

## 2. Teaching Guide

### 2.1. Subject

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

### 2.2. 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.

### 2.3. 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.

The proposed 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.

#### **2.4. Competences**

1. Consolidation of scientific knowledge regarding genetic engineering.
2. Development of cognitive competences such as: data search, data analysis, argumentation and decision making.
3. Development of collaboration competences.
4. Development of attitudes and values such as: responsibility, respect, freedom and tolerance.
5. Development of discussion competences.

#### **2.5. Task description**

With the aim of evaluating the impact of different applications of genetic engineering in 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 (ecologist); 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.

#### **2.6. Procedure**

1. The students must compose groups of 5 persons.
2. Each member 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. The students must use the proposed 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 (PowerPoint presentation, poster, etc.).
5. The conclusions drawn by the different groups will be presented and discussed with the whole class.

### **2.7. Role-playing**

As mentioned above, each element of the group must take on a different role. Following are some issues that must 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 the 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 the 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?

### **2.8. List of useful Websites**

The recommended information sources are:

- Doctor:

<http://www.scribd.com/doc/48282736/Genetica-medicinala>

- Veterinarian:

<http://www.ecolife.ro/articole/stiinta/controversa-organismelor-modificate-genetic.html>



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<http://www.agriculturaromaneasca.ro/produse/animalele-modificate-genetic-rolul-lor-in-zootehnie-149-t10.html>

- Farmer:

<http://www.infoomg.ro/2011/05/organismele-modificate-genetic-elementul-central-al-dezvoltarii-durabile/>

<http://www.ecolife.ro/articole/stiinta/controversa-organismelor-modificate-genetic.html>

[http://www.necenzurat.ro/index.php?option=com\\_content&view=article&id=23355:studiu-detaliat-de-impact-asupra-organismelor-modificate-genetic-omg-&catid=19:viata&Itemid=24](http://www.necenzurat.ro/index.php?option=com_content&view=article&id=23355:studiu-detaliat-de-impact-asupra-organismelor-modificate-genetic-omg-&catid=19:viata&Itemid=24)

- Member of an environmental group (ecologist):

<http://www.infoomg.ro/2011/05/organismele-modificate-genetic-elementul-central-al-dezvoltarii-durabile/>

<http://www.infomg.ro/web/ro/Home/FAQ>

- Animal Rights Advocate:

<http://www.crestinortodox.ro/sanatate-stiinta/bioetica-familia-morala-crestina-72612.html>

<http://www.scribube.com/geografie/ecologie/INGINERIA-GENETICA-SI-DREPTURI17417152415.php>

## **2.9. Assessment**

The evaluation criteria are presented in a separate section (see the file *Assessment*).

## **2.10. Grade level**

Grade 9 to 12

## **2.11. Subject / Curriculum context**

Biology; Integrated Sciences; Civic Education

## **2.12. Kind of activity**

WebQuest (discussion through role-playing and decision making)



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### **2.13. Anticipated time**

4 lessons (40 to 50 minutes each)

### **2.14. Bibliografie**

1. Pedro Reis, *Shall We Create New Organisms?* Teaching-learning module compiled by the PARSEL consortium as part of an EC FP6 funded project (SAS6-CT-2006-042922-PARSEL) on Popularity and Relevance of Science Education for scientific Literacy
2. Gabriel Gorghiu, Laura Monica Gorghiu, *Învățarea cooperativă: proiecte WebQuest*, Macarie Publishing House, Târgoviște, 2004



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