

# Growing Science





# Genetically Modified Organism



I believe sometime you've listened about a GMO by accidents in news or in the internet but, have you asked what are they? How are they applied in our life? Their positive and negative aspects? In this article, we are going to give you information about this. The GMO, are now very important in industrial processes and sometimes, they give us solutions to problems we have now. Although the positive aspects this technology gives us, like other scientific discoveries, their acceptance in society is not good. The judgments about this organisms are about the healthy, economy, and the ones which are useful tolos for improvement. The main problem in this controversy is the lack of scientific information in the media, making it difficult for society to perform an opinion.

First of all, to get a real understanding of GMO's, its necessary to know some definitions. Biotechnology is the application of living organisms for a service of human beings. It is not a new definiton even if it sounds like that, this one has been used for the production of beer and cheese.

Over time, the society requirements have been evolved and the science has changed to maintain those ones. The modern biotechnology consists in the obtainment of a new modified organism which has been constructed fr helping the society to solve an specific problem. This subjects can use the knowledge of microbiology, biochemistry and cellular biology.

The most part of the time when the media talks about these topics, is focused in specific areas of the biotechnology like the agriculture and they dont talk about many others applications that can be produced. One of this is their use in investigation. As we said before, modifying the genes of animals and plants allow us to study the consequences of these ones and with this, to analyze the function and regulation for an iprovement and a better understanding of tese mechanisms.

Using these methods we could establish some genetic aspects like to identify specific sequences of DNA in the chromosomes for maping it. With this we can identify from the embrionic status until specific characteristics of persons. This tool can use from cultivated plants until human beings.

Now, we are going to talk about the areas in which the GMO can be applied with some examples. An example of an organisms with genes of other species is the cat we have in figure 2, in this case the modification is evident. The GFP (green fuorescent proteins) has been inserted in the cat, this porteiins is normally used for fireflies . The most common question by seeing this experiment could be: which is the real use for this cat?, well, one of the applications is the monitoring of proteins in the body.





# Industry

- Since the beginning of industry it has used living things for the processes of it. In this new era, with the support of the technology of the recombinant DNA we have taken the advantage at the 100%. Thus had been realized lots of products and processes, cheaper and better for the environment.

These advantages are important in the textile: the substitution of processes of washing for enzymatic treatments have reduced the use of water and energy by a 50%.

One of the ways in which the GMO are used in industry are the bioreactors, these are living things which are used for the production of protein of interest. As same as the cat we talk before, these living things are modified genetically for producing compounds that normally, are not produce by them.

In this way we can avail the properties of a lot of microorganisms for the production of basic compounds like organic acids and vitamins. For example, actually, compounds like acetone and butanol are produced

through modern techniques of industrial microbiology that allow to reprogram the microbial metabolism for maximize the production of the compound of interest and to give to it the capacity of make new products base don new substrates. In this way, nowadays it is possible to produce through fermentation compounds that before we couldn't.





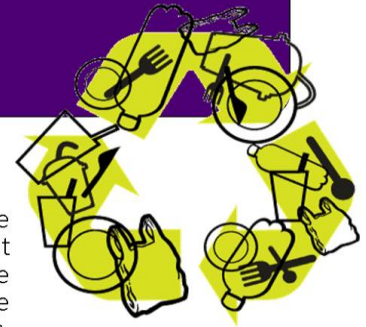
# Environment

The advantages that recombinant DNA gave us in this area are impressive. The damage that human being had given to the environment has had a lot of consequences which have been visible on the last decades. For restoring this damage is necessary the development of products and processes that allow us to make less the creation of chemical compounds in the environment.

Thanks to the GMO's it has been possible the elaboration of products like the biomaterials. These materials are made to substitute the plastic and other ones derived from oil, they are completely biodegradable because that can be destroyed by bacteria easily. Another advantage is that an 80% of the toxic emissions are eliminated. The biomaterials more important until this moment are polymers produced by microorganisms for replacing the plastic. Some examples of these bioplastics are made from starch or glucose.

A very important bioplastic in the market is a polymer derived from 1,3-propanediol which is obtained by the transformation of the starch through modified bacteria. The new fiber is very resistant and flexible which allow its use nowadays.

Other important creation are the biofuels, these ones are fuels that in contrast with the oil fuels are considered renewable. They are obtained from organic wastes. There are several types of biofuels, they are classified according to the input and the technology used for the creation of them.



## >> Another alternative

The biofuels are being produced from genetic modified microorganisms, which use carbon dioxide for processing them. Unlike the past generations of biofuels, the bacterium is the one which makes all the process for this production.





# Agriculture



The biotechnology is used for solving problems in every aspect of the agriculture production, including the breeding for improving the performance, making better the resistance for plagues, animals and abiotic conditions like droughts and cold, even to increase the nutrients in the aliments. It is used for creating a material cheaper and free for diseases and even for accelerate the improvement of plants, cattle, fishes and their properties.

A very important part, is the creation of biopesticides, these ones are pesticides with biologic origin. The creation of these tools is very necessary because the normal delivered a lot of chemical and toxic compounds. These ones are not aggressive for plants and even most of the time cheaper and more effective than the normal ones.



# Medicine

The use of the GMO caused a great change in the medical industry. It emerges as an alternative for satisfy the requirements of the health sector, through the improvement of the preventive and therapeutic measurements that help the human welfare.

Because of the recent growth in the incidence of diseases the investigation and development of new and better techno-

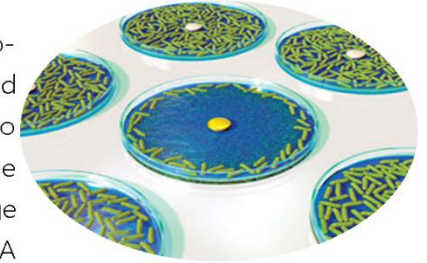


logies such as vaccines, bioactive molecules and diagnostic methods that can make a significant decrease in deaths caused by health problems.

An example of this is the elaboration of vaccines. The genes that codify for the proteins that cause an immune answer (the antigen) are isolated and introduced to a

new host with the pathogen (bacteria, yeasts and mammal cells) for they to produce a quantity in the laboratory, In Exchange the new vaccines with DNA use a portion of purified DNA that is directly introduced into a host and they are the same cells that the host uses in order to synthesize the antigen.

The development of the Genomics and Proteomics, just like the application of the Biotechnology in Medicine will allow the identification of genes that interfere in diseases and develop drugs that substitute the modified genes in each pathology.

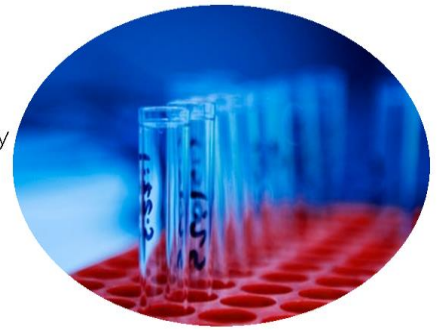






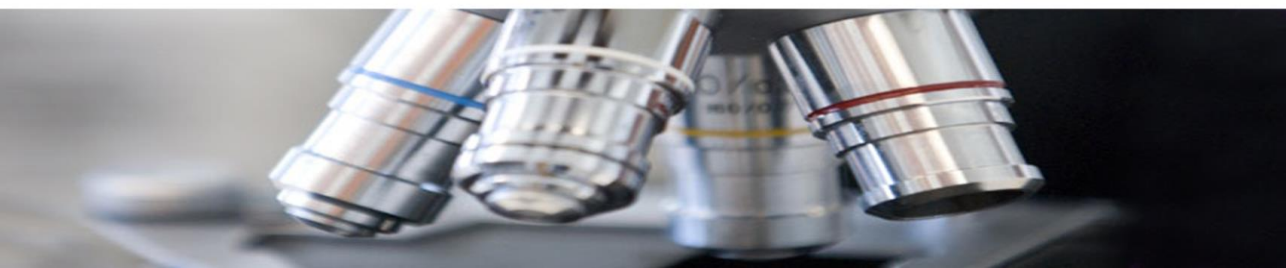
Like we can see , the GMO are vastly used in the economical activities however they have a few uptake in the society.

Taken of the worlds of *Paul Ehrlich*



*"An important problem with the contemporary human, is that the rhythm in the cultural evolution, in the science and technology have been extraordinary high, comparing with the lenght of changes in the social attitude and in the politic institutions that could cannel the use of technology in better directions. No one knows what kind of effort from the society could be necessary in order to correct that substantial imbalance in the evolution rates, but is sure that such effort , if it success it could make happier the human perspective ."*

One of the argument against of GMO is the risk of creating new dangerous pathogens, for this a set of government rules has been establish to act like a security measure, creating procedures that make impossible the departure of microorganisms from laboratpory. However sometimes this is not enough. In order to facilitate their introductions in society , a lot of control mecanisms have been developed for the propagation and function of this organisms. The microorganism strains used in DNA experimnts are genetically modified in order to be imposible for them to survive outside the laboratory. This strategy although prevents the propagation, it destroys the investigation and limits a lot to the scientists because instead of creating a solution we are stoping the advance.



# BIOSAFETY

*In relation with GMO's*

To talk about genetic modification and biosafety is relatively complicated for a public unfamiliar with concepts of genomics and molecular biology. Public opinion moves according to the information that the media such as television, newspaper, social networking and internet pages publish.

In this popular medium it's usual to find some opposing radical views; those who defend the GMOs by its benefits, those who are against given the unknown risk that can be represented, and those who despite being in accordance with its development, do not opt for the creation of transgenic products developed by the massive enterprises of the branch of GMO's.



The debate related to gmos is huge. On the one hand they claim the many benefits they offer in the fields of medicine, agriculture, animal husbandry and bioremediation; and on the other hand, speaks of the possible harm on the biological diversity of ecosystems and in uncultivated areas, plus health risks in humans and animals. In general, the biosafety is looking to strike a balance between the demand for products from genetically modified organisms and the mandates of international and national conservation of the environment.

*Little of this information is backed up by reliable scientific research or carried out by an external agent but the developers of the products, and do not suggest a path to follow in relation to GMOs and biosafety issues.*





# What is biosafety?

According to the WHO Laboratory biosafety manual, the term "biosafety" describes the principles of containment, technologies and practices that are implemented to prevent the exposure desintencionada pathogens and toxins, as well as their accidental release. In contrast, the term "biosecurity" describes the protection, control and responsibility of biological materials valuable, so you can prevent its unauthorized access, loss, theft, misuse, diversion or accidental release.

The debate about the use of GMOs is among one of the most importance and difficulty of the world. Given that the GMOs have an incredible potential to meet critical global problems related to agriculture, nutrition and bioremediation among many more, we recognize that it is necessary to protect human health and the environment of the possibility of adverse effects

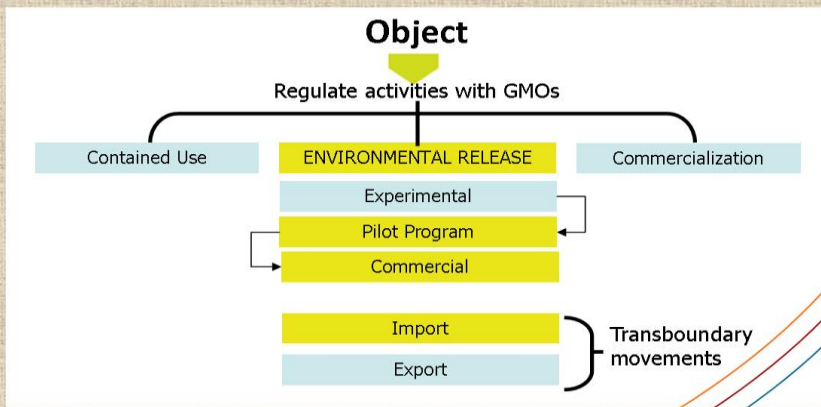


## Internacional Framework

With regard to the international framework, there is the Convention on Biological Diversity, the momentous Cartagena Protocol on Biosafety, and the Protocol of Nagoya (Kuala Lumpur), that seeks to contribute to the conservation and sustainable use of biological diversity in relation to living modified organisms, such as the most outstanding.

## Nacional Framework

The national regulation is responsible for ensuring a proper and efficient level of protection to human health, to the environment and biological diversity, to the animal health, plant and aquaculture, as well as the adverse effects and the problems caused by the activity of GMOs. It is also responsible for establishing measures for public security, the access to information with regard to the GMOs, to regulate their release to the environment and establish instruments for promoting scientific research and technology in biosafety and biotechnology.







## Risk Analysis

Prior to the adoption of a technical or biotechnological product related to gmos economically and politically it is necessary to clarify fuzzy approaches and analyze the biosecurity. The most important tools for decision-making are the analysis of risks/benefits (which reviews the magnitude of each potential harm or benefit involved, possibility of it occurring, remediation costs, similarity with other situations, among others) and risk management techniques such as licensing and labelling of products. In any way these methods with little or no historical background are difficult to carry out.

management techniques such as licensing and labelling of products. In any way these methods with little or no historical background are difficult to carry out.

### Purpose

Prevent, avoid, or reduce the potential risks that these activities can trigger to:

Human Health

The Health of crops, livestock, and aquaculture species

Environment and biodiversity

MEXICO'S LAW ON BIOSECURITY OF GENETICALLY MODIFIED ORGANISM

### Why is it important all the regulation?

here are many ways to misuse of this technology. The regulation helps us to take care of the environment, public health, the economy, and promote the best development of science.

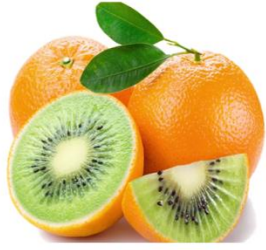
## How to make a Risk Analysis?

*At the time of making an analysis of the risks that a project or idea you may have we have to consider essentially two things; the magnitude of each possible harm or benefit involved, and the probability to happen. For example, if we genetically modified soy that produces an insecticide against lepidorpera; the question is, which would be the likelihood of affecting also affects the monarch butterfly migration in and the magnitude of the environmental damage caused. The methodology of a risk analysis is:*

*(1) risk assessment, a process in which risks are identified and data is obtained to make an estimate of your level of risk; (2) estimation of the likelihood that an adverse effect happens, (3) Assessment of the consequences, (4) estimate of the total risk and (5) risk management, i.e. , check if the overall risks are acceptable or manageable and the creation of strategies for monitoring.*







# Myths VS Reality



With the development of new technologies for the benefit of humanity a lot of debates have been rising about if the application of the new knowledge can cause more bad than good

Talking of the perspective of the world about the production of transgenics, a lot of countries (The European Union) have closed their doors to the application of this technology, but, in the other side of the coin, a lot of industrialized and developing countries count with transgenic crops (United States, Canada, China, Argentina and Mexico, etc). Watching it from a smaller scale, there are groups that are totally against the production of Genetically Modified Organisms (Greenpeace, Ecologist in action, COAG, etc) this groups presents a variety of arguments against this technology this is what caused a great debate about the acceptance of the transgenics in the actual society. Here are some of the arguments a information provided by these groups;

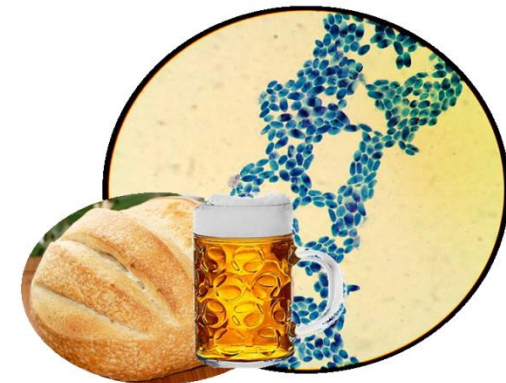
## 1. The modified organisms can genetically contaminate those which are not.

Because the modified organisms share genetic information with the members of their species that have grown naturally, these two can reproduce between them. Making to the offspring to have the modified genetic material.



This can cause fear in a part of the population because through time is estipulated that there will be no more "pure" genetic material This argument is based because in 1997 a farmer from Canada reported that a Roundup Ready organism propagated and contaminated another plants that didn't show the inserted gene in the modified organism.

A new way has been developed In order to avoid this kind of problems happening today and guarantee safety to the consumers,. It consists of avoiding the propagation of the genes inserted in a organism, in order to stop this "genetic pollution" that was happening in previous years. This technology is known as "terminator technology " which constitutes of steril sedes, this sedes cannot cause the germination of new modified plants.





## 2. The transgenics are poisonous for the consumers

Like any other product that will be consumed by a human. The transgenics before being commercialized must fulfill a list of quality requirements. One of these requirements is its safe consumption for the human being, because of this our health is not affected in the moment of eating them.

Another argument of this kind is that a lot of allergies are affecting people who eat transgenic food, but, a thing that must be taken in mind is that allergies have nothing to do with the fact of being genetically modified because even the "normal food" can cause problems with the people who eat them.



## 3. The modified plants in order to produce natural pesticides affect in the population of bees in charge of the pollination process

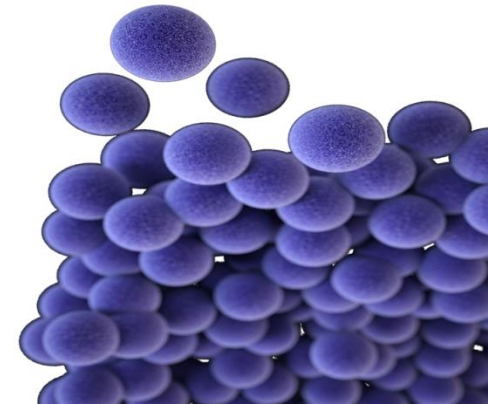
A lot of ecologist groups such as Greenpeace blame the production of transgenic as one of the main causes of the decrease of bee population, although investigations have obtained that an important factor causing this is the low level in the diversity of plants that is causing a damage in the immune system of the bees, causing a problem named Colony Collapse disorder.

This disorder causes the worker bees to die at the moment of going out of the comb in search of pollen, and leave the queen bee alone and without protection what causes the death of the queen.

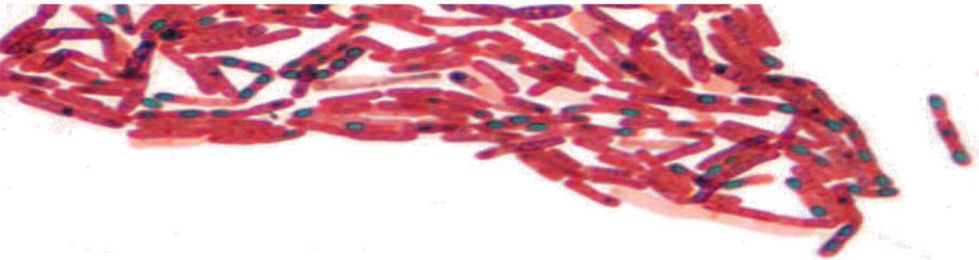
## 4. The information of genetically modified ingredients in food is privatized to the consumer.

Although there are countries that have laws that do not demand to give knowledge to the consumers if the food contains genetically modified ingredients such as the United States there are countries in which it is a requirement, some of them are: Chile, China, New Zealand and members of the European Union.

I told you that apple was to pretty...







## 5. The transgenic crops cause soil erosion.



Some groups say that the transgenic plants known as Bt (*Bacillus thuringiensis*) created in order to produce protein Cry, which are known for their insecticide function cause erosion in the soil because of the protein accumulation on it. Without doubt this is false, because the Cry proteins are well known for being biodegradable which do not allow the accumulation of it.

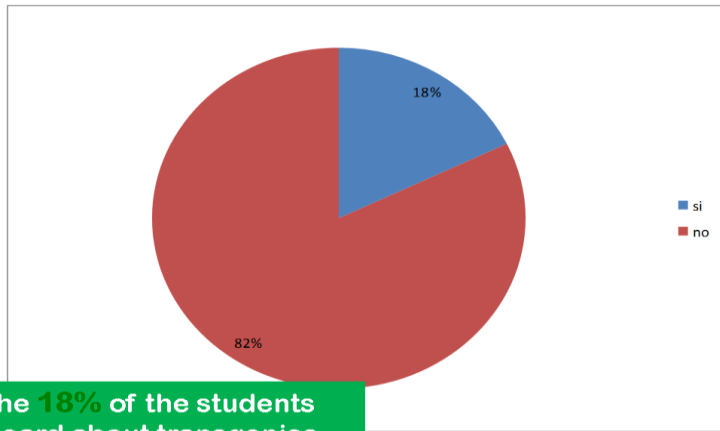
The debate about GMO will keep happening for some years and maybe will never end, but, informing the persons about this technologies and that they can help the world can cause the vastly application of it. Like any other technology, it has it's pros and cons but since the use of medicines and vaccines that in their momento caused a lot of conmosion and today the society would not be the same without them, The GMO are here in order to help us.





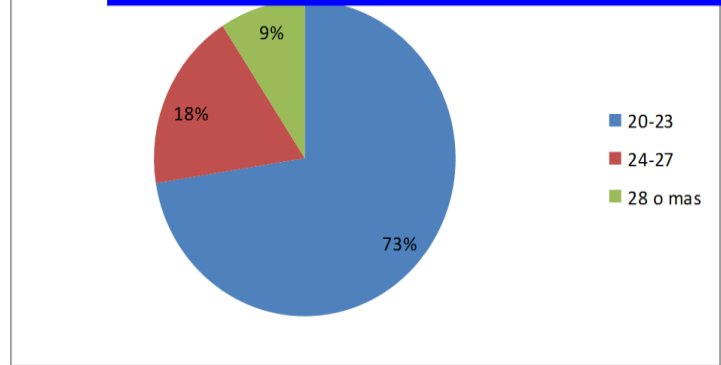
# Do you know about transgenics?

In this article we wanted to know the amount of people who knows what a transgenic is, however we wanted to start with our University. We interview students of the different careers of the *Universidad Autonoma de Nuevo Leon* and from that we obtained the following data:



Only the **18%** of the students have heard about transgenics.

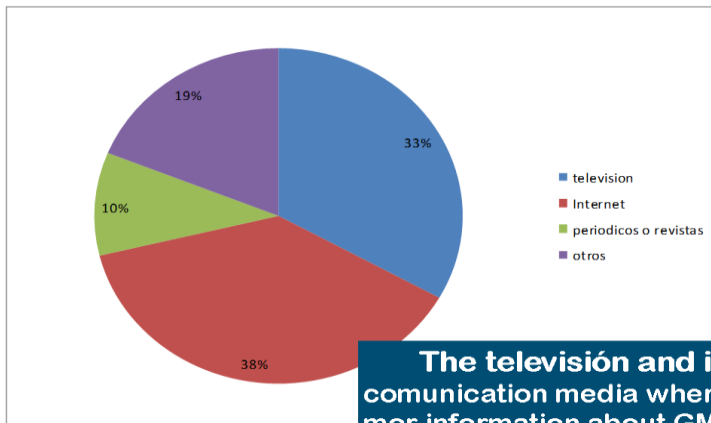
The students who know more about transgenics tend to be between 20 and 25 years old



A **67%** of the people that do not know what a transgenic is are against them

Only the **7%** of the students know what a transgenic is.

While the **10%** knows that they



The **television and internet** are the communication media where people obtain more information about GMO.

According to this estadistic tests the wrong information on media influence in a **0.85** ( in a scale of 1) in having a bad idea about transgenics

