

EDUCATIONAL GUIDE *for the professor* _____

EDUCATIONAL CARD ON GENETICALLY MODIFIED ORGANISMS (GMO).

LEVEL : Secondary 3-4-5

DISCIPLINE(S) : Biology, Chemistry, Geography, Contemporary History, personal and social formation, religious and/or moral studies, etc.

LENGTH: 50 minutes (or more)

GENERAL OBJECTIVE : Inform students about GMO and their consequences on our lives.

Following the activity, the student will be able to: _____

- Define what is a genetically modified organism.
- List some properties of transgenic plants.
- Analyse information pertaining to the problematic of GMO.
- Participate in a debate on GMO with his/her classmates.
- Exploit, inasmuch as possible, relevant references on the subject.

Secondary aptitudes developed by the educational card: _____

1. Intellectual aptitudes:

- Make use of the information
- Exercise his critical judgment
- Use his creativity

2. Social and personal aptitudes:

- Cooperate (if possible)

3. Methodological aptitudes:

- Make use of the new technologies of information and communication

4. Communicative aptitudes

- Communicate properly in writing



EDUCATIONAL SCENARIO



I At the beginning (3 minutes)

A- Poll: GMO?

Does one of you know what GMO means?

Genetically modified organisms

According to you, what percentage of food products on supermarket shelves contains traces of GMO?

According to a report from the Conseil des sciences et de la technologie du Québec, 50 to 60% of food products sold in supermarket contain traces of GMO.

Do you think there can be some fish in a particular kind of strawberry we eat?

Yes. Research workers were able to introduce the genes of a fish found in the arctic into strawberries. These become more tolerant to cold!

Is there a way for consumers to know if there is any GMO in their food?

Unfortunately, for the time being, producers are not required by law to label food products containing GMO (contrary to European countries that must do so if the percentage of GMO is superior to 0.9%).

B- Presentation of the course's objectives.

Look at the objectives listed above. (Before the EDUCATIONAL SCENARIO)

Mention to students there will be a debate on GMO. They will need their educational card and some further explanations given by you in a section further below.

II Short explanations on GMO (7 minutes).

These explanations on GMO are to be explained to students by the professor before he/she hands out the educational card. Most of the explanations given below are taken directly from the report written by the Conseil des sciences et de la technologie du Québec on genetically modified organisms.

What are GMO?

Genetically modified organisms are plants, animals or microorganisms subjected to a genetic change in order to give them characteristics not found in a natural state. The methods used differ from traditional methods used to create new varieties. They allow for desirable characteristics to be transferred between species that could normally not reproduce (transgenic manipulation).

Some examples of food genetically modified...

Corn having scorpion genes; it protects them from insects attacks. Strawberries resisting frost because of a fish gene. Potatoes with a human gene; they can be grown in soils contaminated with heavy metal.

How do you transfer genes?

Techniques used to transfer genes consist in choosing a desirable trait gene, inserting it into a genetic construction used as a transfer vehicle, and then introducing the whole in the genetic pool of the organism we want to change. This doesn't work every single time, it usually takes three to four years to develop a marketable product.

What are the principal characteristics of genetically modified plants?

Up to today, the transgenic method has been used to generate three types of characteristics in genetically modified plants. We can first mention the resistance to insects; the plant can develop its own insecticide; the most popular one is Bt. Another characteristic is the tolerance to herbicides, allowing the plant to survive when the fields are sprayed with weed-killer chemicals. The last characteristic is the resistance to diseases, such as viruses or mold.

These genetic modifications are only of an agronomics importance. They are used to improve the output of the producers and have no effect on the general characteristics of the products offered to consumers. However, research workers are working on a second generation of GMO. These would offer the consumers more advantages such as a better appearance, a nutritional content and an improved preservation period.

III Explain and carry out the educational card (15 minutes)



- There are seven sections (A to G).
- Questions 4 and 5 of section B and F ask students to prepare their arguments for the debate.
- It is possible that some students will finish the card before others. They can use up that time to better prepare themselves for the debate.
- It is recommended to correct section B, D and E before beginning.

Block B

Answer 1-3-4-5: Personal answers from students
Answer 2: In North America, mostly in the USA.

Block D and E

1- h against 5- c for
2- a for 6- e against
3- g against 7- d against
4- b for 8- f against

IV Prepare and carry out the debate (20 minutes)

1. If class time is longer than usual, professors can give more time to prepare and carry out the debate.

2. The period allotted to the debate is relatively short for a usual class time. The professor must be careful not to waste time and adopt a method that will let all students participate.

3. The professors must make sure a group of students defends one opinion while the other group defends another. It might be a good idea to let students decide for themselves which position they choose to defend. However, if one side lacks support from the students, the professor will have to designate students from the other group to change side, or he can himself take part with the less numerous side.

4. We recommend the professor plays two roles: animator and moderator. He can revive the debate with a question if he feels it's necessary. He must also make sure that both positions (for and against) are defended in a sensible way.

5. Finish off the debate 3 to 5 minutes before the end of the course to let sufficient time for concluding and reviewing remarks.

6. Enclosed in Annex I, is a list of arguments to stimulate the debate on one side or the other.



v Conclusion (5 minutes)

The professor can ask his/her students some questions to test the level of their integration.

For example:

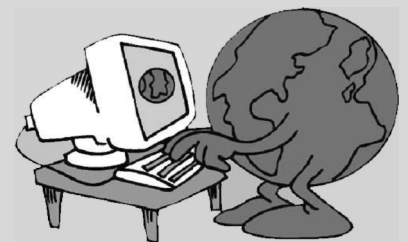
- List some characteristics of transgenic plants
- Which continent enforces the labelling of GMO?
- List some advantages of GMO.
- List some risks associated to the production of GMO.
- Etc.

In conclusion, the professor can reiterate the importance and the power the consumer has in the debate over GMO.

The problematic related to GMO is a subject they will be hearing about for a long time!

Don't hesitate to browse through the following references to learn more about GMO.

- <http://www.greenpeace.ca/e/campaign/gmo/>
- <http://www.fao.org/ag/default.htm>
- http://www.who.int/topics/food_genetically_modified/en/



ANNEX I - List of arguments to stimulate the debate on one side or the other.

FOR.

- Transgenic agriculture can help farmers in poor countries because of their ability to grow in poor, dry and acid soils
- Some transgenic vegetables, enriched with nutritional elements, could help fight against heart problems and cancer.
- The new genetic techniques help farmers grow healthier food products at a lower price while using less chemical agents.
- Some genetically modified animals, such as the pig, will be able to provide in the future organs compatible with humans.
- Genetic manipulation seems to be a practical and cheap way of producing pharmaceutical drugs. Some genetically modified animals, such as the sheep, produce a specific protein used in the treatment of diseases.
- Up to now, no catastrophe has been related to GMO.

ANNEX I - List of arguments to stimulate the debate on one side or the other.

AGAINST

- Pesticides spread over transgenic plants to help get rid of harmful insects can endanger harmless insects such as the monarch butterfly and consequently endanger a specie.
- Transgenic processes can accidentally produce harmful chemical substances.
- Many questions about security are still left unanswered. This is the reason why further independent tests are necessary to fully understand the effects of GMO on humans.
- GMO spread all over the ecosystem by ways of wind and/or bees spreading the pollen, produce a genetic pollution impossible to control.
- Worldwide hunger can be resolved without GMO because the food production is already sufficient to provide for all human beings. However, the problem lies in the inequitable sharing of resources between all countries.
- It is important to recognize the right to GMO's information for all citizens - information on the agriculture, usage in food products, effects and risks on health, the environment - and install a democratic system to take decisions.
- There are two potential risks to GMO. On one part, GMO can contain toxic substances, attacking the metabolism. These effects can be acute (poisoning) or chronic (a long exposure provokes cancer). On another part, they can contain allergen, i.e. substances provoking immune system deficiency in some people.
- Faced with an important potential risk, the absence of formal proofs cannot justify inactivity. We should therefore suspend all production of transgenic plant (the precaution principle).
- Faced with an important potential risk, all measures must be taking to prevent this risk of happening. The scattering of potentially harmful plants on the environment and human health should be forbidden (the prevention principle).
- The genetic pollution created by the scattering of transgenic plants can impeach biological farmers to guarantee their products are free from any trace of GMO.



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