrapped around each other in a helix, and these strands are connected by molecules called bases.

Do you want to see how DNA looks like?
You can do this simple exercise at home.



Prepare the following materials

- 1 pc banana (cold)
- ½ cup cold water
- pinch of salt
- 1 tbsp liquid detergent
- ½ tsp pineapple juice
- cold ethyl alcohol (70–95%)
- 3 pcs clear plastic cups
- toothpick
- blender
- coffee filter
- rubber band
- fork
- saucer



What do scientists do with the DNA to improve crops?
bit.ly/PocketK19

What does DNA look like?

- 1** Peel a piece of banana and then mash.



- 2** Mix mashed banana, water, and salt in a blender for 15 seconds at high speed.



- 3** Cover one plastic cup (A) with a coffee filter. Secure with a rubber band. Pour the banana mixture on the filter.



- 4** Remove the coffee filter and add the liquid detergent. Mix gently to avoid forming bubbles. Leave it for 10 minutes.



- 5** Slowly pour 1/3 of the mixture on another cup (B). Add the pineapple juice. Slightly tilt the cup then pour 1/8 cup of ethyl alcohol through the side of the cup.





- 6** Wait for 5 minutes or until a cloudy substance appears. That substance is the DNA of banana! Scoop it using a toothpick.



Who develops biotech crops?

Did you enjoy the DNA extraction activity? That activity is similar to what scientists do in the laboratory.

Developing GM crops   requires experts' skills and knowledge about biotechnology. Scientists are continually updated with the latest trends and techniques in biotech. Just like your parents, they also care about our future. They also want us to have enough and better food to eat.

Activity: Ask your teacher to help you find a scientist involved with crops. Schedule an interview with him which could be face-to-face, through the phone or e-mail. Use the questionnaire below for your interview.



SCIENTIST APPRECIATION ACTIVITY Interview Questionnaire

Name of Scientist:

Specialization:

Organization:



E-mail add:

Questions:

- 1) Why do you love being a scientist?
- 2) Why is biotechnology important?
- 3) What is your advice for kids who would like to be a scientist in the future?

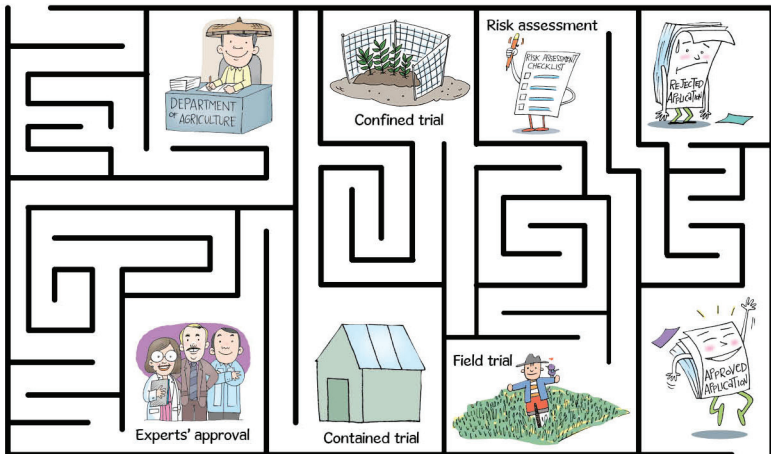
Send us the results of your interview through knowledge.center@isaaa.org with subject *Scientist Appreciation Activity* and get a package of information materials on biotech for free! Don't forget to include your name, age, and address.

What process do GM crops undergo to assure that they are safe to eat?

Biotech crops  are considered as the most studied food products because of the long process  they take before they become available in the market. To understand this process that they go through, let's help biotech corn pass through the maze and reach the farmer's field.



Biotech corn developed in the lab with biosafety approval



Farmer's field



Are GM foods safe to eat?
bit.ly/PocketK3

How much land is used for biotech crops?

One of the benefits of biotech crops   is that less land is needed by farmers to produce the same yield as conventional crops.




Farmer Ted owns 1.6 hectares (ha) of farm. By planting conventional corn on the entire farm, he can only harvest 2 tons. By planting insect resistant (Bt) corn, he can harvest as much as 7 tons per hectare. How much land does he need to plant Bt corn to produce 2.1 tons only? How much Bt corn can he harvest if he would plant his entire farm with Bt corn?



bit.ly/PocketK16

Ted needs 0.3 ha only to harvest 2.1 tons of corn. If Ted will plant his entire farm with Bt corn seeds, he'll produce 11.2 tons of corn after harvest.

Which countries are producing biotech crops?

The top 10 countries with the largest land area planted with biotech crops  are found in this puzzle. Find those countries and put a circle on each one of them.  

X	C	E	O	R	B	O	L	I	V	I	A	F	V	P
I	B	D	B	Z	G	X	N	B	M	A	X	A	V	W
I	N	M	Q	H	W	D	N	M	O	K	P	R	Y	G
S	T	D	D	D	E	R	C	S	U	S	A	G	J	M
V	E	M	I	D	R	C	K	A	I	C	K	E	X	Z
M	W	F	W	A	D	W	I	E	I	T	I	N	G	T
U	Q	C	I	T	B	I	C	R	Y	E	S	T	Z	W
X	Y	G	S	X	P	V	F	A	C	A	T	I	S	Y
K	K	C	H	I	N	A	U	M	A	Z	A	N	Q	O
Y	E	Q	I	B	H	G	R	S	N	F	N	A	D	B
I	O	O	T	T	A	L	U	U	A	B	G	N	Z	B
U	L	O	U	R	C	Y	G	G	D	Q	S	R	U	U
M	V	O	A	E	M	S	U	I	A	X	E	Y	F	R
V	S	P	E	B	B	R	A	Z	I	L	V	S	Y	D
R	P	F	H	A	F	E	Y	X	I	I	X	T	Y	K



Biotech sQuizBox



Create Team of the
Global Knowledge Center on Crop Biotechnology
Tin, Chel, Olah, Clem, & E.J



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