# Biosafety

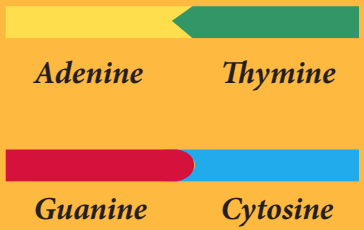
# Q + A

National Biosafety Framework Project
Bhutan Agriculture and Food Regulatory Authority
(BAFRA)
Ministry of Agriculture and Forests

## What is the purpose of this Q & A card?

This Q & A card will help the public especially school students to understand the topics on modern biotechnology, Genetically Modified Organism and biosafety easily.

1 What is a DNA?

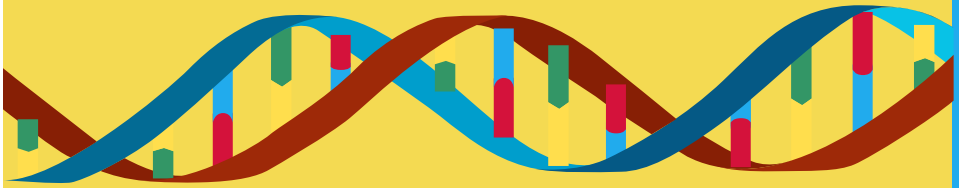




Flip for Answer

## dna

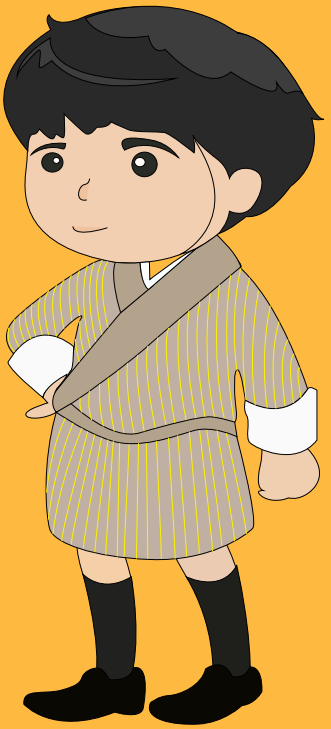
We all know that elephants give birth to only little elephants, giraffes to giraffes, dogs to dogs and so on for every type of living creature. But why is this so?



The answer lies in a molecule called deoxyribonucleic acid (DNA), which contains the biological instructions that make each species unique. DNA, along with the instructions it contains, is passed from adult organisms to their offspring during reproduction.

Deoxyribonucleic acid (DNA) is a molecule that encodes the genetic instructions used in the development and functioning of all known living organisms.

## 2 What is a GENE?



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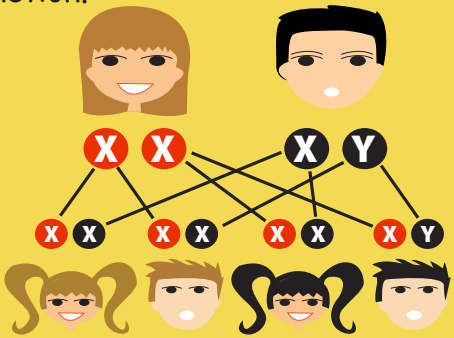
Genes are instruction manuals for our bodies. They are the directions for building all the proteins that make our bodies function.

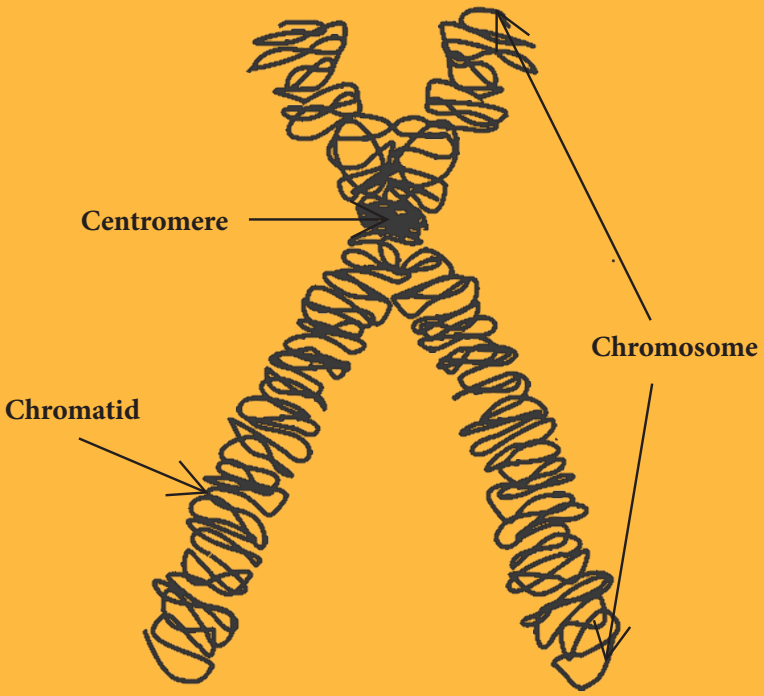



Genes are made of DNA. One strand of our DNA contains many genes. All of these genes are needed to give instructions for how to make and operate all parts of our bodies.

Genes contains instructions for building proteins, which are involved in all sorts of things. Proteins such as the enzymes that produce pigment in your eyes and keratin, responsible for growing hair and nails are also produced by genes.

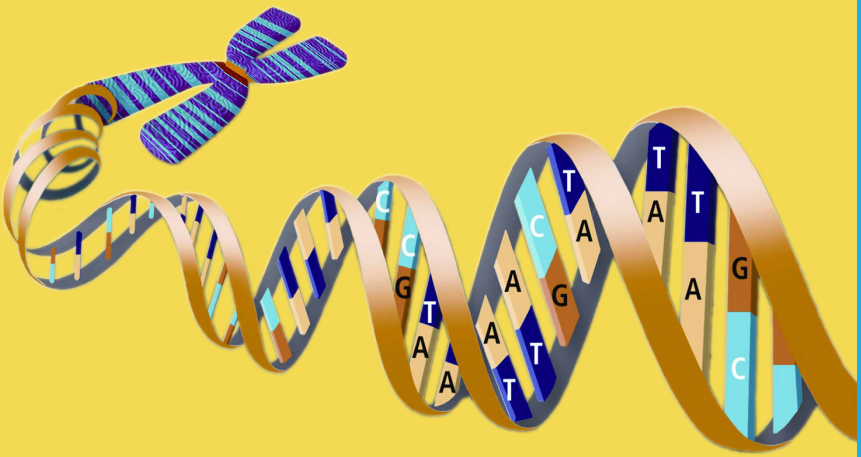
3

# What is a Chromosome?

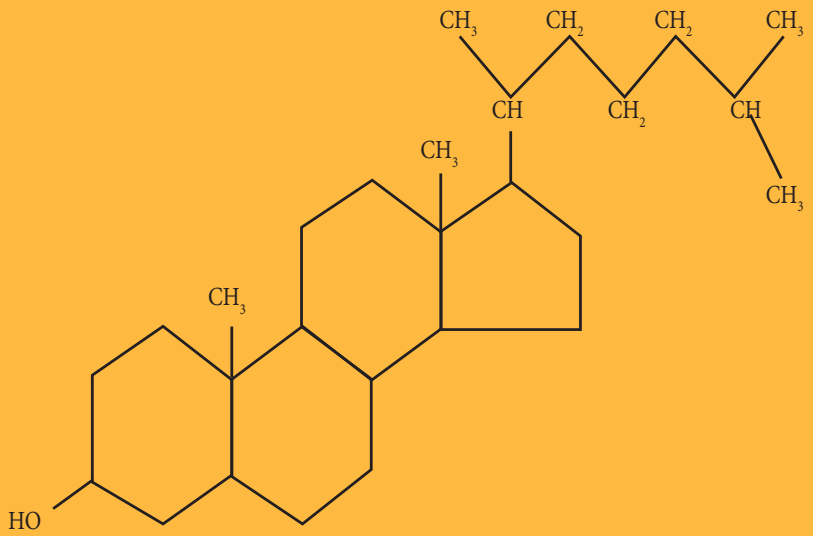



*Flip for Answer*

Each cell in our body contains a lot of DNA. In fact, if you pulled the DNA from a single human cell and stretched it out, it would be three meters long! The DNA is packed into compact units called "Chromosomes"

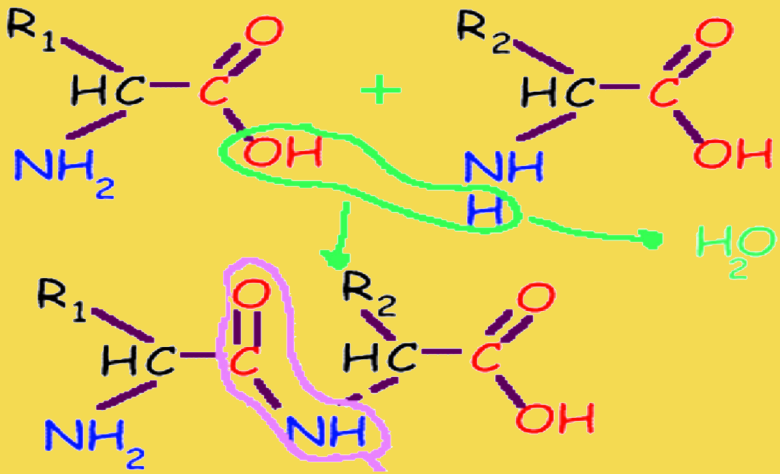


# 4 What is a Protein?

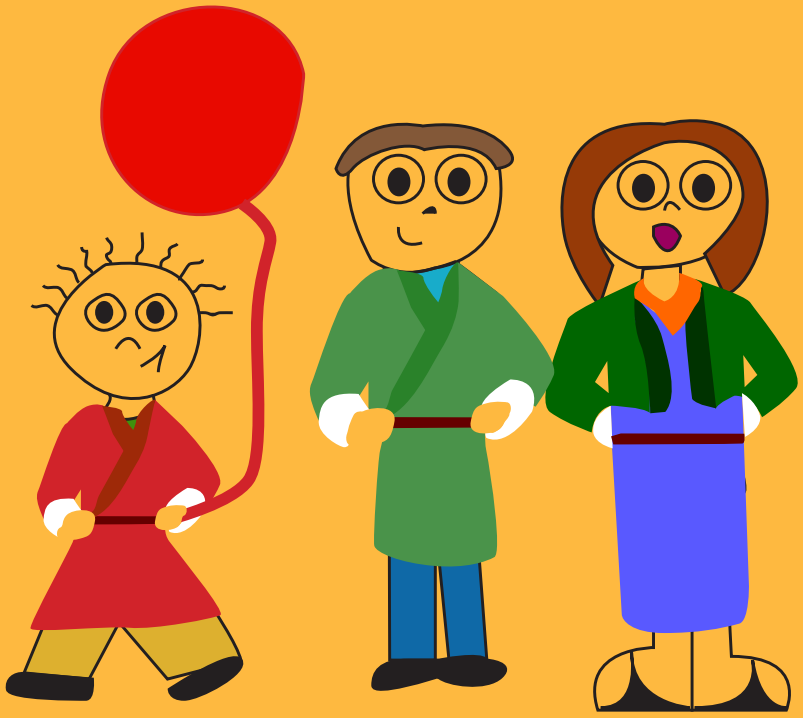



*Flip for Answer*

Proteins are machines that make all living things functions, from Viruses to Daffodils, Spiders to Sea Lions, and everything in between.



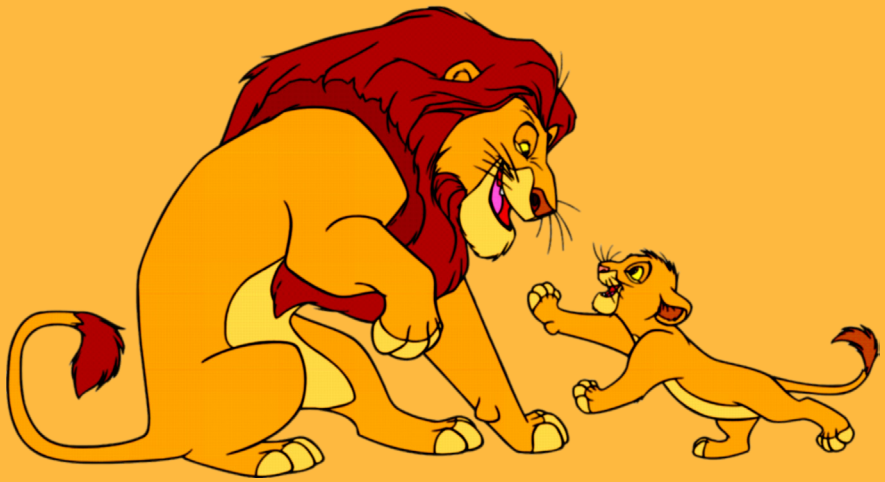
## 5 How do proteins work in the body?



*Flip for Answer*

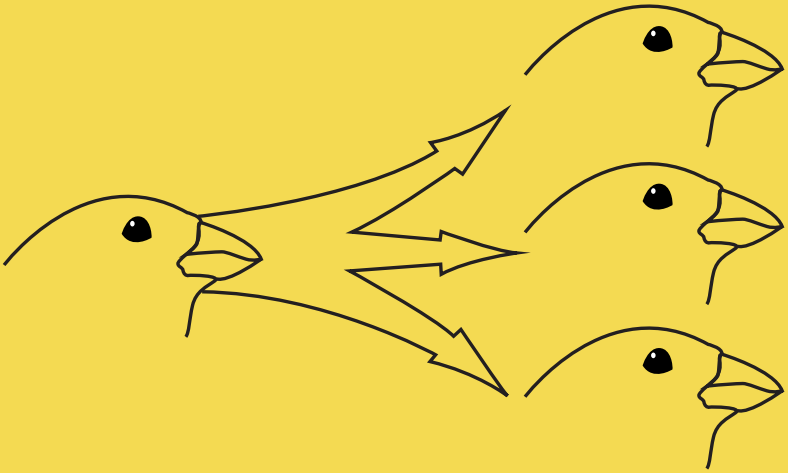
Our bodies are made up of about 100 trillion cells! Each of these cells is responsible for a specific job. Every cell contains thousands of different proteins, which work together as tiny machines to run the cell. You can think of proteins as parts of car engine – each part looks different, and they all do separate jobs to make the engine run.

## 6 What is a Trait?



*Flip for Answer*

A trait is a notable feature or quality in a living thing. Each living being has a different combination of traits that makes each one of us unique.



Traits are passed from generation to next generation. We inherit traits from our parents, and we pass them on to our children.

7 What is Biotechnology?


*Flip for Answer*

Any technological application that uses biological systems, living organisms or derivatives thereof, to make or modify products or processes for specific use is known as Biotechnology.

8 What is a Modern Biotechnology?

*Flip for Answer*

Modern biotechnology is a term adopted by international convention to refer to biotechnological techniques for the manipulation of genetic material and the fusion of cells beyond normal breeding barriers. The most obvious example is genetic engineering to create genetically modified Organisms through "transgenic technology" involving the insertion or deletion of genes.

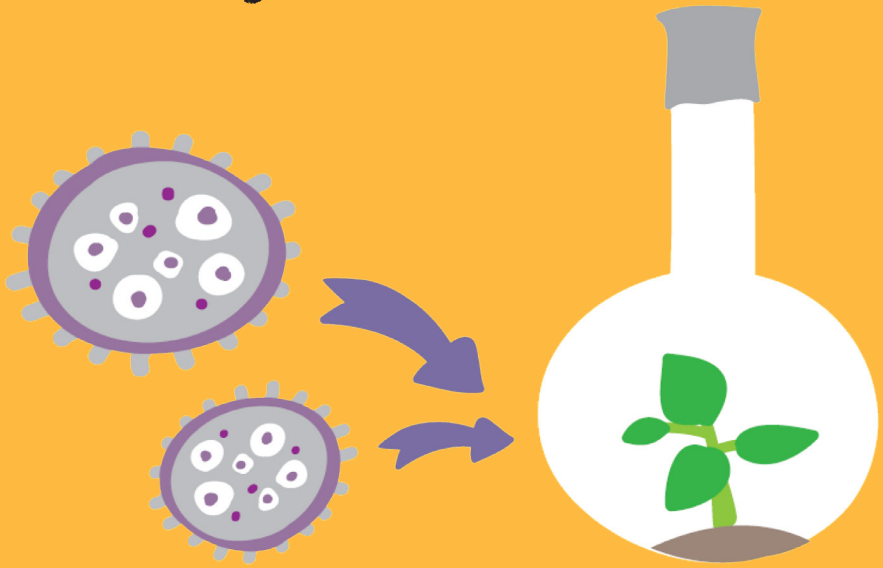
9 What is a Genetically Modified Organism?


*Flip for Answer*

A GMO is an organism whose genetic material has been altered using modern biotechnology. A gene from an organism can be introduced into a different organism to create a new trait or to improve on existing traits.


An existing gene can also be silenced to remove an undesired trait. Living Modified Organism (LMO) is used interchangeably with GMO.

10 How is Modern Biotechnology different from conventional breeding?



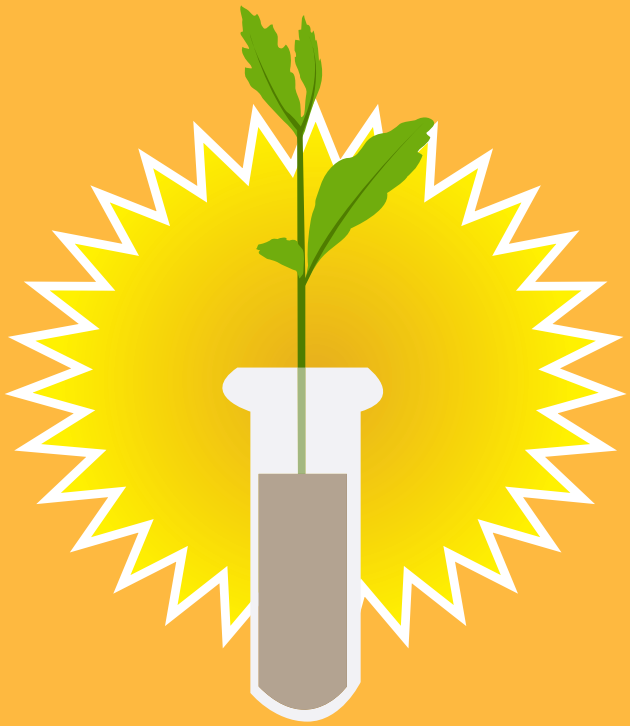
*Flip for Answer*

Both techniques are used for the production of more useful and productive crop varieties.

In Modern Biotechnology however, only desired genes are added or deleted. The genes could come from diverse sources unlike in conventional breeding and may be transferred into unrelated species.

Through Modern Biotechnology, a useful gene from bacteria can be transferred into a plant, a process that can't be done in conventional breeding.

## 11 What can Modern Biotechnology do?

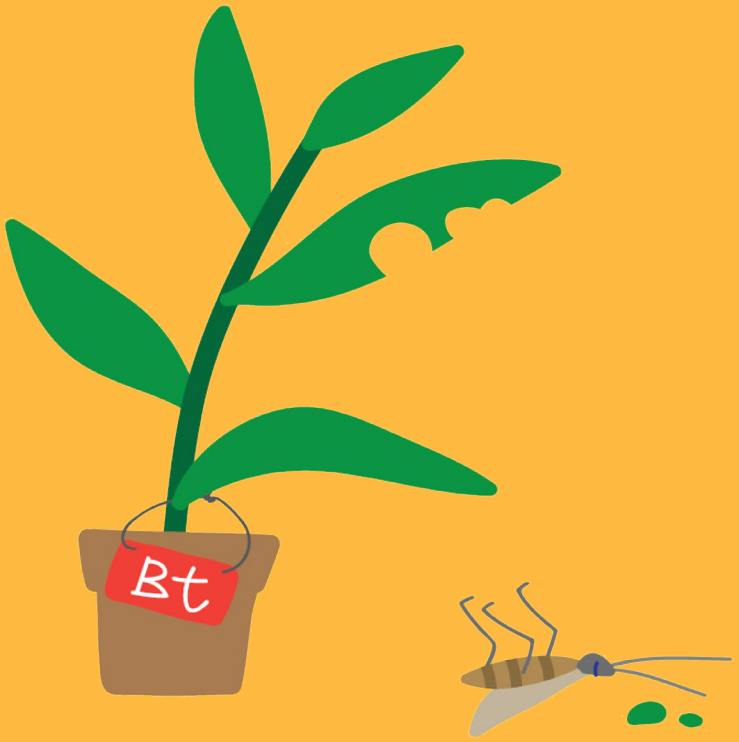


*Flip for Answer*

Modern Biotechnology may help in producing better yield and increase crops production.

Plants, bacteria and animals can be genetically modified to produce therapeutics, vaccine antibodies and other compounds useful in healthcare.

12 What is "BT"?




*Flip for Answer*

"Bt" is short for Bacillus thuringiensis, a common soil bacteria used as a biological pest control.

Bt produces a protein that is toxic to certain types of insets. This toxin can kill the insects that are harmful to the crops.

With Modern Biotechnology, the gene encoding for this toxin can be transferred to plants, therby creating plants that are pest/insect resistant. Many commercially grown crops have been genetically modified this way, including Bt cotton and Bt Maize.

13 What are the benefits of having Genetically Modified Crops?

*Flip for Answer*

1

Higher crops yields due to reduce loss to pests and diseases

2

Reduced farm production costs due to reduced use of pesticides and labour cost

3

Reduced use of pesticides in the environment

14 Are there any risks with the use of GMO and its products?

*Flip for Answer*

A number of potential risks exist. GMO products may be allergenic or toxic to some. When GMO is released in the environment, the imparted traits might affect other species and biodiversity in general. Insect populations might eventually develop immunity with stronger resistance to Bt toxin.

There is also the risk of unintended effects on non-targeted organism hence the need for the biosafety regulations and its enforcement.

15 What is a Genetically Modified Food?

*Flip for Answer*

Genetically modified foods are foods that have been produced from, derived or composed of GMOs.

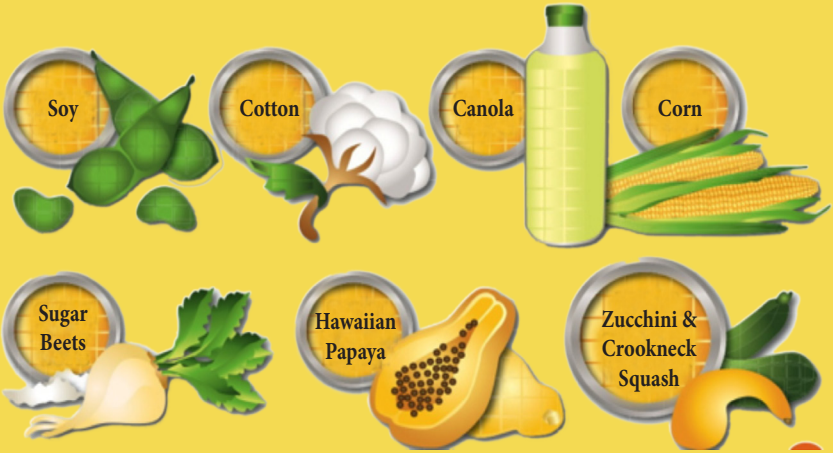
16

# Are GM Foods Safe for Human Consumption?

*Flip for Answer*

So far, there has been no scientific evidence of danger but also there is no certainty regarding the risk free consumption of GMOs. There are mixed opinions on the impacts of GMOs on human health.

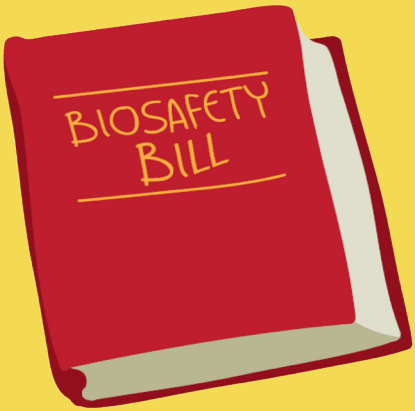
Typical crops that are subjected to gene modification are mostly: Soy, Cotton, Maize, Canola, Hawaiian Papaya, Zucchini, Tobacco and sugar beets.



17 Has Bhutan taken any steps in regulating GMO?


*Flip for Answer*

Consistent with the provisions of the Constitution of the Kingdom of Bhutan, National Environment Protection Act, Cartagena Protocol on Biosafety and other relevant legislations, Biosafety Bill 2013 has been drafted by Ministry of Agriculture and Forests for enactment. With endorsement of the Biosafety bill, the Biosafety Act will govern every aspect of GMO management in Bhutan.



18 Where can i get more information on biosafety?


*Flip for Answer*

Bhutan Agriculture and Food Regulatory Authority
Ministry of Agriculture and Forests
Thimphu : Bhutan
Tel: +975-02-339953, +975-02-327031
Fax:+975-02-327032
www.bafra.gov.bt

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**Bhutan Agriculture and Food Regulatory Authority (BAFRA)**

**Ministry of Agriculture and Forests**

**Thimphu : Bhutan**

**Tel: +975-02-339953, +975-02-327031**

**Fax:+975-02-327032**

**www.bafra.gov.bt**