



PARSEL teaching –learning materials compiled by the consortium
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Shall we create new organisms? (Teachers)

Subject

Evaluating the impact of different applications of genetic engineering on our society, with the aim of deciding on the attribution, or not, of a large funding for research in this field.

Introduction

Science education involves the construction of knowledge about main scientific themes and some of its contents, its agents, its methods, its uses as well as its misuses. As such, for developing science literacy one has to develop teaching strategies where students can discuss critically contemporary science and its implications. At the moment, through genetic engineering it is possible to introduce a gene from one living organism of a species in another living organism of a different species and make it functional. This technique enables the creation of micro-organisms that are capable of synthesizing proteins with commercial interest and changing features of plants and animals.

For instance, the introduction of human genes in bacteria or yeast has allowed for the mass production of hormones and vaccines. In this manner, these products are obtained in unlimited amounts and, subsequently, at reduced cost.

However, despite their undeniable benefits, these genetic changes raise ethical issues related to eventual negative impacts on the environment, on public health and on society and its values.

Objectives

Education for citizenship is one of the main justifications for science education. Currently scientific literacy is thought to constitute a vital element for all citizens' intellectual independence and for the performance of an active role in decision-making as regards scientific and technological proposals. A society where the power to decide is the privilege of experts cannot be considered democratic.

It is up to science teachers to promote the development of the scientific knowledge and the abilities (of critical thinking, problem-solving and decision-making) necessary to assess the consequences and correct problems arising from rapid scientific and technological growth.

This activity is thought to contribute to citizenship education through the promotion of thinking competencies and attitudes and values that certify an active, constructive and responsible role in the evolution of society.

Competences

Construction of scientific knowledge regarding genetic engineering.

Development of cognitive competences such as: data search, data analysis, argumentation and decision making.

Development of collaboration competences.

Development of attitudes and values such as: responsibility, respect, freedom and tolerance.

Development of discussion competences.

Task description

With the aim of evaluating the impact of different applications of genetic engineering on our society, a committee was constituted, formed by several citizens: 1) a doctor; 2) a veterinarian; 3) a farmer; 4) a member of an environmental group; and 5) an animal rights advocate.

This committee must decide on the attribution, or not, of a large funding from our community to research in this field. Should it decide positively, it must then define the terms, or conditions, of this funding.

Procedure

1. Compose groups of 5 persons.
2. Each element of the group will represent one of the roles with the aim of writing up a report (maximum 3 A4 pages) that summarizes his/her informed expert opinion as to attributing the funding or not.
3. Use the given websites to gather information.
4. After discussing the arguments presented by the different members, the group must: a) write up a joint report that justifies the final decision regarding the attribution of funding; b) choose the way of presenting the outcome.
5. The conclusions drawn by the different groups will be presented and discussed with the whole class.

Role-playing

Given the complexity of the theme under analysis and the possible diversity of opinions surrounding it, an evaluation according to different perspectives is essential. Therefore, as mentioned above, each element of the group must take on a different role.

Following are some issues that may be discussed:

- Doctor – What is the potential of genetic engineering in treating and preventing human diseases? What are the long-term effects of the intake of genetically altered products?
- Veterinarian – What is the impact of these technological innovations on livestock (animal production)? How about on animal species? Is modifying the genetic patrimony of animals permissible?
- Farmer – What is the impact of these technological innovations on agriculture? How about on vegetal species? Is modifying the genetic patrimony of plants permissible?
- Member of an environmental group – What are the consequences of releasing into the environment genetically modified organisms? Which criteria should be adopted in order to avoid serious environmental imbalance?
- Animal rights advocate – Is the genetic manipulation of animals morally acceptable? Is transferring genes between different animals permissible? Is it permissible to introduce in animals genes that are responsible for human diseases?

List of useful Websites

The following websites contain a lot of information on genetic engineering. They must be used both by students and teachers to prepare and implement this activity.

Ifgene, the International Forum for Genetic Engineering - <http://www.ifgene.org/>

HUM-MOLGEN - Communication Forum in Human Genetics - <http://hum-molgen.org/>

European Initiative for Biotechnology Education - <http://www.eibe.info/>

European Society for Agricultural and Food Ethics (EurSafe) - <http://www.eursafe.org/>

Genetics for a New Generation - <http://www.ansci.cornell.edu/usdagen/usdamain.html>

Genetic engineering on Wikipedia - http://en.wikipedia.org/wiki/Genetic_engineering

Population

9th – 12th grades

Curriculum context

Biology; Integrated Sciences; Science for Public Understanding



Kind of activity

Webquest (discussion through role-playing + decision making)

(<http://myeuropa.eun.org/shared/data/myeuropa/2005/webquests/genetic-engineering.htm>)

Anticipated time

4 lessons (40 to 50 minutes each)