

Medical Applications of Genetic Technologies

Activity Guide v1.2

Overview

This literacy activity asks students to read an article about genetic technologies with the purpose of answering two questions about various medical applications. Firstly, does the technology change the DNA of the subject, and secondly, whether the technology has the potential to change the human population forever. Students then represent their answers using a graphic organiser. Two versions of the article are available (one in summary form) to allow for differentiation. Optional additional questions are also provided.

Assumed knowledge

- Structure and function of DNA
- Inheritance of genetic diseases

Activity outcomes

Students:

- Interpret a text and extract information to answer an inquiry question
- Use critical thinking to solve problems
- Represent information using a variety of communication styles
- Assess the validity and reliability of information sources

Syllabus connections NSW HSC Biology

Genetic Change

- distinguish between somatic mutations and germ-line mutations and their effect on an organism
- investigate the uses and advantages of current genetic technologies that induce genetic change
- compare the processes and outcomes of reproductive technologies
 - [IVF with PGD as additional example]
- describe techniques and applications used in recombinant DNA technology, for example:
 - the development of transgenic organisms in agricultural and medical applications
- evaluate the benefits of using genetic technologies in agricultural, medical and industrial applications

Conducting Investigations

- select and extract information from a wide range of reliable secondary sources and acknowledge them using an accepted referencing style

Problem Solving

- use scientific evidence and critical thinking skills to solve problems

Materials

For each student:

- Student instructions with additional questions selected by teacher
- A copy of the article, either full version or summary depending on time available and student capacity (page of links is optional)

For each pair:

- Graphic organiser worksheet (preferably printed in colour)
- Scissors
- Glue or, ideally, blu-tack (to allow repositioning of icons)

Activity Guide

1. Introduction and article

Hand out the student instructions (see below, and word document on our website) and copies of the article. The most important aspect to this activity is to introduce the two inquiry questions to the students before giving them the article to read.

These are:

- Does the technology involve changing the DNA of the subject?
- Could the technology result in lasting population change?

This allows students to read with purpose. Students should be encouraged to highlight only parts of the article that are directly relevant to the two questions. Students should also circle any unfamiliar words.

Printed versions for highlighting are ideal, however you are also welcome to share the pdf with your students electronically.

Differentiation

A summary version of the article is also provided. This version uses point form, which can be easier for students to follow if a two-page text would take them longer than the time available. Another option is to give students a certain length of time with the full version before providing the summary.

2. Graphic organiser- Pair, think, square

Once students have read and highlighted the article, they should pair up to complete the graphic organiser (one sheet needed per pair, preferably printed in colour). Students should cut out the images on the left hand side of the worksheet and arranging them on the matrix (blu-tack is useful here). Students should be encouraged to discuss and “think out loud” in their pairs as they decide where to place each technology based on the text and their own prior knowledge and critical thinking. Once the pair has decided on an arrangement, they can “square” (join with another pair) to compare answers. If there are any differences, students should attempt to justify their placement based on the text.

Suggested answers are available in the full teacher guide available by emailing kccgeducation@garvan.org.au from an educational email address

3. Additional questions

The student instructions include a list of additional questions. A Word version of this page is available so you can include only suitable questions based on time and student needs. Suggested answers are available in the full teacher guide.

4. Further reading

The page of links for further reading can be provided for student interest or as part of a larger research task. These can be printed or ideally, given to students in electronic form. See also our student resource guide.

Credits

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With kind acknowledgement of input from John Duggan.



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Student instructions

1. Read the article “Medical Applications of Genetic Technologies”. For each of the genetic technologies mentioned, extract information to answer the following two questions:

- Does the technology involve changing the DNA of the subject?
- Could the technology result in lasting population change?

Highlight any parts of the article that are relevant for these questions

Circle any new or unfamiliar words

2. Work in pairs to complete the graphic organiser, arranging the technologies according to the answers to the questions above. Cut out the icons from the left hand side and arrange them on the axes to show their impact on the DNA of the individual and the population. These are not yes/no questions- your placement along the axes can be used to show the extent of the impact.

3. Team up with another pair and compare your answers. Explain your reasons for any positions that differ.

4. Complete the following tasks and questions on separate paper

- 1) Using the article and other reference books or sites, create a glossary that includes the six genetic technologies as well as any other words that were new to you
- 2) “Somatic” changes in DNA are those that affect some cells of the body but do not alter the gametes, meaning that they cannot be inherited by future generations. “Germline” changes do effect the gametes and can therefore be passed on and contribute to the “gene pool” for the population. Which of the technologies in the article involve changes to the germline?
- 3) Evaluate the article as a source of information for answering the two inquiry questions. You could draw up a table of positives and negatives for each of the following questions:
 - a. Is it relevant? Does it relate to the question? Does it contain the information you need?
 - b. Is it accurate? Does it match what you already know about genetics? Could you verify the information elsewhere? Does it contain references to primary sources?
 - c. Is it valid? Who wrote it? Are they an appropriate authority on the subject? What is the purpose and potential bias of the author?
- 4) Prepare an answer for the follow exam-style question
Genetic technologies that induce genetic change have many current and future applications in medicine. Discuss to what extent such technologies have the potential to change the human population forever. (7 marks)
- 5) Using the dates from the article, as well as any other key dates you feel are important, create a timeline of developments in medical genetic technology.
Creative extension: design the timeline as an infographic for a non-scientific audience.