Genetic Modification

Careful selection by humans can lead to plants with particular characteristics.

This process is known as **SELECTION**. It has been used for hundreds of years to produce plants, such as apples, and animals, such as dogs, with traits seen as desirable.

List some of the ways in which plants and animals have been altered by selective breeding over the centuries.

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List some of the features of food crops which would be considered desirable to develop by selective breeding.

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Sometimes this process can have unforeseen results when other features are accidentally promoted or bred out in the process. Flowers bred for appearance, for example, may lose their scent. This danger has provided the subject matter for a number of scary films!

List examples of how this could be undesirable or even dangerous.

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Scientific advances in recent years have enabled us to modify the characteristics of plants and animals by selectively altering the genetic structure of one organism by inserting genes that control certain characteristics from a related or quite different organism.

Plants and animals altered in this way are known as **Genetically Modified Organisms (GMOs)**.

What do you understand by the term GMO?

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How is this process different from the historical process of selection?

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Genetic Modification

Sc2 Life Processes and Living Things

Careful selection by humans can lead to plants with particular characteristics. This process is known as SELECTION. It has been used for hundreds of years to produce plants, such as apples, and animals, such as dogs, with traits seen as desirable.

List some of the ways that plants and animals have been altered by selective breeding over the centuries.

Introduce the concept of VARIATION and selection as part of the natural process of evolutionary change. Virtually any food crop and domesticated animal provides an example of this.

List some of the characteristics that may be seen as desirable.

Get students to consider the different groups that might benefit by altering the characteristics, eg- Growers - resistance to cold,resistance to certain herbicides.
Supermarkets - even appearance, colour, long shelf life.
Consumers - texture, sweetness.

Sometimes other features are accidentally promoted or bred out in the process. Flowers bred for appearance, for example, may lose their scent.

List examples of how this could be undesirable or even dangerous.

There are many examples of this. For example in 1957 swarms of bees that were the result of a crossbreeding European and African honey bees escaped from an experimental apiary in Brazil. The intention was to breed bees which produced more honey but unfortunately they became more aggressive and were termed 'killer bees'.

Scientific advances in recent years have enabled us to modify the characteristics of plants and animals by selectively altering the genes that control those characteristics. Plants and animals altered in this way are known as Genetically Modified Organisms (GMOs).

Biotechnology can be applied to produce two varieties of enhancements: transgenic or intraspecies. These words refer to whether scientists are working within one species of plants — intraspecies — or across several species — transgenic. For example, adding a pest-resistant trait to yellow corn from white corn is an intraspecies enhancement, while adding the same pest-resistant trait to wheat is transgenic. Transgenics (often referred to as biotechnology) is the application of scientific knowledge to transfer genetic traits from one species to another to enhance or protect an organism.

How is this different from the traditional process of plant selection?

Traditional plant breeding involves the transfer of pollen containing the gene for a desired trait from one crop variety to another. Eventually, the desired trait will appear in a new family of plants. But continually combining genes in this way takes years to yield new varieties, and it is less precise. Biotechnology helps scientists be more precise and efficient in isolating genes and developing new varieties of plants, taking years away from the lengthy, trial-and-error traditional breeding process.

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There is a very fierce debate over the ethics of GMO technology.
Here are a few recent statements about the subject.
Sort them into those in favour and those against.

"Genetic engineering has been hailed by the biotech industry as offering a new model of sustainable agriculture, which will 'feed the world'. Yet their products are forcing small farmers into a new form of serfdom by the extraordinary control the industry exercises over the way farmers must grow, harvest and buy genetically modified (GM) seeds."
"Biotechnology helps scientists be more precise and efficient in isolating genes and developing new varieties of plants, taking years away from the lengthy, trial-and-error traditional breeding process."
"Once GMOs are released there is no calling them back."
"Biotechnology's been around almost since the beginning of time. It's cavemen saving seeds of a high-yielding plant. It's Gregor Mendel, the father of genetics, cross-pollinating his garden peas. It's a diabetic's insulin, and the enzymes in your yogurt. Without exception, the biotech products on our shelves have proven safe."
"The use of GMO crops could result in changes in land use that would be harmful to wildlife and the environment."
"...to maintain the productivity of agriculture, we must continue to improve the agricultural seeds that are used... We are now blessed through research and technology with new methods of actually speeding up the process of improving the seeds and the products we get from them..."
"Labelling foods with GM ingredients is a positive step, but does not address the fact that we have come to distrust scientists when they claim that some new discovery is safe and low risk, and there is good grounds for such scepticism."
"The benefits of biotechnology are many and include providing resistance to crop pests to improve production and reduce chemical pesticide usage, thereby making major improvements in both food quality and nutrition."
"We do not know what escaped genes will do in the environment and we do not know what might happen to us when we eat products derived from GMOs."
"If foreign researchers can patent indigenous crop plants without making recompense to the communities who provided them, there are fears that farmers will end up paying royalties on the products of their own knowledge, products on which they rely for survival."
"Genetic engineering represents an intervention with unprecedented depth and power. Radical artificial alterations of the code of life, the genetic makeup, can be created. Such changes may have very complex consequences on the properties of the organism".
A Blair spokesman recently said that the Prime Minister has "a sense of frustration that the debate [on GM foods] is not being conducted in as fully informed a manner as it could be." It is certainly true that the use of emotive terms such as 'Frankenstein Foods', the unseemly scrambles for the moral high ground and the distortions of science in the service of competing ideologies have hardly been conducive to calm, rational consideration of the GM issues.

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- Use the internet to research the subject of GMOs using the sites listed below.
- Give three arguments in favour and three against GMOs.
- The sites are published by groups holding their own interests on the subject.
- Try to weigh up the opposing opinions and reach a view of your own.

www.biotech.dupont.com

www.biotechknowledge.com

www.africabio.com

www.psrast.org

www.economist.com

www.foodstandards.gov.uk

www.sirc.org

www.punjabilok.com

www.lincstrust.org.uk/conservation/gm.php

www.bayercropscience.com

www.oxfam.org.uk

www.ukfg.org.uk

www.greenpeace.org

www.foe.co.uk

www.defra.gov.uk

www.fao.org

www.newscientist.com

Conduct a short debate in your class on the subject of GMOs.