

What do the public think of genetic technologies?

This resource was developed by teachers within the Royal Society Schools Network



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Curriculum key words

DNA Food security
GM crops Genetic engineering

Curriculum links

Science GCSE:

- AQA Trilogy/Biology 4.6.2.4;
- AQA Trilogy/Biology 4.7.5.4
- AQA Synergy 4.3.3.8;
- AQA Synergy 4.4.4.6
- OCR Gateway B6.2b
- OCR Gateway B6.2d
- OCR Gateway B6.3q
- OCR 21st Century B1.3;
- OCR 21st Century IaS4
- Edexcel Combined/Biology 4.10
- Edexcel Combined/Biology 4.11(HT)
- Edexcel Combined/Biology 4.12B
- Edexcel Combined/Biology 4.14

Equipment needed

- Access to Royal Society web pages
- Post it notes

KS4

Lesson time: 1 hour

Introduction

Genetic technologies have advanced rapidly in the last 20 years, and in turn so has the wariness of the public towards them. Topics such as genetically modified organisms (GMOs) in food, screening for diseases and designer babies have caused many moral, religious and ethical objections. Consequently, an important part of a genetic scientist's work is with public perception.

This lesson looks at some of the common public concerns around genetic technologies, and facilitates a discussion around how the science can best be communicated. This lesson can be undertaken in science, with a biology focus, or within personal, social and health education (PSHE), Extended Project Qualification EPQ, International Baccalaureate /theory of knowledge (IB/TOK) time.

The activities and sources of information are based on materials produced by the Royal Society as part of its public dialogue on Genetic Technologies. All of these resources, and more detail on the Gene Technologies project, can be accessed via the [Royal Society website](#).

Learning Objectives:

- Explain what gene editing is.
- Suggest reasons why good public communication is important.
- Create methods to better communicate with the public.

What do the public think of genetic technologies

Starter activity: what does genetic technology mean?

(Approximately 5 minutes)

Discuss with students what they think is meant by 'genetic technologies'. Consider using the *Think Pair Share* learning strategy for this activity.

The key point that should be elicited from the students is:

- Genetic technologies can be anything to do with understanding, making or adapting genetic material.

Activity A:

(Approximately 15 minutes)

Watch the short animation [What is gene editing](#) (4:22 mins). Discuss the following questions with the class (key answers from the animation in bullets points underneath):

- What could gene editing be used for?
 - Improvements to human health e.g. leukaemia
 - Fixing the gene mutations that predispose to cancer
 - Enable new therapies for HIV
 - Edit the genes that cause hereditary disease
 - Make crops more nutritious, able to resist disease or grow in difficult conditions
 - Make animals more disease resistant
 - Prevent mosquitoes from carrying malaria (already being done in Brazil by Oxbiotica based in Oxford)
 - (genome editing enables faster, easier, cheaper and more precise changes to DNA)
- What are some ways in which gene editing could be misused?
 - Designer babies – choosing eye/hair colour (or gender)
 - Genetic modification of embryos would be passed on to descendants
 - Designer pets
 - More virulent strains of diseases (for weapons)
- Why would scientists want to ask the public for their opinions on genetic technologies?
- Is this something scientists usually do in other areas of research?

Activity B:

(Approximately 35 minutes)

Part A

Watch the short video about scientists discussing their work with the public '[Genetic technology dialogue interviews](#)' (7:04 mins)

After the video, discuss the following questions with the class:

- Who were the people in the video and what were their areas of interest/expertise?
 - Robert Lovell-badge – The Frances Crick Institute – geneticist.
 - Dale Sanders – The John Innes Centre – plant biologist looking at genetic solutions to societal problems.
 - Ottoline Leyser – Sainsbury Laboratory, University of Cambridge – looking at a wide range of issues around genetic technologies.
 - Helen Sang – Roslin Institute, University of Edinburgh – expert in genome editing in livestock.
 - Emma Woods – The Royal Society – looking at policy around the wellbeing of humans, plants, animals and the environment.

- Why were they involved in this project?

- What did they hope the public would be able to contribute?

- Why do they think that public engagement should be given a high priority in this area of science?

Part B

Ask students to write down on a post it note a question they would like to ask a scientist about genetic modification.

Stick the notes on the board trying to group them into categories such as 'knowledge questions'; 'ethical questions'; 'questions about risks'; 'questions about benefits' etc.

Review the outcome of the notes with the student, considering questions such as:

- How many questions are there in each category?

- Why have the students asked these questions rather than giving any answers?

Part C

Watch the short video about scientists discussing how organisations have different views on gene technologies [A range of opinion on genetic technologies](#) (6:30 mins).

After the video, discuss the following questions with the class:

- Which organisations do the people in the video represent?
 - Greenpeace International
 - Sustainable Food Trust
 - University of Edinburgh
- Why do they and their organisations have an interest in genetic technologies?
- Do all their views agree with those of the scientists?

Part D

Undertake the following role playing activity with the class.

Breaking news! You're a scientist has just discovered a gene for intelligence. Thanks to CRISPR, it is easy to edit into embryos. Bear in mind, we think babies with edited genes live shorter lives than those left alone.

How will you tell the public about your discovery? Who do you think will support you? Who do you think will oppose you?

In groups of about 4, give each student a role: the scientist, and three members of the public: a person wanting to get pregnant, a politician and a member of a human rights charity. The scientist's job is to explain the idea clearly, and the public need to think about what questions they are likely to ask given their roles.

Depending on your teaching style and class, you could do this as a podcast that students record on their phones, or snowball it into a whole class exercise after individual group discussions, and have the scientists sat at the front being grilled by the public.

Plenary:

(Approximately 5 minutes)

Discuss as a class if students think that knowing the gene for intelligence would be good for science?

Would it be good for society?

Additional resources for students conducting extension projects or research for EPQs

- Transcript of [an address](#) by the President of the Royal Society on Gene Technology to the American Association for the Advancement of Science:
- Reports on the Royal Society's [Gene Technologies public dialogue workshops](#) and introductory workshop [videos](#):
- Information on [international discussions of Gene Technologies](#) including International Summits on Human Genome Editing and the Sackler Forum on Synthetic Biology:

Resources for further information on gene technologies.

A range of resources are available from The Royal Society to help answer some of the questions students may have posed concerning issues around genetic technologies.

- [Interactive timeline of significant events](#) Timeline of key events in genetic technologies.
- [Genetic technologies and human health](#) Infographic with embedded quizzes and displays. It could be displayed in class and used to lead and inform discussions or used by students for a flipped learning exercise or for extended research outside the classroom.
- [Genetically modified plants: questions and answers](#) This page has a short video (2:30 mins) on 'What is GM?' which is a good introduction to the topic. The page then gives the eighteen questions and answers suggested during the public dialogue project.
- [Case studies and videos](#) Examples of the application of genetic technologies under the three headings of people, plants and animals. These could be used in class by groups of students to make presentations or public information displays based on one or more of the examples.