

## DEVELOPMENT

### Genetically Modified Foods

These are foods obtained from living beings (plants, animals or microorganisms) that have been genetically manipulated by incorporation, inactivation or suppression of genes (modifying their genome). In the first case, coming from the same or different species<sup>5</sup>.

According to the Biosafety Work Group of FAO (1998), GMO includes chromosome manipulations, genes transference, fusion or reordering, gene destruction, inactivation or loss, transplant of cellular organelles, cellular fusion, nuclear transplants or clonation of multicellular organisms through cell cultivations or transferred embryos with new genes<sup>2</sup>.

The techniques of genetic modification (production of transgenic) were used for the first time in animals in 1981, and shortly after in plants. The first tests with genetically modified cultivations were carried out almost simultaneously in France and the United States in 1986. A few years later, in 1992, a genetically modified tobacco plant started to be cultivated in China, resistant to a certain virus, commercialized since 1993<sup>6</sup>.

### Types of Genetically Modified Organisms (GMO)

Normally, there are three groups of GMO, depending on the biological group they are part of: plants, animals or microorganisms<sup>7</sup>.

**1. Genetically modified plants:** these are basically vegetables whose genome (its DNA) has been modified with different objectives:

- The obtention of a new plant from a perspective of its use as a food; that means, that it is expected the obtention of a new plant-based type of food or the modification of the plant in order to be more useful as a food (they are going plant-based genetically modified foods)
- The production of genetically modified foods that are useful as biological fuels (bio-fuels), by fermentation. The reason is that such plants have a high concentration of carbohydrate polymers.
- The production of GM plants where genes with therapeutic proteins have been introduced to (drugs) or vaccine antigens, represents an option of genetic modification with a high practical utility, as it can be useful to the plant itself to get resistances or make a useful product to men (e.g. edible vaccines)<sup>7</sup>.

**2. Genetically modified animals:** they are animals that have been genetically modified to improve their production (more meat production, more milk, etc.) or simply to get new production (a protein, for example), directly used by men (it is the case of some animals that have been modified to produce human lactoferrin,

antihemophilic, etc.), or to accelerate their growth by introducing genes of other species allowing to duplicate or triplicate that rate. A special type of genetically modified animals are the ones called knockout animals (KO animals) where the gene that codifies the animal itself for a certain character has been inactivated, transferring to it the gene of a man or another animal species, behaving as “models” to study human diseases, or “experimental models for animal diseases”. These animals are also produced to serve as potential organ donors for humans (xenotrasplants), although this is still an experiment and a very polemic social and medical topic<sup>7</sup>.

**3. Genetically modified microorganisms:** normally, they are yeasts and bacteria of industrial interest that through a genetic modification technique are modified to eliminate industrial inconveniences or even just to produce something (for example a drug, a protein or just a vaccine antigen)<sup>7</sup>.



Fig. 1. 1.1: Genetically modified vegetables (tomato, carrot, broccoli).

1.2 GM cruciferous plants useful to depollute the soil

1.3 GM plant used as bio-fuel

1.4 GM mouse

1.5 GM pigs

1.6 GM yeasts