

Why is Europe afraid of GMO?

Kornelia Polok

Centre for Evolution, Genomics and Bioinformatics

"We share half of our genes with the banana"

Robert May, 2001



Genetic similarity of humans is:

- 96% - chimpanzees
- 50% - plants
- 30% - bacteria

Genetic engineering does not create new genes. It only rearranges the existing ones

Protests against GMOs in Poland

"GMO to nie to". Artyści przeciwko genetycznie zmodyfikowanej żywności

+1 0 | Lubie to! 178 | Wyślij

mwi 24.08.2011, aktualizacja: 24.08.2011 11:27



O.S.T.R.

Gazeta.pl, 21.08.2011



©Agencja Gazeta

Protest in front of the Presidential Palace in 2009

POLSKA

czwartek 19 stycznia 2012 r. imieniny obchodzą: Marta, Henryk, Mariusz

Fakty | Opinie | Sport | Pieniądze | Twoje finanse | Kultura | Dodatki | Ogłoszenia

Polska » Dodatki » Rozmaiatości » Artykuł

Dodaj ogł

Tajny plan Unii: Europa ma jeść GMO



Zmodyfikowana kukurydza, która odstrasza szkodniki, jest uprawiana m.in. w Chinach (© AP)

POLSKA Konrad Godlewski

e metro

w serwisie w internecie Szukaj

Wydarzenia | Kultura | Sport | Praca | Zwierzaki | Reklam

Kto się boi GMO

Igor Nazaruk

metro

GMO jest jedyną szansą na przetrwanie gatunku ludzkiego - mówi prezes PAN. - Żywność GMO może być dla ludzi szkodliwa - argumentują ekolodzy. Prezydent Komorowski do 24 sierpnia musi zdecydować, czy podpisze ustawę, która może wpuścić transgeniczne produkty na polskie stoły



Zdaniem ekologów drogę do tego otwiera znowelizowana w lipcu przez Sejm ustawa o nasiennictwie. Z jednej strony zabrania uprawy roślin genetycznie modyfikowanych (GMO), ale z drugiej pozwala je

Polska
wolna
od GMO



koalicja polska wolna od gmo

Informacje:

PROTEST OTWARTY w
SPRAWIE DEBATY O GMO
Koalicja "POLSKA WOLNA OD
GMO" - Facebook
Interpelacja poselskie w
sprawie GMO

Koalicja "POLSKA WOLNA OD GMO"
ul. Chłobda 40/53
00-872 Warszawa
http://www.polska-wolna-od-gmo.org

Wrocław / Warszawa, 1 lutego 2012 r.

Pan
Bronisław Komorowski
Prezydent
Rzeczypospolitej Polskiej
ul. Wajajska 10

Protests against GMOs in Europe

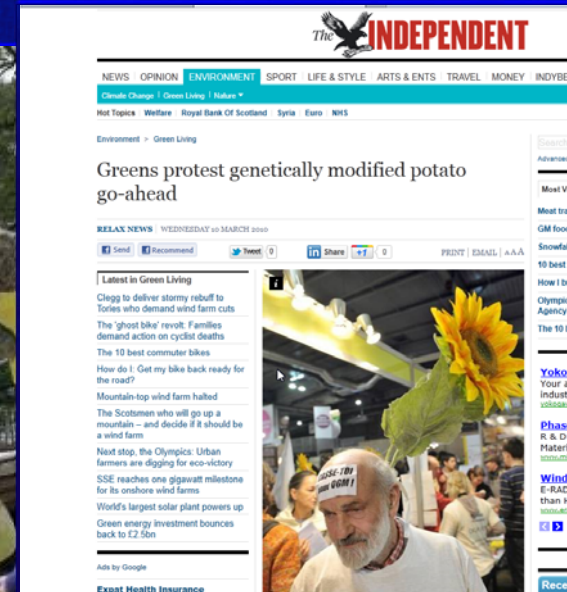
Protests are against genetically modified food



Greenpeace protest, European Parliament, 2008



Protest against GM broccoli in front of the patenting office, 2011, Munich



2010

GMOs are not controversial in medicine, pharmacy and research

- 1978 – *E. coli*; insulin
- 1994 – introduction of GM tobacco in France started the debate about risks

Why is Europe afraid of GMO?

1) Why is Europe afraid of GMO?

- Public perception
- Legal aspects

2) What is GMO?

3) How to obtain GMO?

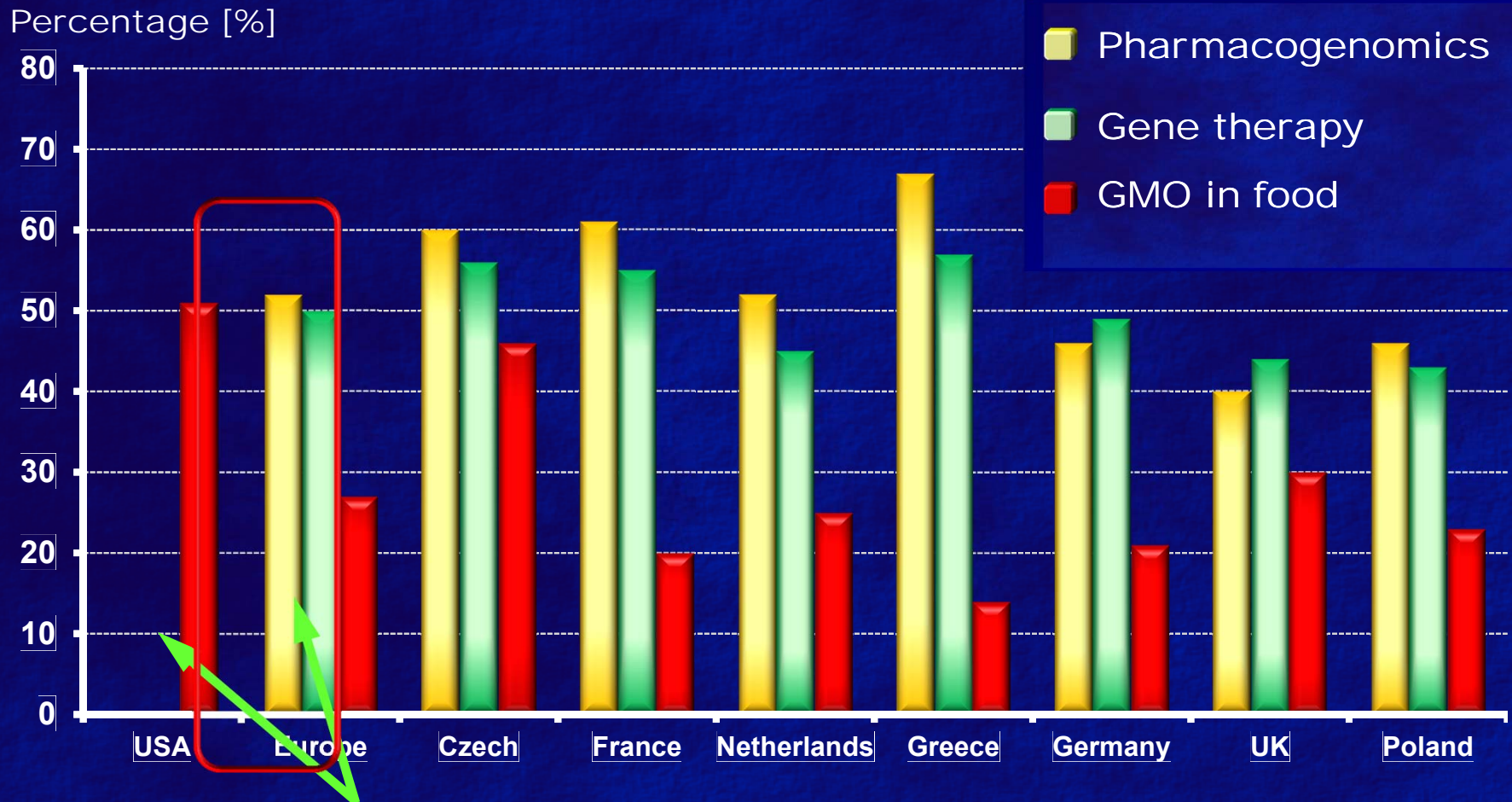
4) Why is GMO produced?

5) Is GMO dangerous?



1. Why is Europe afraid of GMO? - opinions

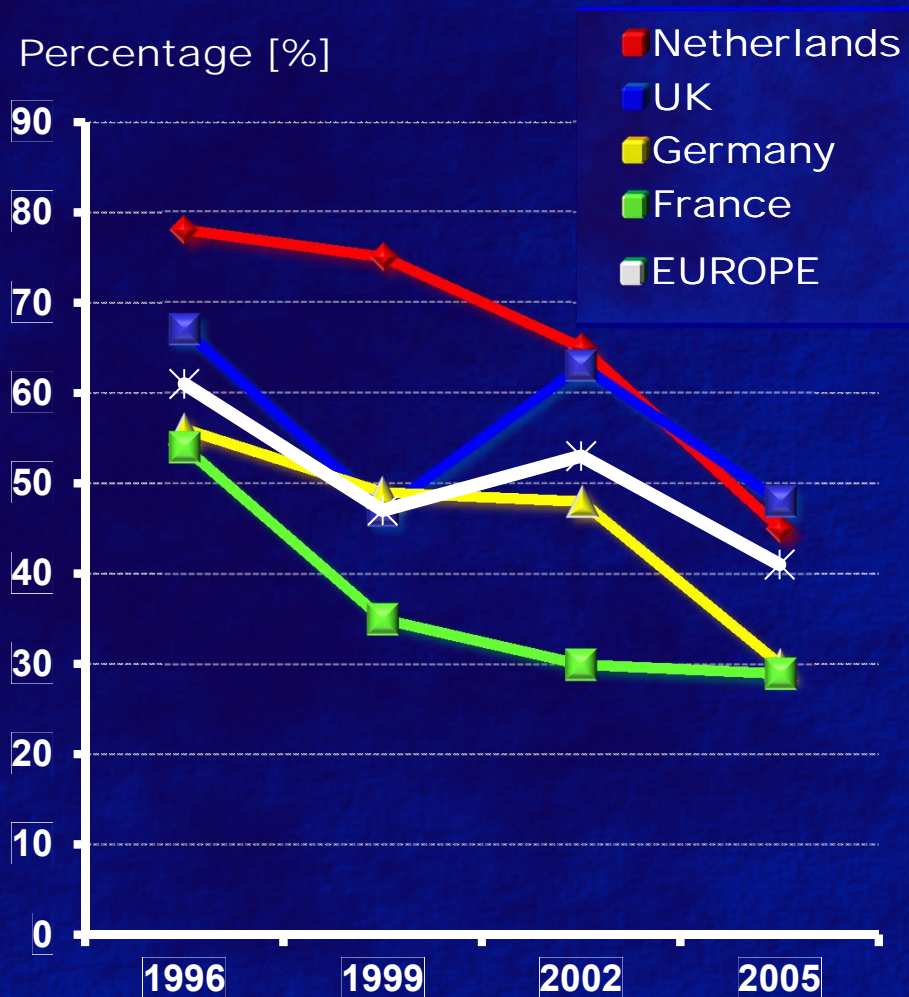
In Europe, support for GMO in food is twofold lower than for other biotechnologies



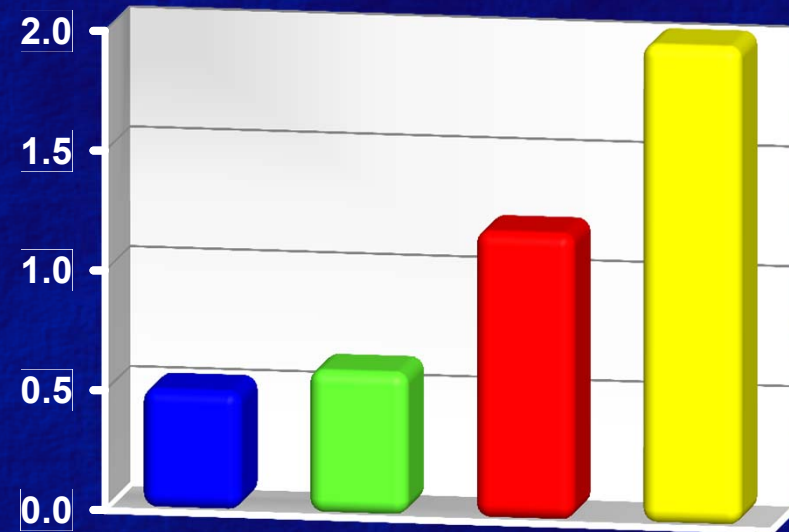
In Europe, support for GMO in food is twofold lower than in the USA

1. Why is Europe afraid of GMO? - opinions

Support for GMO decreased in 1996-2005



Note



- Morally unacceptable
- Useless
- Risky
- Should be forbidden

GMO technology is perceived negatively in Europe. It is considered a risky technique that should be forbidden.

1. Why is Europe afraid of GMO? - rules

Food Safety - From the Farm to the Fork

EUROPA > European Commission > DG Health and Consumer Protection > Overview > Food and Feed Safety

General Food Law Animal Nutrition Labelling & Nutrition Biotechnology Novel Food Chemical Safety Biological Safety Official controls Sustainability Food improvement agents

GM Food & Feed - Introduction

The search tool makes it possible to look for all products corresponding to a search criteria entered in the field. e.g. if you type 'cotton', you will get a list of all products containing cotton in their description. The search searches both in the EU register of GM products established in accord with Regulation (EC) 1829/2003 and the Products subject to Commission Decisions on withdrawal from the market.

Search:

search

Topics

- What are GMOs
- List of GMOs authorized in the EU
- Rules on GMOs in the EU
- Introduction
- Authorisation
- Labelling
- Traceability - from production to distribution
- Reference Laboratories
- Ban on GMO cultivation

Resources

- Speeches
- Press Releases
- Health & Consumer Voice Newsletter
- Committees
- Links

International Affairs

- Organisations
- Codex

- EC 1829/2003 – GMO food
- EC 1830/2003 – GMO labelling
- EC 2001/18/EC – release to environment

EU register of genetically modified food

Transformation event/ Unique ID/ Company	GM
Cotton (MON1445)	Genetically modified
MON-01445-2	cod. epsosa. gans

GMO databases in EU and Poland

Ministerstwo Środowiska
organizmy genetycznie zmodyfikowane

Rejestry | Formularze
Produkty | BCH Polska

Organizm genetycznie zmodyfikowany to organizm inny niż organizm człowieka, w którym materiał genetyczny został zmieniony w sposób nie zachodzący w warunkach naturalnych wskutek krzyżowania lub naturalnej rekombinacji.

NOWA WITRYNA GMO

W sierpniu 2010 roku następuje wdrażanie witryny Internetowej dotyczącej GMO, dlatego też może ona nie działać poprawnie. Bardzo prosimy o cierpliwość i wyrozumiałość, a w razie problemów kontakt z Zespołem ds. GMO w Ministerstwie Środowiska, tel. 22 5792723.

Organizm genetycznie zmodyfikowany to organizm inny niż organizm człowieka, w którym materiał genetyczny został zmieniony w sposób nie zachodzący w warunkach naturalnych wskutek krzyżowania lub naturalnej rekombinacji.

Żywy zmodyfikowany organizm oznacza każdy żywy organizm, który ma nową kombinację materiału genetycznego, otrzymanego z wykorzystaniem nowoczesnej biotechnologii.

Za zagadnienia związane z wykorzystaniem organizmów genetycznie zmodyfikowanych w Polsce, z wyjątkami określonymi w przepisach prawnych, odpowiada Minister Środowiska. Do głównych obowiązków w tym zakresie należą m.in.:

- wydawanie zezwoleń na prowadzenie zakładów inżynierii genetycznej,
- przyjmowanie zgłoszeń zamkniętego użycia,
- wydawanie decyzji w sprawach zamierzonego uwolnienia GMO do środowiska w celach doświadczalnych,
- wydawanie decyzji w sprawach wprowadzenia do obrotu GMO jako produkt lub w produktach,
- koordynacja kontroli i monitorowania działalności w zakresie GMO,
- koordynacja gromadzenia i wymiany informacji w zakresie GMO

Aktualności

2011-07-08 15:55

Rozporządzenie Ministra Nauki i Szkolnictwa Wyższego z dnia 22 stycznia 2008 r. w sprawie kryteriów i trybu przyznawania i rozliczania środków finansowych na naukę przeznaczonych na finansowanie projektów badawczych (Dz. U. Nr 21 poz. 126 z późn. zm.) oraz zmiany rozporządzenia: 1) Rozporządzenie Ministra Nauki i Szkolnictwa Wyższego z dnia 3 czerwca 2009 r. - w Dz. U. z 2009 r. Nr 94, poz. 776. 2) Rozporządzenie Ministra Nauki i Szkolnictwa Wyższego z dnia 9 marca 2010 r. - w Dz. U. z 2010r. Nr 45, poz. 262. W przypadku projektów badawczych związanych z prowadzeniem badań nad organizmami genetycznie zmodyfikowanymi lub z zastosowaniem takich organizmów do wniosku dołącza się kopię zgody wymaganej na podstawie przepisów o organizmach genetycznie zmodyfikowanych.

- Law on GMO (Poland) 22.06.2001. Dz.U. Nr 76, poz. 811
- Minister's regulations 2002, 2004.
- Polish framework 18.11.2008.

1. Why is Europe afraid of GMO? - rules



Authorized use of GMO in Europe

Maize -	25
Cotton -	8
Oilseed rape -	3
Soybean -	3
Starch potato -	1
Sugar beet -	1
Microorganisms -	2

Most GMOs on the European market are genetically modified crops

Ban on GMO cultivation based on the "safeguard clause" (Art. 23 Dir. 2001/18/EC; Food and Feed Safety 2012)

1. Why is Europe afraid of GMO? - rules



GMO-free zones in Europe (2010)

GENET – an European network engaged in the critical debate on GMO, involves 51 organizations from z 27 EU countries. It focuses on:

- plant and animal breeding,
- food production,
- GMO implications on biodiversity and human health

OPINIONS:

- Problem of GMOs is irrelevant. (HJ Jacobsen, August 2011, TVP)
- Nobody has proved so far that GMO is harmful for humans. (K. Niemirowicz-Szczytt, 2012.02.08. PR 3)
- GMO is a huge threat. The damage it would cause will be higher than anything we had so far to deal. (Z. Mirek, 2012.02.08., PR3)

Why is Europe afraid of GMO?

1) Why is Europe afraid of GMO?

YES - in Europe there are concerns about GMO in food production.

2) What is GMO?

- Meaning of the word "GMO"
- Problems with definition



2. What is GMO? – meaning of the word

GMO – „*Genetically Modified Organism*”



Deinonychus
(birds' ancestor)



Bullfinch (photo by J. Chmiel)



Liverworts -
first land plants



Grasses – youngest
land plants

The term of GMO is misleading because the genetic modification is a basis of evolution (variation). In this sense all organisms are genetically modified.

2. What is GMO? - definition

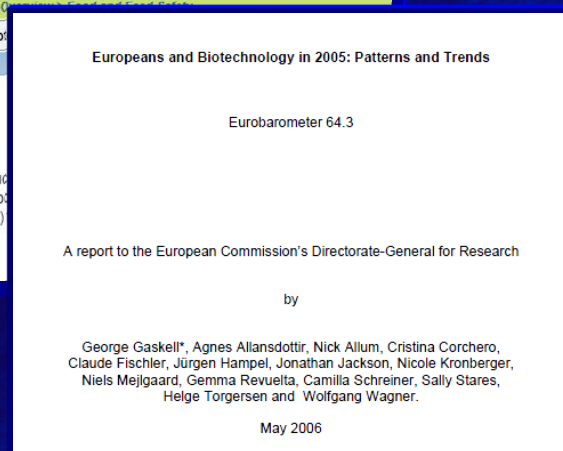
Organisms, whose genes have been altered by humans

Organisms, whose genetic materials have been modified artificially in a way that does not occur under natural conditions (cross-breeding, recombination)

- Ministry of Environment (PL)
- Directive 2001/18/EC
- WHO



Food and Feed Safety, 2012



Eurobarometer 2006

Organisms that possess foreign genes in genomes (Biotechnolog.pl; STOP.GMO)



Wikipedia (Poland)

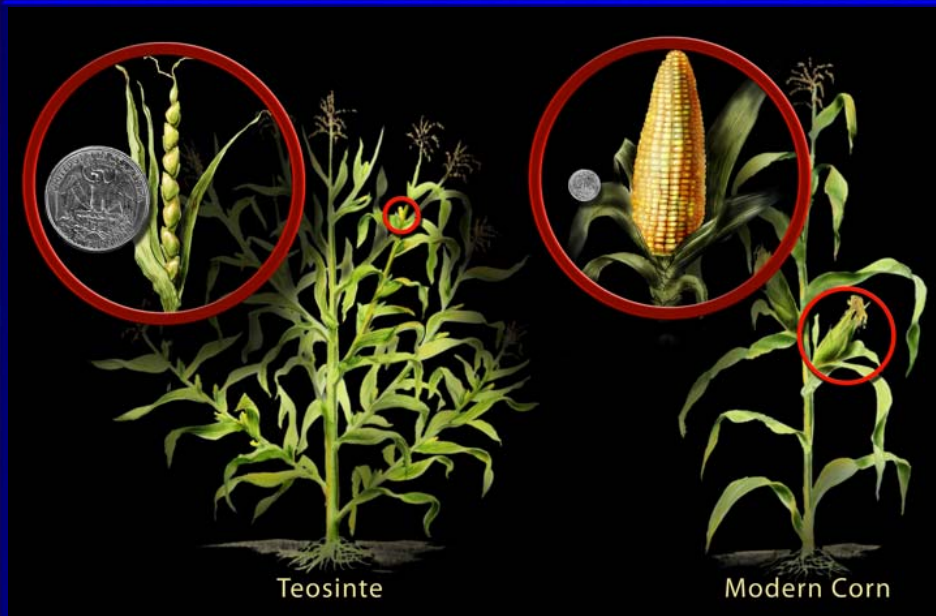
- Definitions are inaccurate
- They enable different interpretations by both GMO supporters and opponents

2. What is GMO? – problems with definitions



Targeted alterations of genomes can cause unpredictable effects, scientists are not able to control effects of genetic modifications

(Wiackowski 2007)



Maize ancestor *Teosinte* and *Zea mays*
(Allmystery.de)



Helianthus annuus, wild

Helianthus annuus, crop



All domesticated species were modified by humans and this process was not controlled

2. What is GMO? – problems with definition



Genetic material has been altered in a way that does not occur under natural conditions

(GMO - ...c2010-2011)



GMO



H02B pea mutant



Pea mutant *clavicula*



Brenda cultivar



MRS stock



Many modern cultivars were created in a way that does not occur under natural conditions, e.g., by seed treatment with chemical reagents such as MNH, NaN_3

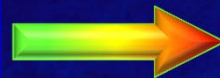
2. What is GMO? – problems with definition



GMOs have foreign genes in genomes. These genes could not be transferred by natural processes



Solanum pimpinellifolium



Fusarium
resistance
gene



S. lycopersicum



Festulolium (*Lolium multiflorum* x *Festuca pratensis*) – since 1950



Plants infected by *Agrobacterium tumefaciens*. A part of bacterial DNA is transferred into plant genome

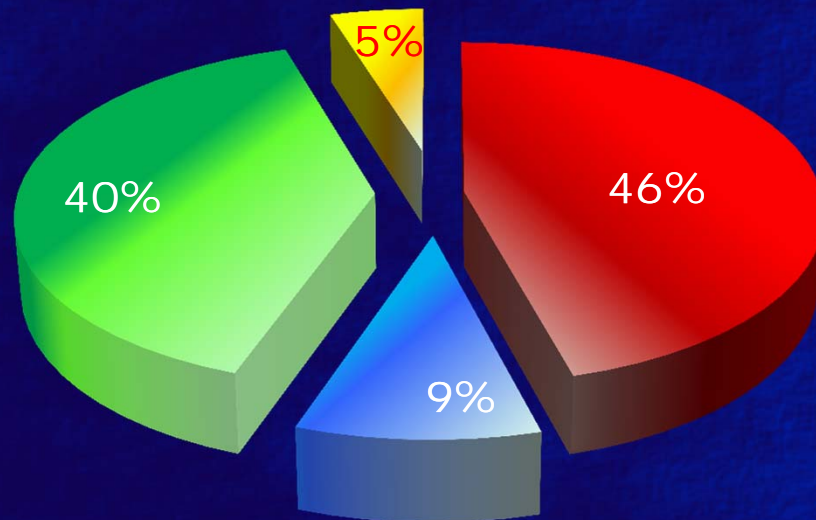


Gene flow among species has been very common during evolution and it has been employed in breeding for many years

2. What is GMO? – problems with definition

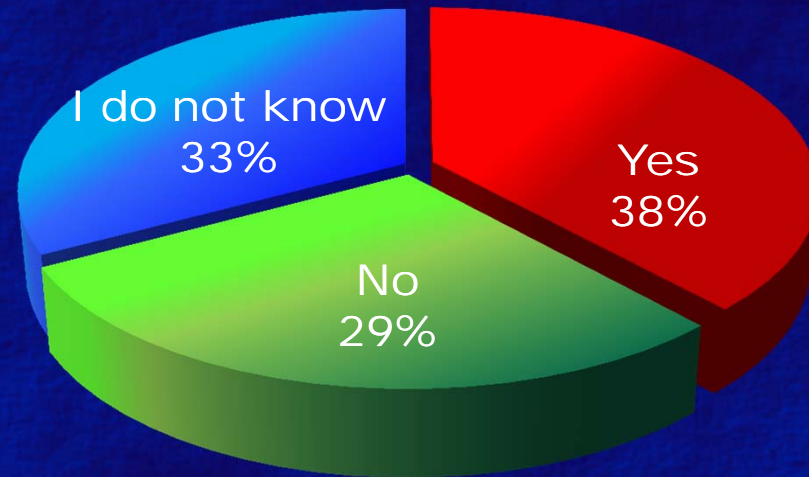
University and high school students know the term "GMO", 92% have heard about GMO in press (34%) TV (24%), schools (24%), Internet (18%)

What are genetically modified organisms?



- Each organism to which a foreign gene was introduced using genetic engineering
- Each organism with a foreign gene
- Organisms obtained by inducing mutations
- I do not know

Are GMOs dangerous?



Over half of respondents did not know what GMO is. They did not know whether GMO is dangerous.

Questionnaire project by Piotr Kaczyński, completed by students from the "GENIUS" Association on 508 high school students in 2009.

Why is Europe afraid of GMO?

1) Why is Europe afraid of GMO?

YES - in Europe there are concerns about GMO in food production.

2) What is GMO?

Inaccurate definition enables to manipulate public opinions and knowledge of societies is limited.

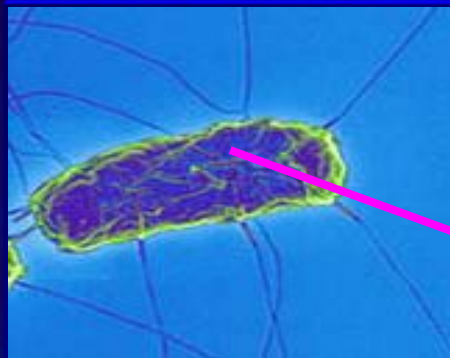
3) How to obtain GMO?

- GMO or GEO?
- GMO technology base
- Accuracy



3. How to obtain GMO? – GMO or GEO

Cohen et al. 1973 – received *Escherichia coli* with the *Salmonella typhimurium* gene. They employed natural processes in bacteria.



Salmonella typhimurium
(photo by V. Brinkmann)



Escherichia coli

Streptomycin
resistance

DNA
pRSF1010

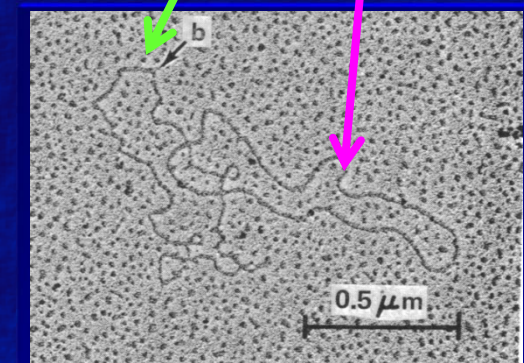
Restriction
enzyme
EcoRI

Tetracycline
resistance

DNA
pSC101

Ligase

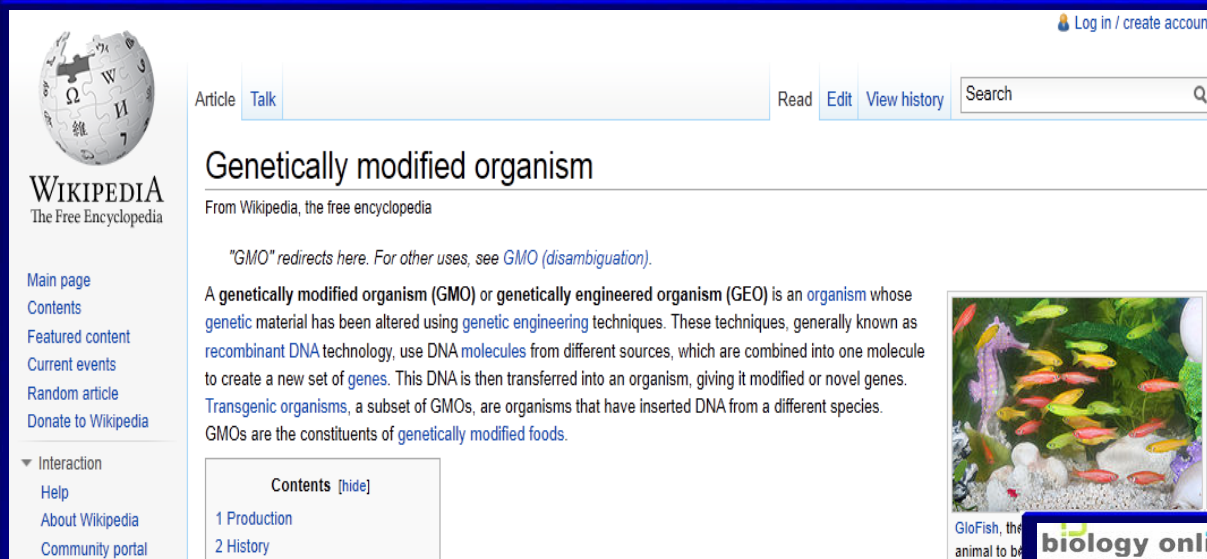
Streptomycin and
tetracycline
resistance



pRSF1010/pSC101 duplex

GEO: „*Genetically Engineered Organism*“
Organisms produced using genetic
engineering methods

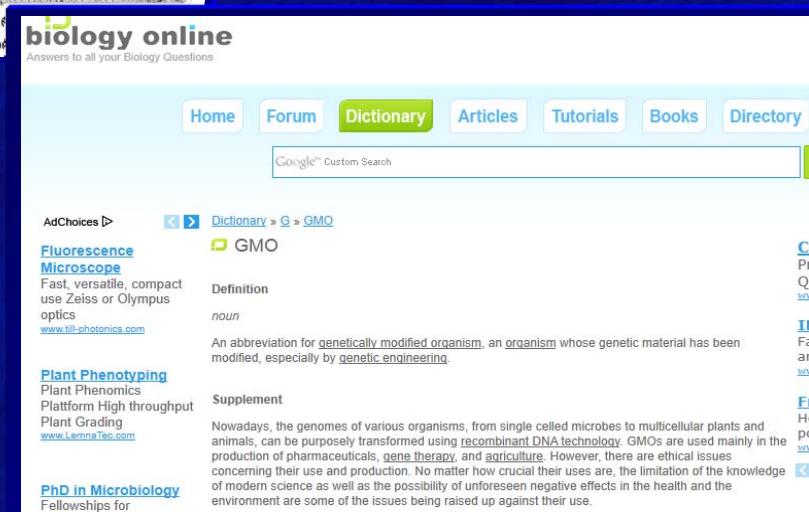
3. How to obtain GMO? – GMO or GEO



The screenshot shows the Wikipedia page for "Genetically modified organism". The page title is "Genetically modified organism" and it is noted as being from Wikipedia, the free encyclopedia. A note states: "GMO" redirects here. For other uses, see GMO (disambiguation). The main text defines a genetically modified organism (GMO) or genetically engineered organism (GEO) as an organism whose genetic material has been altered using genetic engineering techniques. It mentions recombinant DNA technology, DNA molecules, genes, and transgenic organisms. A table of contents is visible with sections for "1 Production" and "2 History". An image of GloFish is partially visible on the right side of the page.

en.Wikipedia.org 2012

GMO (GEO) – organism, whose genetic material has been altered using genetic engineering techniques. These techniques combine DNA molecules from different organisms into a new molecule, which is then transferred into an organism giving it novel features.



The screenshot shows the Biology online website. The navigation menu includes Home, Forum, Dictionary, Articles, Tutorials, Books, and Directory. A search bar is present. The main content area shows the definition of GMO: "An abbreviation for genetically modified organism, an organism whose genetic material has been modified, especially by genetic engineering." There is also a "Supplement" section that discusses the use of GMOs in various fields like pharmaceuticals, gene therapy, and agriculture, and mentions ethical issues.

Biology online

3. How to obtain GMO? – technology

Gene transfer between biological species

Transgenic organism – a new gene is inherited in agreement with the Mendel's laws

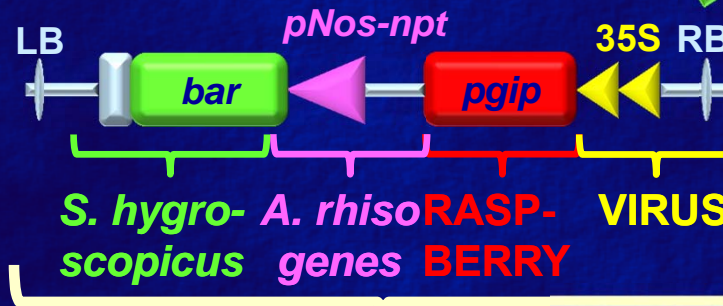


Raspberry (*Rubus idaeus*)



Pea (*Pisum sativum*)

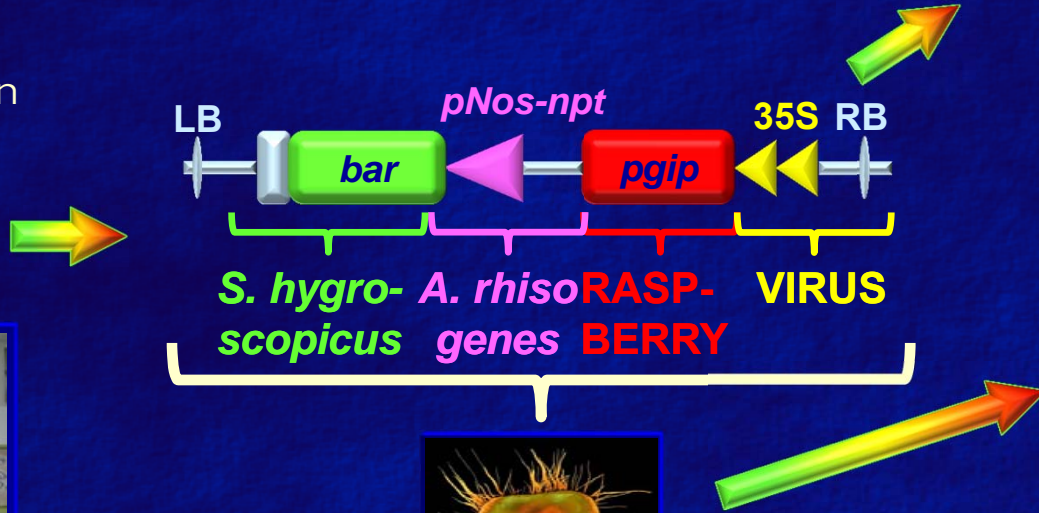
Gene isolation



E. coli

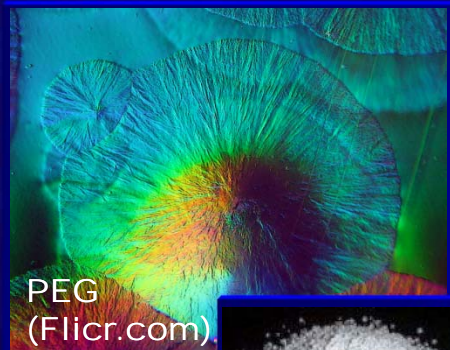


A. tumefaciens
(visualphotos.com)



3. How to obtain GMO? – technology

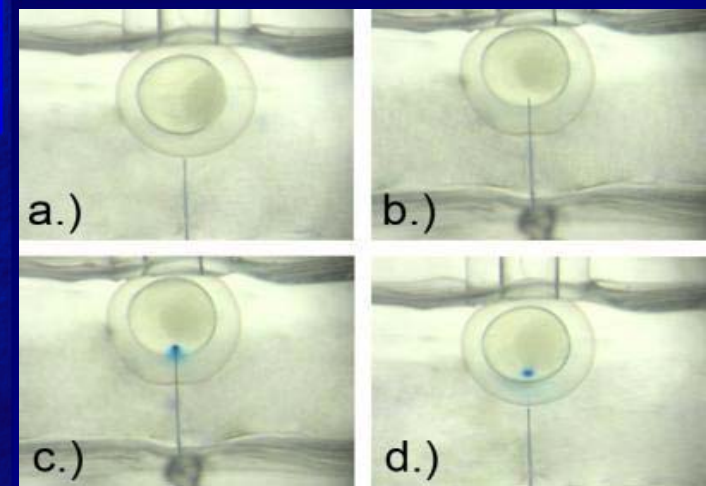
Physical and chemical agents support the transfer of DNA into cells



Chemicals used in mammals



Particle (biolistic) gun
(Bio-Rad)



Zebrafish – microinjection
(Gene Nakonechny, McMaster University)



Electroporator (Bio-Rad)

3. How to obtain GMO? – technology

The resulting transgenic organism contains the DNA construct comprising genes derived from different species. These foreign genes are “transgenes”



Pea (*Pisum sativum*) with *rpgip1* gene derived from raspberry (*Rubus idaeus*). The gene encodes fungal resistance.



The method is inaccurate, we do not know where the construct was inserted and what changes it underwent in the donor genome

Pea with *rpgip* was developed by the team supervised by Prof. H.-J. Jacobsen, Leibniz Universität Hannover, Germany

3. How to obtain GMO? – accuracy

Introduced genes can be inactive or they can be lost in subsequent generations



Baroness – parent cultivar



GMO with *rpgip1* and *bar* (herbicide resistance)

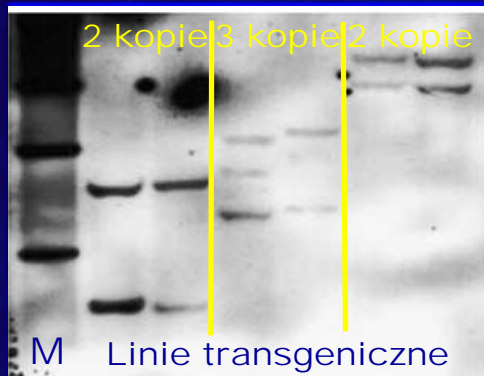


GMO with *vst1* and *bar* (herbicide resistance)

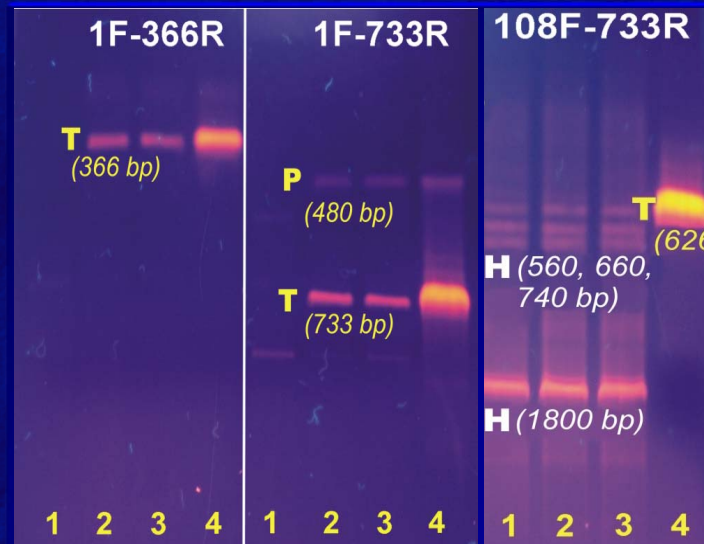
Expression of *bar* disappeared in further generations. Both control and transgenic plants are sensitive to the BASTA herbicide.

3. How to obtain GMO? – accuracy

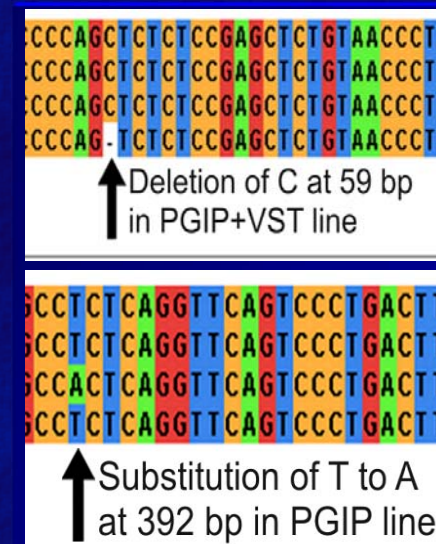
There can be many copies of transgenes and they can be rearranged



Copy number of *rpgip1* in transgenic peas (Richter et al. 2007)



Identification of a transgene in pea 1 Baroness, 2 PGIP, 3 PGIP x VST, 4 Plasmid (Polok & Jacobsen 2011)



Mutations in the *rpgip1* gene in GM pea, frequency - $1,1 \times 10^{-3}$ (Polok & Jacobsen 2011)

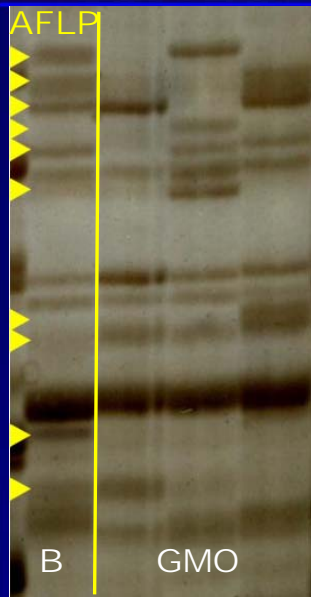
Mutation frequency in GM soybean, Roundup-Ready (Ogasawara et al. 2005)

- ☒ Transgene - $0,87 \times 10^{-3}$
- ☒ *Cong1* i *Cong2* - $0,92 \times 10^{-3}$ (soybean genes)

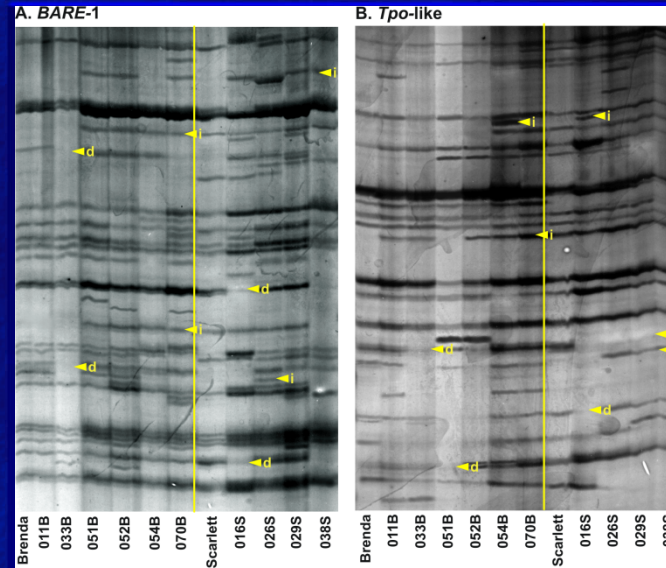
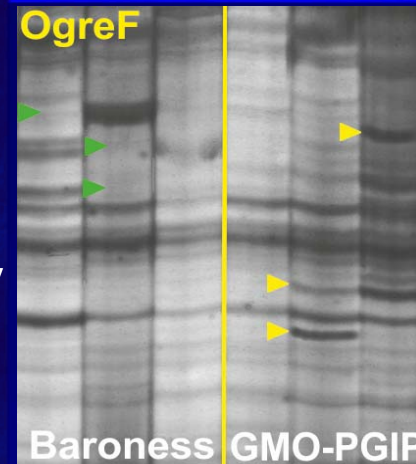
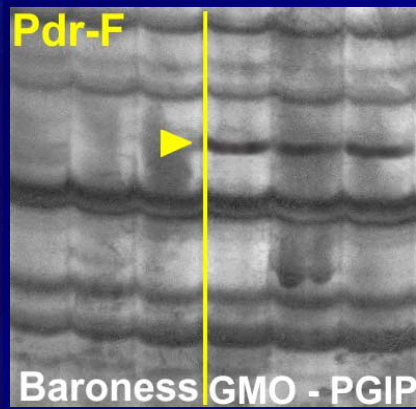
Frequency of mutations in transgenes does not differ from this in host genes and it is in agreement with the frequency predicted by the theory of molecular evolution

3. How to obtain GMO? – accuracy

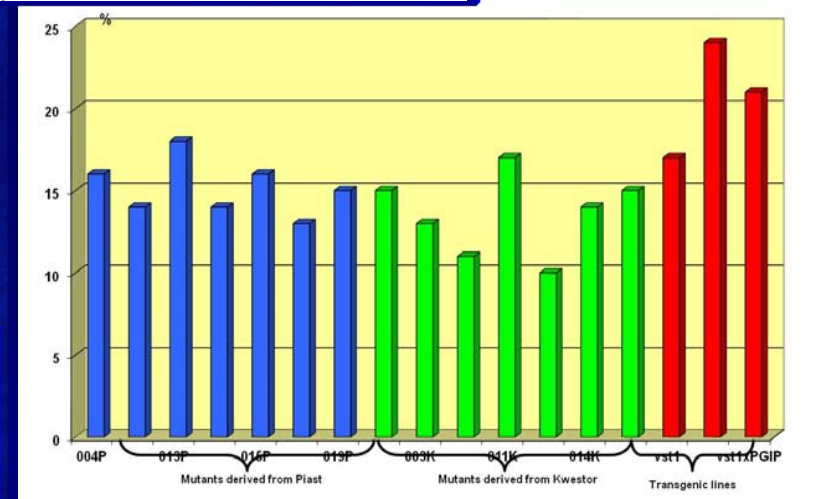
Frequent wide genome mutations can be observed in transgenic plants



Genetic diversity of transgenic pea lines



Genetic diversity of induced barley and pea mutants



Insertions and deletions of genomic sequences are observed in transgenic plants but such mutations are also present in induced mutants and cultivars

Why is Europe afraid of GMO?

1) Why is Europe afraid of GMO?

YES – in Europe there are concerns about GMO in food production.

2) What is GMO?

Inaccurate definition enables to manipulate public opinions and knowledge of societies is limited.

3) How to obtain GMO?

GMO (GEO) – organisms developed using genetic engineering. The method is inaccurate and does not differ from traditional breeding.

4) Why is GMO produced?

- Examples of GMO
- GMO in medicine
- GMO in industry
- GMO in agriculture



4. Why is GMO produced? – examples



Tomato with two snapdragon genes responsible for anthocyan synthesis as an adjuvant treatment of cancer (**Purple tomatoes...2008**)



Cat with a jellyfish gene (luminescence) and the FIV gene of macaques that blocks the HIV infection (**Mayo Clinic...2011**)



„Glofish” - Zebrafish with a sea anemones gene encoding green fluorescent proteins (**Hallerman, 2004**)

4. Why is GMO produced? – medicine

Nearly 250 drugs and vaccines are produced using GMO and further 100 undergo tests



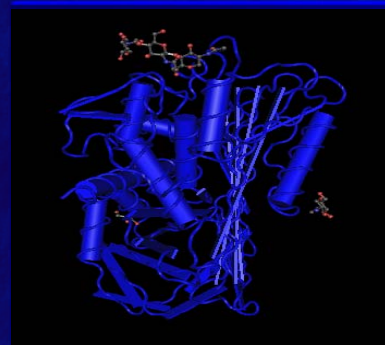
A recombinant bioreactor used for making synthetic human insulin. Photo credit: Biocon Pharmaceuticals, Ltd.



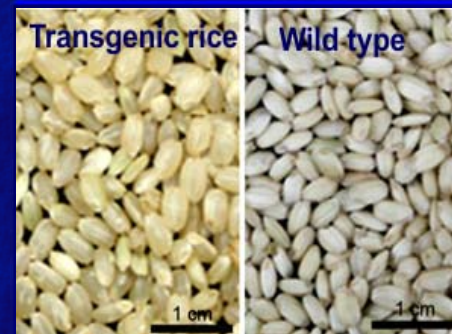
Insulin is produced by *E. coli* in bioreactors since 1982

GMO is used in:

- production of hormones and other compounds (protropin, erythropoietin, human SOD, antibiotics)
- production of antibodies (cancer, AIDS)
- production of vaccines (polio, hepatitis B)
- skin and bone cultures



Antithrombin (ATryn) is produced from milk of GM goats since 2009



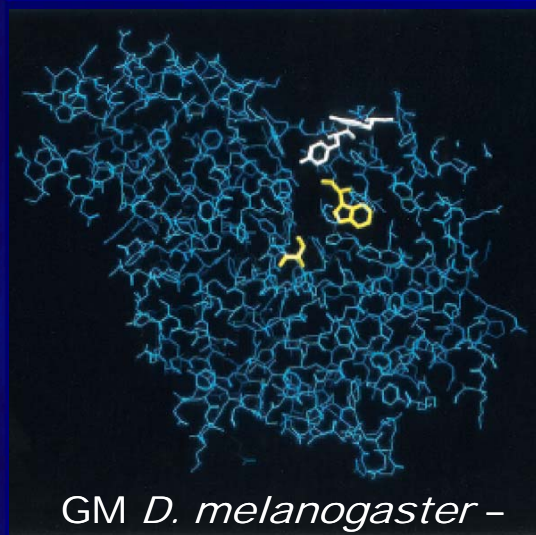
Rice with the human albumin gene *OsrHSA* (He et al. 2011)

4. Why is GMO produced? – industry

GMO or GMO derived products are employed in production of cosmetics, alcohols and modern materials



GM yeast strains, ML01, ECMo01 – USA, Canada (Fermentation, urea degradation) (Grossmann et al. 2011)



GM *D. melanogaster* – *Dm-AChE* protein as a biosensor detecting pesticides (Campas et al. 2009)



GM flax produces polyhydroxybutyrate (PHB), biodegradable plastic (Wróbel et al. 2003)

Generally, products derived from GMO are not labelled due to GMO amounts below thresholds (<0,9%)

4. Why is GMO produced? – agriculture

GM animals are produced to fasten growth, increase disease resistance or increase fertility



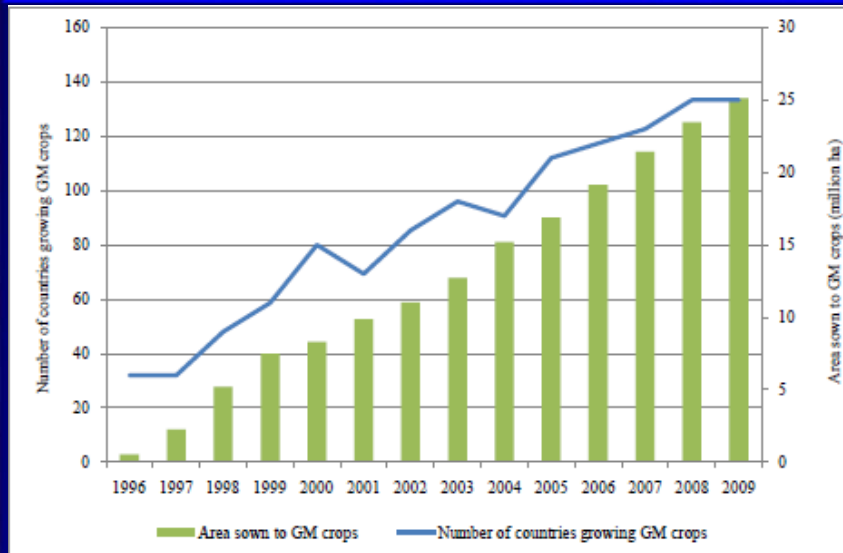
- **Faster growth (fish, cattle, pigs, sheep, rabbits)**
Genes of growth hormone
- **Milk composition (cattle)**
Additional copies of casein genes
- **Lower level of phosphorus in excrements (pigs)** Phytase genes from bacteria
- **Higher production of wool (sheep)**
Cysteine genes from bacteria
- **Disease resistance (chicken, cattle, pigs, sheep, rabbits)**
Antigen genes from mice, viral envelope genes from sheep
- **Higher fertility (pigs, sheeps)**
Genes of estrogen receptors

(Cowan 2010; Gottlieb & Wheeler 2011)

Transgenic animals have not entered into commerce

4. Why is GMO produced? – agriculture

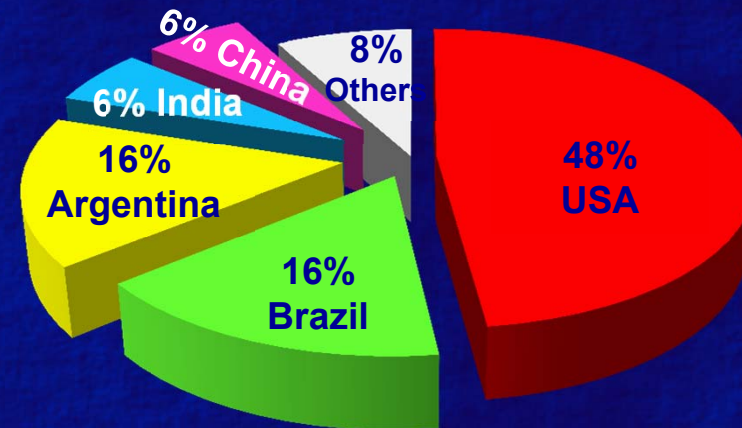
Transgenic crops are grown on 134 mln ha in 25 countries. In years 1996-2009 the area of cultivation has increased 50 times (2,8 mln ha in 1996).



Increase of World area of GMO production in years 1996-2009
(FCEC 2010, p. 16)

Only GM corn grows in Europe. Growing area is only 0,7% of the world area. Most fields (87%) are in Spain.

(data from 2007, FCEC 2010)

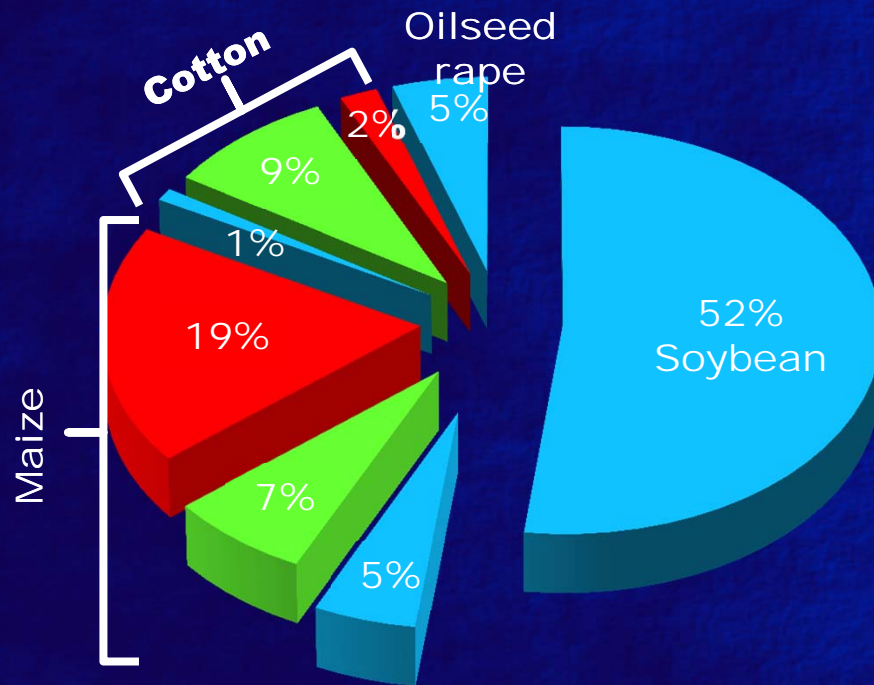


Spain	75 000 ha
Czech	5 000 ha
Portugal	4 200 ha
Slovakia	900 ha
Romania	400 ha
Poland	300 ha

(data from 2007 , FCEC 2010)

4. Why is GMO produced? – agriculture

12 GM crops are cultivated in the world, of which the largest surface is occupied by soybean (52%) and maize (31%)



- HT/Bt – herbicide and insecticide tolerance (21%)
- HT – herbicide tolerance (62%)
- Bt – insecticide tolerance (16%)

Number of authorized GMO uses in Europe

- HT/Bt - 11 permissions:
9 - maize, 2 - cotton
- HT - 12 permissions:
3 - soybean, 3 - maize,
3 - oilseed rape, 2 - cotton,
1 - sugar beet
- Bt - 7 permissions:
5 maize, 2 cotton
- F (quality) - 1 permission:
potato without amylase

All currently cultivated GM crops carry genes responsible for pesticide tolerance

4. Why is GMO produced? – agriculture

Transgenic soybean and maize are used in food and feed production in Europe

Product		Total [mln ton]	Unlabelled GMO	
			[mln ton]	[%]
SOYBEAN	Seeds	1.50	1.17	78%
	Oil	2.12	1.29	61%
	Food	31.15	27.41	88%
	TOTAL	34.77	29.87	86%
MAIZE	Seeds	0.87	0.04	5%
	Feed	29.25	1.46	5%
	Food	8.97	0.45	5%
	TOTAL	39.00	1.95	5%

(based on FCEC 2010)

Most products derived from transgenic soybean are not labelled in Europe (<0.9%)

Why is Europe afraid of GMO?

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Producing active compounds or food using GMO can be profitable, but most GMOs comprise HT crops. Not all products derived from GMOs are labelled.



5) Is GMO dangerous?

- Environment
- Health
- Economy

5. Is GMO dangerous?

Environment



- Contamination
- Biodiversity
- Gene flow



Health



- Allergies
- Toxicity
- Antibiotic resistance

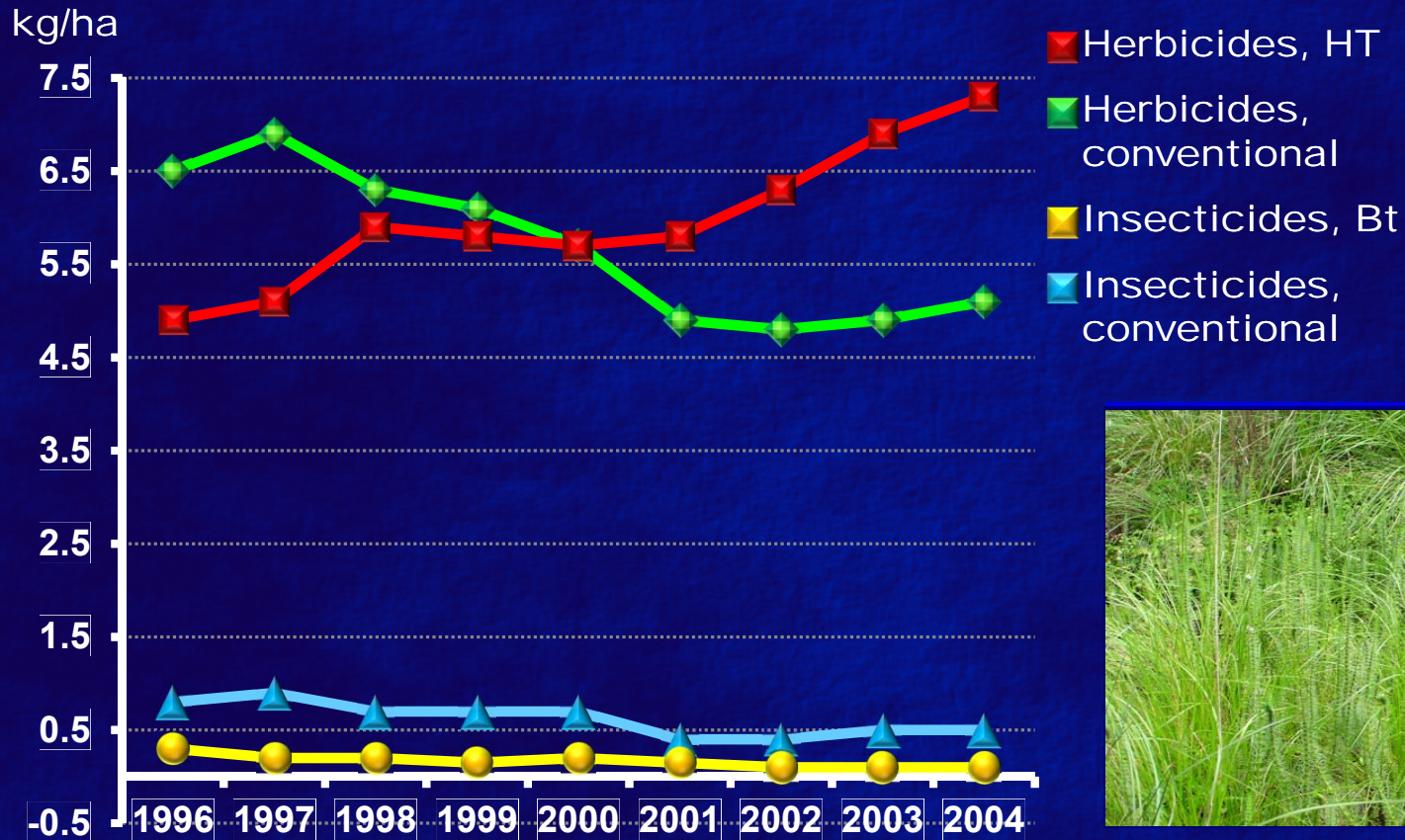
Economy



- Production costs
- Farmers' rights
- Monopolistic practices

5. Is GMO dangerous? - environment

Bt crops consume by 80% less insecticides (2004). HT crops use by 43% more herbicides than conventional ones



Marestalk (*Conyza canadensis*)

Average consumption of pesticides in maize, soybean and cotton crops in USA
(based on Benbrook 2004)

The emergence of herbicide resistant weeds has caused the increase of herbicide consumption

5. Is GMO dangerous? - environment

Protein toxins, Cry from bacterium, *B. thuringiensis* produced by transgenic plants have no negative effects on untargeted organisms



Diptera caterpillars attacking maize and cotton



Cry genes of *Bacillus thuringiensis* encode protein toxins lethal to insects

- There is no significant influence of Cry1Ab proteins on growth, development and reproduction of earthworms. Proteins, however are present in their digestive tracts.
- The growth and reproduction of *Caenorhabditis elegans* are inhibited in the presence of Cry1Ab proteins in soil. There are no population studies.
- Contradictory data regarding the effect of *Bt* crops on rhizosphere.
- Cry proteins have decreased the level of root colonization by mycorrhizal fungi.**
- Cry proteins have no effects on enzyme activity. Chemical composition of *Bt* crops differs from that in conventional cultivars (isogenic lines).

(Icoz & Stotzky 2008)

Influence of Cry toxins depends on climatic, soil and cultivation conditions

5. Is GMO dangerous? - health

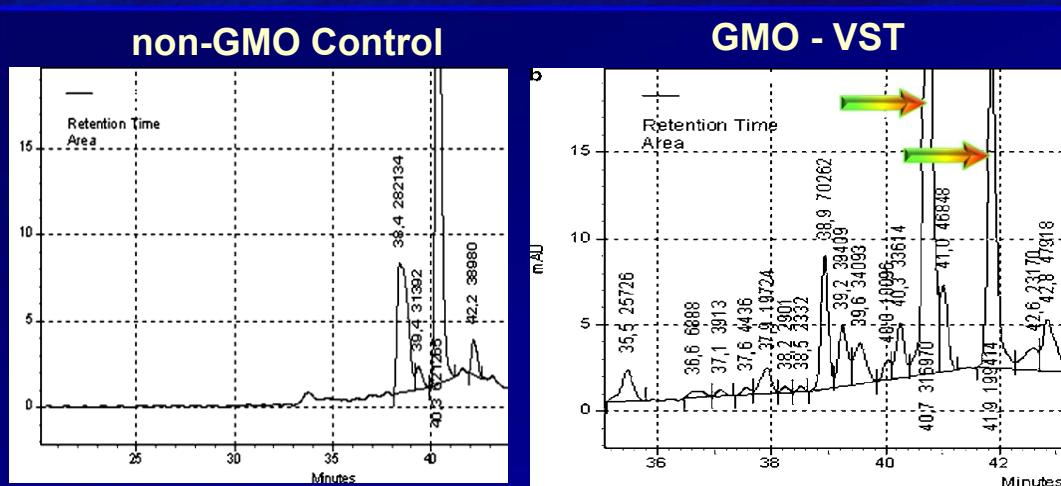
All products derived from GMO are tested regarding the allergenicity and the presence of compounds potentially harmful to humans



The screenshot shows the EFSA website interface. At the top is the EFSA logo with the text "European Food Safety Authority" and "Committed since 2002 to ensuring that Europe's food is safe". Below the logo is a navigation menu with "About EFSA", "News & events", "Topics A-Z", "Publications", and "Panels & units". The "Panels & units" section is expanded to show "GMO". Under "GMO", there is a sub-section "The Panel on Genetic Modification" with a description: "The Panel on Genetic Modification deals with genetically modified food and feed. It is part of the GMO Unit." Below this is a photo of two ears of corn and a "Publications" button. The text "Plants developed through cisgenesis and" is partially visible at the bottom.

EFSA gives opinions on the risks of GM food in agreement with the regulation 178/2002

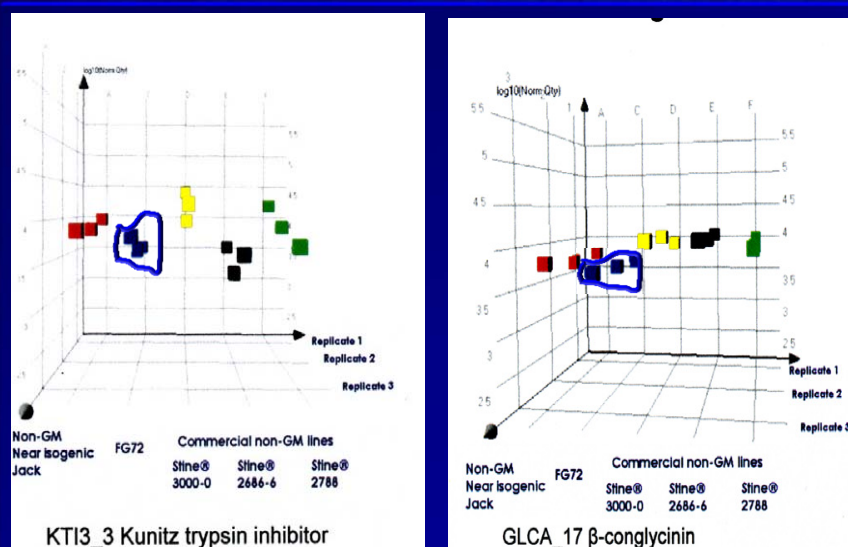
- STEP1
Testing a novel GM feature, e.g., whether a new protein can cause allergies.
- STEP2
Analyzing potential changes in plant metabolism (chemical composition, animal tests)



HPLC profiles of pea demonstrate the presence of resveratrol in transgenic plant with the *Vst1* gene (Richter et al. 2007)

5. Is GMO dangerous? - health

It is too little independent research on GM food safety, and available tests are not always sufficient



Quantity of allergens in transgenic soybean is within the range of biological variation of non-transgenic cultivars (Rouquie et al. 2010)

So far, no negative effects of GMO eating have been demonstrated but there is the lack of population data

Parameters	Week	Males 11%	Males 33%	Females 11%	Females 33%
BONE MARROW					
Absolute Lymphocytes	14	-12	29	-1	-23 *
Neutrophils	14	13	-34 **	4	16
Lymphocytes	14	-3	8 **	0	-2
Eosinophils (p)	5	38 *	-19	43	-13
Lar Uni Cell	5	4	-6	33 **	6
HEART					
Heart Wt	14	6	11 **	0	4
Heart % Body Wt	14	5	9 **	2	1
Heart % Brain Wt	14	6	9 *	-2	4

Physiological parameters of rats fed HT maize NK603 (gen *epsps*) differ from these in control rats (Vendomois et al. 2009)

The study was conducted only on 10 rats, and the authors published neither absolute values obtained for control animals nor GM fed rats. The results were presented only as a percentage of decrease/increase

5. Is GMO dangerous? - economy

Farmers cultivating GMO are dependent on chemical companies, which are owners of patents



NP603 maize is resistant to Roundup. Monsanto is both the patent owner and Roundup producer

Practices of GMO patent owners may lead to monopoly in the food production and they restrict the freedom of scientific research on GMO that have been already traded

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Do Seed Companies Control GM Crop Research?
Scientists must ask corporations for permission before publishing independent research on genetically modified crops. That restriction must end

By The Editors | August 13, 2009 | 37

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5) Is GMO dangerous?

So far, none GMO has caused environmental losses and health risks. However, the owners of GMO patents apply monopolistic practices.



Those, whose participation was invaluable...



We owe GMOs many drugs, but GMOs are unfulfilled hopes in agriculture. Instead of a breakthrough comparable to "the Green Revolution" we have „the Cold War“.

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AGROVOC descriptors: genetically modified organisms, genetic engineering, biosafety, genetically modified foods, biotechnology, genetic manipulation, gene transfer, induced mutations, breeding methods

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