

# It's all in the genes (Pg1)

## Exploring Issues About Genetically Modified Foods

### Curriculum

Science:	Making Sense of the Living World
Technology:	Knowledge and Understanding
Social Studies:	Resources & Economic Activities

### Teacher Notes

The recent government announcement on GM research has polarised many of our community. Unfortunately when this happens, common sense and debate based on factual information seems to go out the window.

Proponents of this biotechnology area cite four main reasons for its development - better health, better products, better for the environment and better business.

There are a number of practical and ethical issues surrounding genetically modified foods and debate can often become very emotive when issues are publicised in the news media.

In this unit for Year 7+ students, we investigate and debate some of the issues to gain a better understanding of the pros and cons of GMF (genetically modified food).

### Website

For an excellent background on GE and GM go to the Australian Biotechnology Association site at: [www.aba.asn.au](http://www.aba.asn.au) (Click on educational leaflets & links)

### What do we Know? - A Brainstorming Session

- Establish what prior knowledge your students have by giving them the following key words. In groups, have students brainstorm, list their responses and report back to the class. Key words ...
  - chromosomes
  - cells
  - DNA
  - genes
  - genetic engineering
  - genetically modified food (GMF)

### On-going research projects

- Have students search school and local library for any information relating to the key words. Students write brief notes.
- Keep a media watch for any references to genetic engineering and GMF for the duration of the unit.
- Establish a bulletin board to display all information.

### What is Biotechnology?

- Explain to the students that biotechnology is a way of using the characteristics of microbes and plant and animal cells for the perceived benefit of mankind.
- Humans have been using biotechnology for thousands of years in the form of cross breeding, **eg**
  - a farmer notices that certain sheep in a herd give birth easily to lambs or they grow better wool than others. He will then breed from these lambs to establish a flock of sheep that all have these wanted characteristics.
  - Cite the example of a breed of dog, the long haired dachshund, established over 100 years ago by cross breeding dachshunds and cocker spaniels
- Can the students think of any possible negative effects of animal cross breeding, **eg** hip dysplasia in many german shepherd dogs?
- Invite some of the following people to talk to the students about examples of cross breeding in their fields of work.
  - a horticulturist or garden centre manager
  - a farmer
  - a veterinary surgeon
- Ask them what are the positive aspects of cross breeding? Can they cite any negative effects?

### Introducing Genes and DNA

- How a cell performs specific tasks is determined by its genetic make-up - that is the instructions contained in the cell as a collection of chemical messages called genes.
- These genes are passed on from one generation to the next so that offspring inherit a range of individual traits from their parents.
- Illustrate this by having students list similar characteristics that members of their extended family have, **eg**
  - eye colour
  - facial/body features,
  - hair colour
  - skin pigment ...
- Tell students that scientists understand how this system of chemical instructions works. It is based on a substance called Deoxyribonucleic Acid - DNA. In simple terms a gene is a segment of DNA which contains these instructions.

# It's all in the genes (Pg2)

## Exploring Issues About Genetically Modified Foods

- Give an example in nature - every time a seed from a tree is distributed by the wind it contains the instructions on how the new tree is to grow.

### Genetic Engineering Technology

- Explain that traditional methods of plant and animal breeding typically take about 10-12 years or even decades to breed out all the undesirable genes or to capture those that are wanted.
- What reasons can students advance for the purpose of plant and animal breeding, eg
  - disease resistant crops
  - tastier fruit
  - a healthier animal
- Now that scientists understand the secrets of DNA they can transfer a gene carrying the DNA code by **copying** it from **any organism to another**. This is known as genetic engineering. Genetic engineering reduces the time problem of cross breeding.

### Before We Get Outraged

- As it is now possible to transfer copies of genes from any organism to another; give the following two possible scenarios for group discussion ...
  - *If you were a vegetarian, would you be upset to learn that the broccoli you are eating had been changed using a **copy** of a gene from a pig?*
  - *If a fruit that you were eating contained a gene copied from a human being, would you be a cannibal?*
- List student reactions
- Explain that DNA, the substance comprised of genes, is the **same** whether you are a tree, a human or an animal. It is only how the DNA is **arranged** that is different. Does this alter how the students reacted to the two above scenarios?

## Discuss and Debate

### Gene Technology - Good or Bad?

- In 1996 US researchers were genetically engineering a banana to produce an antigen found in the hepatitis B virus. If successful, this banana could immunise children in developing countries for just a few cents a dose. Current vaccines cost between \$100-\$200 per dose.

- Many fruits and vegetables are difficult to grow in areas where there is frost. A few years ago, researchers discovered that the Arctic flounder produces an anti freeze to protect itself in these cold waters. Research is now underway to introduce the anti frost gene into fruits and vegetables like strawberries that can be damaged and destroyed by frosts.
- Growing genetically modified crops that are resistant to pests and diseases could reduce the reliance that agriculture has on chemical sprays. This would be better for the environment, keep costs down and could even enhance the 'clean green' image of New Zealand.
- Depending on its makeup, a genetically engineered plant or animal may be more competitive than our native plants and animals and eventually overrun our native species. Examples of not fully understanding the impact of introduced species can be seen with possums, rabbits, gorse, stoats and even domestic cats.
- Does manipulating genes mean that man is playing God? Do we have the right as human beings to meddle with natural selection?
- Maori do not see biotechnology and in particular genetic manipulation as complimentary to nature or biodiversity. Rather they see it as humans forcing natural objects to fit into their world. The Maori view is that the external world should try to fit unobtrusively into the natural world.

## Further Directions

- Produce fact sheet brochures outlining both the pros and cons of genetically modified foods to stimulate debate amongst students and parents.
- Design and run a community survey on attitudes to, and understanding of genetic engineering. Collate and publish results.

### Discuss

'If this genetic engineering gets any worse we will end up with babies feet sticking out of tomatoes'.

### Debate

'Genetic engineering will lead to a better quality of life for all human beings'.