

Lesson 13
Genetic
modification



Suitable for: 14–16 years

Curriculum and learning links: Genetic modification

Learning objectives:

- Describe the process of genetic modification.
- Explain some of the ethical issues surrounding genetic modification.

You will need:

- Clips: 13.1, 13.2 and 13.3
- Worksheets: 13A, 13B, 13C and 13D

Opening activity

- Show students the images of genetically modified organisms on **Worksheet 13A** and ask them to determine what they have in common.

Development activities

The process

- Watch **Clip 13.1** in which Liz explains how papaya plants on Hawaii have been genetically modified to be resistant to a viral disease. Whilst watching the clip, ask students to make their own notes or answer questions on **Worksheet 13B**. Review their notes or answers.



Design an organism

- Describe the process of genetic modification (perhaps using the popular example of jellyfish genes inserted in rabbits, which then fluoresce under UV light) or watch **Clip 13.2**.
- Check students' understanding by using the card sort activity on **Worksheet 13C**.
- Ask students to design an animal or plant that could be genetically modified to survive in an unusual or hostile environment. They could also design a genetic modification that they would like for themselves.

The ethics

- Explain that genetic modification is an ethical issue. Ask students to come up with some of the reasons for this. Watch **Clip 13.3** in which some of these issues are discussed. Use **Worksheet 13D** as a prompt for a group or class discussion on the ethics of genetic modification.

/bang

Reflect and review

- Ask students to design a textbook page that summarises the process of genetic modification. Students could also write a balanced account of the ethical issues surrounding this process.

Want to explore further?

- Students could research and debate the similarities and differences between genetic modification, cloning and selective breeding. Similarities of the three processes include their purpose (to modify organisms) and advantages (e.g. higher crop yields). Differences include the techniques themselves and the ethical issues surrounding genetic modification and cloning.

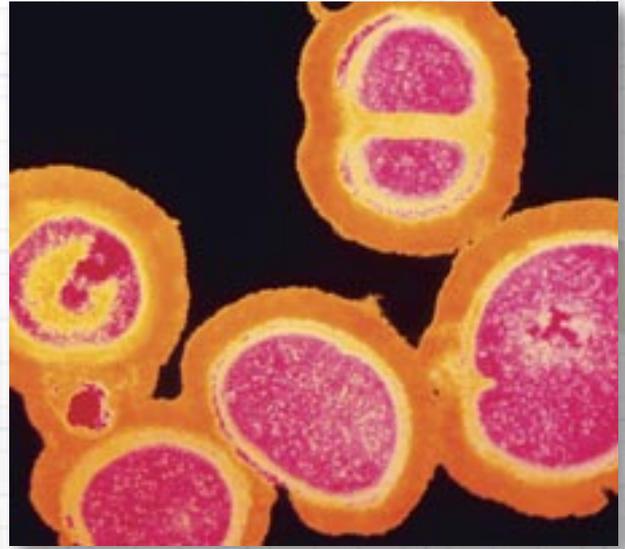


Technician's notes:

- **Worksheet 13C** can either be prepared in advance as a card sort, or given to the students as a cut-and-stick activity.

Worksheet 13A:

What do the organisms in these images have in common?



Worksheet 13B: Genetic modification of papaya plants

We will now watch a clip from *Bang Goes the Theory* in which Liz explains how papaya plants on Hawaii have been genetically modified. Answer the questions below whilst you are watching the clip.

1. Why was the genetic modification of papaya on Hawaii in 1998 so special?

2. What is the problem of using intensive agriculture, as mentioned in the clip?

3. What is the name of the disease that threatened the papaya population before genetic modification, and what are its symptoms?

4. Which organism did the gene that was inserted into the papaya come from?

5. Why was this gene inserted?

6. How was this gene inserted into the papaya genome?

7. What was the economic 'cost' to the genetic modification of papaya on Hawaii?

8. What disease now threatens papaya production on Hawaii?

9. Which organism did the gene that has now been inserted into the papaya come from?

10. Why was this gene inserted?

11. How was this gene inserted into the papaya genome?

Worksheet 13C: Card sort activity for genetic modification

Cut out the sentences listed below and put them in the correct order. The process is for the genetic modification of herbicide-resistant crops.

Embryos of the plant are infected by the bacterium.

The gene is removed using restriction enzymes.

The crop plant is grown and now contains the inserted gene.

Pesticides can now be used to kill all other plants except the crop.

The gene is inserted into a vector such as the bacterium *Agrobacterium tumefaciens*.

The gene that is responsible for the disease resistance is identified.

A naturally occurring plant that is resistant to the disease is found.

Worksheet 13D:

The ethics of genetic modification

Use the following prompts to discuss the ethics of genetic modification.

If we continue to make crops resistant to pests by using genetic modification, this might mean that the pests evolve more quickly or start eating other plants.

Genetic modification is 'playing God'.

Genetic modification has many uses in medicine. Insulin for diabetics is now produced in genetically modified bacteria.

We are still not sure if these 'Frankenstein foods' made by genetic modification really are safe.

Genetic modification of crops has the potential to reduce hunger and malnutrition, especially for those living in the developing world. It can make crops more tolerant to cold or drought.