

## Future of Food

# Understanding GMOs

### 1. Define *Genetically Modified Organism* -

**Here are some questions that will be answered by the end of this activity:**

*Where can one find scientific information about GMOs?*

*How is crop production affected by GMOs in different environments? (wet, dry, low temperatures, high temperatures)*

*How could a GMO increase food security?*

*How might GMOs change land use, legislation, use of water/crude oil, and transportation?*

\*Take the **What do you know about GMOs?** elearning course, to gain some background about GMOs

#### **What is a GMO?**

Genetically modified organisms are created by altering the DNA sequence of an organism using genetic engineering techniques that can't occur naturally. GMOs are also called G.E. crops, biotech crop, G.M.P. (genetically modified plant), G.M.F (genetically modified food)

**What are some common traits?** Herbicide tolerance allows farmers to spray herbicide to kill weeds without having to worry about damaging the actual crop. Insect resistant crops produce an insecticide that is only harmful to a specific subset of insects so farmers don't have to apply insecticide or worry about insect damage. Disease resistant crops are engineered so that certain diseases don't affect the plant. Non-Browning/Bruising crops help reduce food waste. Crops can be engineered to contain added nutrients, which can help combat malnutrition.

**Who makes GMOs?** Seed companies (Monsanto, Dow AgroScience, DuPont Pioneer, Syngenta), public researchers & universities (University of Florida, Cornell) and non-profits (Gates Foundation). It often costs seed companies \$130 million and 13 years of research and development before a new crop is allowed to come to market.

**How are GMOs regulated and tested?** In the US, the FDA, USDA and EPA approve GM seeds. The FDA ensures that a specific GM crop is safe to eat, while the USDA and EPA makes sure that a GM crop is safe to grow and safe for the environment. To plant GM seeds, farmers must sign a contract with whatever company or group they are buying seeds from. Farmers are required to follow certain guidelines for using the seed and are given suggestions for technology to use with the crop (i.e. pesticides, fertilizers). According to the contract they sign, farmers can't save seeds to grow the next year or sell the seeds and the seed company can inspect the farmer's land and equipment, if the company asks.

Scientists must get permission from the organization that created the seed to do research and the organization can revoke permission. Biotech industry is committed to allowing nearly all public research on available crops (as long as they don't attempt to recreate the seed or release it).

**Are GMOs safe?** The general scientific consensus says GMOs don't pose unusual risk. The National Academy of Science, American Association for the Advancement of Science, American Medical Association, European Commission and World Health Organization state that GMOs don't pose any unusual risk to health or the environment and an independent review of over 1,700 studies on GMOs didn't find any significant hazard associated with GM crops. But not every scientist or scientific body agrees; a statement signed by 300 scientists said that there is not an agreement on the safety of GMOs. (Add reference to the study released in 2016)



## Future of Food

**Are there environmental benefits?** Herbicide tolerant (HT) crops reduce the need for tilling; HT crops reduce the need for tilling (turning the soil to kill weeds) so less CO<sub>2</sub> (greenhouse gas) is released from the soil and soil degradation is reduced. Higher yields of GM crops reduce land usage and reduce deforestation associated with demand for land, GM crops reduce use of more dangerous herbicides and reduce insecticide use. Drought tolerant crops use less water.

**What are the environmental concerns?** GM crops promote monoculture (planting of a single crop in an area), which reduces biodiversity. HT crops lead to super weeds (herbicide-tolerant weeds), which are much more difficult to kill. Cross-pollination of GM and non-GM crops makes it difficult to ensure non-GM crops won't have trace amounts of GM DNA.

**What are the economic benefits?** Higher yields of GM seeds benefit farmers financially. GM seeds provide greater coverage if something goes wrong so farmers are more protected from major losses. Certain traits allow for reduced use of inputs by reducing trips across the field and product use (fuel, water, land, pesticide).

**What are the economic concerns?** GM seeds allow corporations to influence food and farming. GM seeds are patented so corporations can sue those who use their seeds without paying or for not following the contract.

**What are the social benefits?** Higher yields boost farmers' profits. GM crops can increase food production and help meet the food demands of an increasing population with decreasing resources.

**What are the social concerns?** GM seeds allow corporations to gain more control over farmers and food. GM companies are funding a large portion of the studies on GMOs so many are concerned about the bias that may cause.

### See-Saw Debate

Randomly select a stance on GMOs: Agree, Disagree or Both Sides

Present your stand on the GMO debate and its overall importance to the world. Keep in mind there are multiple perspectives as the market for food is global.

Day 1: Research all aspects of your selected stance. Be sure to use multiple sources to find out as much as you can.

Day 2: Create a position statement that illustrates at least four (4) evidence-based reasons that the class should support your stance on GMOs. Be a salesperson!

Some websites to investigate:

#### Pro-GMO

<https://gmoanswers.com/>

<https://www.geneticliteracyproject.org/>

#### Anti-GMO

[http://e360.yale.edu/feature/why\\_i\\_still\\_oppose\\_genetically\\_modified\\_crops/2191/](http://e360.yale.edu/feature/why_i_still_oppose_genetically_modified_crops/2191/)

<http://www.ucsusa.org/our-work/food-agriculture/our-failing-food-system/genetic-engineering-agriculture#.VvqiWlwrKrc>

#### Moderate/ Both Sides

<http://grist.org/series/panic-free-gmos/>



Future of Food

[https://www.washingtonpost.com/lifestyle/food/the-gmo-debate-5-things-to-stop-arguing/2014/10/27/e82bbc10-5a3e-11e4-b812-38518ae74c67\\_story.html](https://www.washingtonpost.com/lifestyle/food/the-gmo-debate-5-things-to-stop-arguing/2014/10/27/e82bbc10-5a3e-11e4-b812-38518ae74c67_story.html)

[https://www.washingtonpost.com/lifestyle/food/genetically-modified-foods-what-is-and-isnt-true/2013/10/15/40e4fd58-3132-11e3-8627-c5d7de0a046b\\_story.html?tid=a\\_inl](https://www.washingtonpost.com/lifestyle/food/genetically-modified-foods-what-is-and-isnt-true/2013/10/15/40e4fd58-3132-11e3-8627-c5d7de0a046b_story.html?tid=a_inl)

Here is a chart to organize notes and research

Land Use	Legislation	Crude Oil/Water	Transportation

How can the introduction/usage of GMOs help current locations of the globe increase food supply and food security?