Activity E

Genetically Modified Foods

Developed by Holly Cook

Introduction

The lesson explores pupils' ideas about the use of genetic modification (GM) in the food industry. It opens with a quick attention-grabbing starter about using green tomato sauce. Questions are used to introduce the term 'GM', which is then explained in simple terms. In the main activity pupils are given four articles on GM foods, one of which is fictitious. The aim is for them to use evidence in the text to try to discover which story is false. This is followed by a debate about the use of GM foods.

Objectives

Pupils will learn to:

- select scientific evidence in a news article;
- use evidence to justify or alter their opinions;
- make judgements based on available evidence.

Outcomes

By the end of the lesson, pupils will be able to:

- decide whether each article is true or false;
- identify 3 pieces of evidence to support their decision;
- use the skills developed in the main activity in a debate.

Notes for Teachers

During the main activity pupils can be reminded of the key questions about how to look for evidence in text. During this activity it is also useful to get an idea of what groups have decided so that the debate can be structured. The organisation of the debate depends on the class, for example pupils can nominate a spokesperson for their group or it can be more general.

Stress the importance of finding evidence (different sources, "trusted" Internet sites/newspapers, journals, and peer-reviewed work).

The false article is "strawberry fields". In this example the new GM food has been tested on human subjects (children) before being granted a license. This would not be possible. All names, quotes and places are completely fabricated in this example and, although the scientific idea is possible, it has not been done (so far!).

Misconceptions
There has been little research about pupils' misconceptions in the area of genetic modification, probably because it is a relatively new technology and not a specific learning objective of the national curriculum. However, some misconceptions were discovered in teaching this lesson and these were:

- GM food can kill you/is bad for you;
- Cross-species gene transfer is not possible e.g. from fish to tomato;
- Genetic modification is the same as selective breeding;
- Other characteristics of the organism will be carried over e.g. tomatoes will smell of fish;
- That when we eat the GM gene it will integrate into our DNA.

Teaching Sequence

- Begin by sharing the learning objectives with pupils. Use the tomato sauce as an example, asking key questions to explore pupils' existing ideas about genetic modification. Explain the principles of GM.

- Explain to the pupils that they will be given 4 news stories about GM foods, one of which is false.

- Give out the stories to each group of pupils. Each pupil reads the story and then, as a group, they come up with three reasons why they think it is either true or false.

- Ask pupils to think carefully about what they might base their reasons on because they will be asked to defend their decisions to the rest of the class.

- In the plenary, collect decisions from each group. Get an idea of the overall consensus. Discuss problems pupils might have had in reaching decisions.

Background science
The following information is adapted from www.bbc.co.uk

Genetic modification involves altering an organism's DNA. This can be done by altering an existing section of DNA, or by adding a new gene altogether. A new gene can be added from one individual to another from the same species, e.g. tomato gene into another tomato plant, or between individuals from two different species, e.g. tomato gene into a fish. It is possible to transfer genes from one species to another from plant to plant, from animal to plant, from plant to animal or from animal to animal. This is because all genes, no matter where they come from, are made of DNA.

How to add a fish gene into a tomato
Scientists have created a frost-resistant tomato plant by adding an antifreeze gene from a cold-water fish to it. The antifreeze gene comes from the cold-water flounder, a fish that can survive in very cold conditions. This is how it was done:

The flounder has a gene to make chemical antifreeze. This is removed from the chromosomes within a flounder cell.

The antifreeze DNA is joined onto a piece of DNA called a plasmid. This hybrid DNA, which is a combination of DNA from 2 different sources, is known as recombinant DNA.

The recombinant DNA, including the antifreeze gene, is placed in a bacterium.

The bacterium is allowed to reproduce many times producing lots of copies of the recombinant DNA.

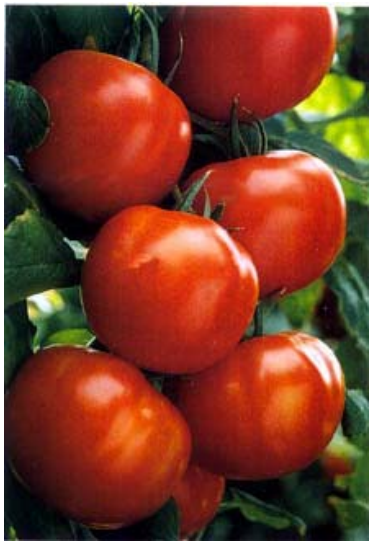
Tomato plant cells are infected with the bacteria. As a result, the antifreeze gene in the plasmids, in the bacteria, becomes integrated into the tomato plant cell DNA.

Tomato cells are placed in a growth medium that encourages the cells to grow into plants.

Tomato plant seedlings are planted.

The GM tomato plants contain a copy of the flounder antifreeze gene in every one of their cells. The plants are tested to see if the fish gene still works and whether they are now frost resistant.

Fishy tomatoes



Californian scientists have created a frost-resistant tomato by adding an antifreeze gene from a cold-water fish to it. Pamela Dunsmuir and fellow researchers at the DNA Plant Technology Corporation have taken the gene which makes an anti-freeze chemical out of the cold-water flounder, a fish that can survive in very cold conditions, and put it into tomato plants.

The genetically modified (GM) tomato plants were tested to see if they could grow in frosty conditions and it was found that they could. Every year millions of tomatoes are damaged by frost, and this new technology could revolutionise the way which tomato growers grow tomatoes by allowing the tomatoes to survive even the frostiest of conditions, preventing waste and easing transport.

- Our group thinks that this story is true / false because …

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- Why did the scientists want to make this new type of food?

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GM could hold back the tears

A new finding could lead to genetically modified (GM) onions that don't make us cry as we chop them. Researchers in Japan have identified the enzyme that releases a tear-duct-tickling chemical when an onion is cut. We isolated the gene that controls the production of this enzyme and we can now switch this gene off. "A GM onion lacking the enzyme would not irritate your eyes, but taste very similar to the original," says Shinsuke Imai at House Foods Corporation in Japan. It's not exactly what the world has been crying out for, but Richard Dixon, a plant scientist at the Noble Foundation, Oklahoma, argues that it could be one of the first GM organisms acceptable to consumers. "A non-tear onion would perhaps be one of the first examples where mainly the consumer benefits," Dixon says.

- Our group thinks that this story is true / false because …

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- Why did the scientists want to make this new type of food?

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Pupil activity sheet 3: Genetically Modified Foods

Golden Rice

A new genetically modified (GM) rice may save over 250 million people around the world from permanent blindness and 1 to 3 million children from death caused by Vitamin A deficiency. A rich source of Vitamin A is a chemical called beta-carotene, found in some plants like daffodils and carrots. The GM rice, called 'Golden rice' because of its colour, contains a gene extracted from a daffodil and inserted into the rice DNA that increases the amount of beta-carotene in rice grains. The beta-carotene is then converted to vitamin A in the body.

''If the rice is acceptable to children in developing countries, it could immediately begin to make a difference" said Dr. Alfred Sommer, Dean of the John Hopkins School of Hygiene and Public Health, who led the research that linked vitamin A to higher death rates in children. The new varieties will be distributed free of charge by the Philippines-based, International Rice Research Institute and various agricultural research centres in developing countries.

- Our group thinks that this story is true / false because …

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- Why did the scientists want to make this new type of food?

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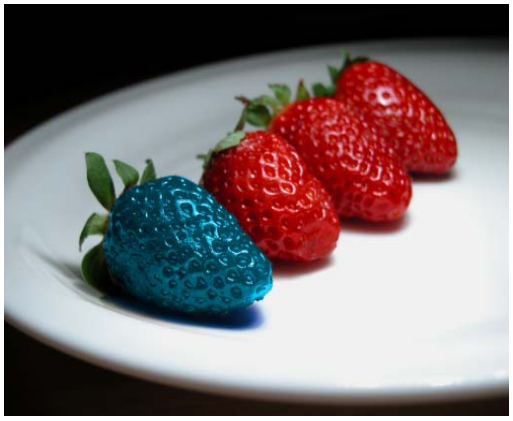
Pupil activity sheet 4: Genetically Modified Foods

Strawberry fields forever



Strawberries and cream have always been associated with the traditional British summer, but this could all be about to change. Dr. Elizabeth Davies and colleagues at the American Association of Genetic Modification, have identified the gene that makes blueberries blue and have put it into a strawberry. "The results are astonishing," says Davies, "the genetically modified strawberries still taste exactly the same but are a rich blue colour like blueberries". It is hoped that this will help to make children eat more healthily by making fruit more appealing. The GM blue strawberries have gone down well in taste tests on children. "We are very pleased with the results of the initial trial and major supermarkets have already shown interest" says Davies. However, UK scientists are wary of licensing blue GM strawberries for production. Robert Gilmartin from the GM Monitoring Organisation says, "I don't think that the British public are quite ready for blue strawberries just yet!"

- Our group thinks that this story is true / false because …

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- Why did the scientists want to make this new type of food?

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