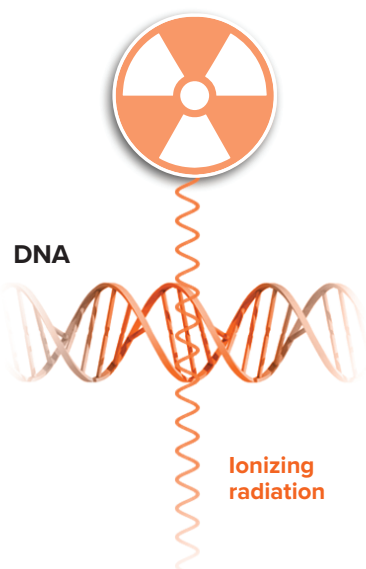
March 4, 2019

Modifying the Genetics of Food

Humans have been tinkering with the genetic makeup of plants and animals for thousands of years, mostly through selective breeding. Only within the past century have people been able to directly manipulate DNA, first through random mutagenesis affecting thousands of genes, but now by employing advanced techniques that can home in on a single gene for removal or replacement.



Five industry methods used to genetically modify foods

UNREGULATED

Traditional breeding

Crossing individuals of the same species to select for desirable traits.

EXAMPLE: Heirloom corn varieties

UNREGULATED

Hybridization

Cross-breeding two closely related species to produce a hybrid.

EXAMPLE: Tangelo, a cross between tangerine and pomelo

UNREGULATED in U.S. — EU classifies as GMO

Mutagenesis

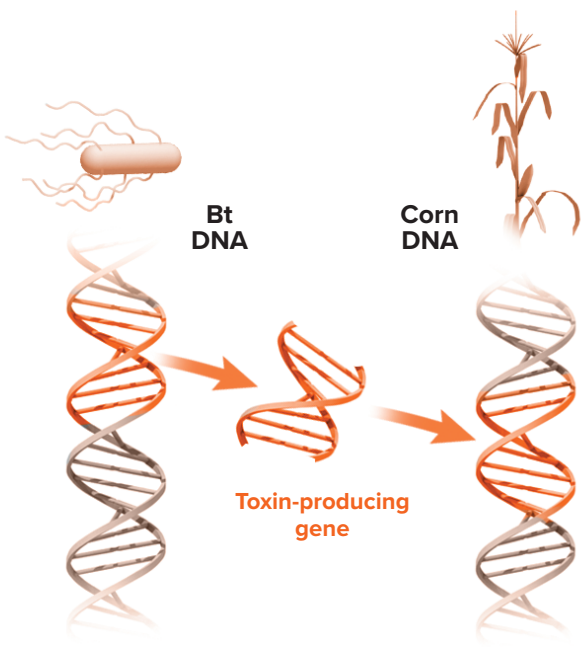
Radiation can cause random mutations in the DNA of an organism, leading to unexpected — and sometimes desirable — results.

EXAMPLE: Red grapefruit

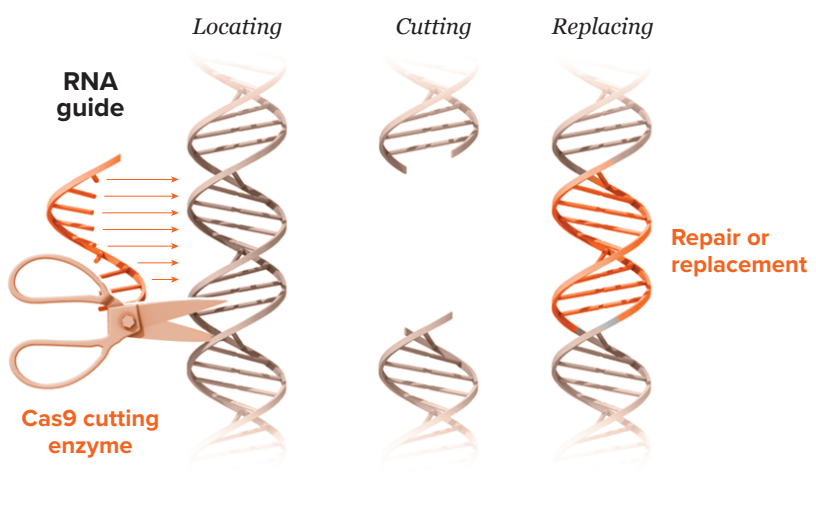
The debate among proponents and critics

Genetically modified organisms and associated herbicides can spur heated debate among proponents and critics. Agribusinesses, the National Academy of Sciences and U.S. federal regulatory agencies say no credible scientific studies reveal any detrimental health effects of GMOs.

GMO detractors — skeptical of genetic tinkering, control of the food supply by corporations, and the presence of pesticide residue in foods — say chronic diseases in the United States have dramatically increased since the introduction of GMOs and certain pesticides. Critics contend that ruling out a correlation would require thorough studies on the health and environmental effects of GMOs, which they say cannot be done effectively without the labeling of GMO foods, access to patented seeds from agribusinesses and full disclosure of herbicide ingredients.



CONTROLLED GENETIC MODIFICATION



HIGHLY REGULATED by USDA, EPA, FDA

Transgenesis

Genes from one organism are introduced into the DNA of a very different organism to engineer desirable traits.

EXAMPLE: **Bt corn** carries a gene from the soil bacterium *Bacillus thuringiensis*, which produces a toxin deadly to insect pests.

U.S. REGULATION DEPENDENT upon nature and characteristics of application

Genome Editing

A relatively new process — CRISPR — is fast, relatively inexpensive and very precise. It uses a strand of RNA to locate a specific gene sequence, which can be snipped out by a enzyme. The broken DNA strand is repaired or replaced.

EXAMPLE: White button mushrooms resistant to browning; not classified as a GMO because a single mushroom gene was removed.

Sources: NIH; CRS; Nature, Biotech-now; Genetic Literacy Project; news reports; GMO Myths and Truths, by Claire Robinson, Michael Antoniou and John Fagan; International Journal of Environmental Research and Public Health; Journal of the American Medical Association

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