Is your cheese GMO? The Non-GMO Project and other activists claim 90% of cheeses in America are ‘tainted’. Here are the facts

Almost all the hard cheeses made in the United States, and in much of the West, use a protein made with genetic engineering.

In cheese production, coagulants called rennet are used to clot milk. The primary enzyme in rennet driving the clotting process is called chymosin, which acts on milk proteins like casein and makes milk curdle. In recent decades chymosin has been developed using a genetic engineering process. Many activists and the Non-GMO Project misrepresent that 90% of American cheeses, and most cheese in Europe and other industrialized countries, are genetically modified. Organic activists and some manufacturers claim that cheese made from natural rennet â?? rare today except in soft cheeses â?? are “non GMO” and healthier for you.
Here are the facts: History of rennet

There are four different types of rennet that can be used in cheesemaking. Animal-based rennet was most commonly used for hundreds of years, but has become increasingly scarce. It is obtained from the fourth stomach lining of an unweaned calf. Calves have a higher amount of rennet in their stomachs compared
to adults as they use it to digest milk, their main source of food. The rennet extracted from the stomach linings is usually a mixture of chymosin, pepsin (another enzyme) and other proteins. Rennet can only be obtained once from a single, young animal. This makes it a costly necessity during cheese production.

To make billions of pounds of cheese, industrial chemistry is needed to produce large quantities of rennet. Harvested calf stomachs were chopped up *en masse* and then chemically refined to produce rennet consisting of precise ratios of various enzymes, such as chymosin and pepsin, which are needed for consistent cheese production.

Beginning in the 1960s, the price of rennet, a byproduct of the veal industry, *rose and became less stable* as the animal rights movement grew. Demand for cheese also soared, and cheese-makers began looking for alternative sources of rennet from plants and microbes.

Some plants and microbes naturally produce enzymes that have coagulating properties like rennet. However, rennet from these sources tend to produce other side reactions in cheese production, leading to undesirable results in taste.

**Genetic modification rescues the cheese industry**

So how did biotechnology come to play a role? In 1982, Genentech earned approval from the U.S. Food and Drug Administration for the medical use of insulin produced by genetically modified microbes. It was more than a boon for medicine??it also showed that GMOs were a viable substitute for animals in the production of pure proteins. In the late 1980s, scientists figured out how to transfer a single gene from bovine cells that codes for chymosin into microbes, giving microbes the ability to produce chymosin. These genetically modified microbes are allowed to multiply and cultivated in a fermentation process while they produce and release chymosin into the culture liquid. The chymosin can then be separated and purified. Chymosin produced using this method is termed fermentation-produced chymosin, or FPC.

Follow the latest news and policy debates on sustainable agriculture, biomedicine, and other â??disruptive?? innovations. Subscribe to our newsletter.

**SIGN UP**

In 1990, the FDA approved Pfizer??s GMO-derived chymosin by the Food and Drug Administration for human consumption, on the basis that it was identical to the chymosin found in animal rennet, and FPC was *given* Generally Regarded As Safe (GRAS) status. After 28 months of review, the FDA found that FPC was substantially equivalent to rennet produced from calves, thus it needed no special labeling or indication of its source or method of production. FPC is actually more pure than calf rennet, as it does not contain other proteins from the calf stomach lining that cannot be separated from calf rennet during production. “The real advantage is that it is probably a much cheaper way of producing this substance than to grow calves,” said William Grigg, an FDA employee.

Today ninety percent of the cheese in the United States is made using FPC. In the past two decades, FPC has been considered the ideal milk-clotting enzyme. The GMO-derived enzyme has been a boon for cheese manufacturing and cheese sales. The US produced about 11-billion pounds of cheese in 2013.
alone, thanks in large part to the cost-effectiveness of FPC. The technology transformed the industry, making it more efficient, more environmentally friendly and less dependent on animals. FPC has been regarded as suitable for meeting vegetarian, kosher and halal requirements.

Some vegetarians consider FPC to be derived from animals as the microbes were genetically modified using bovine genetic material. In response, scientists began synthesizing the gene needed to produce a synthetic form of FPC that does not have any genetic material from animals.

**GMO criticisms**

GMO concerns about FPC are few compared to those directed at genetically modified crops, but still persist on the radical fringe. Vermont, a major cheese-producing state that passed a GMO-labeling law in 2016 did not address the use of FPC to make cheese; dairy products were simply exempt. The Vermont law never took effect as it was eventually superseded by federal regulations.

FPC is especially interesting for the divisive role it continues to plays in contemporary debates over the safety of genetic engineering, and the labeling of GMO foods. Should consumers be made aware of the fact that genetically modified microbes were used to make their cheese but are not in the cheese itself? If so, how should they be made aware? It's not as though the cheese itself is genetically modified. Neither is the chymosin that produces the cheese. Because chymosin is a protein it contains no genetic material.

Cheesemakers know this line of reasoning well. Chr. Hansen, a Danish company, manufactures of some of the most popular brands of FPC in the world. The company describes its FPC as “GMO-free,” because purified FPC contains little to no trace of the genetically modified fungus, *Aspergillus niger*, that produces it. (But because organic food cannot even be a byproduct of GMOs, Chr. Hansen states that its GMO-free FPC is not acceptable for organic cheese production.) Similarly, Tillamook, an Oregon-based dairy company, uses FPC for all but five of its dozens of cheese varieties. Tillamook representatives recently stated on the company’s blog that after purification, the end rennet product does not contain any genetically modified material, since it no longer contains DNA from the cow gene. It is considered non-GMO by U.S. food industry standards.

“These enzymes are not GMOs; they’re products of GMOs,” stresses Paul McSweeney, professor of food chemistry at University College Cork in Ireland and founder of CheeseScience.net, an informational dairy chemistry resource. “The actual GMO never leaves the enzyme factory, and the coagulant is tested to ensure no modified DNA is in the enzyme preparation used to make cheese.
But many activists continue to misrepresent the science. A video recently went viral on Facebook that makes numerous false claims. It appears to be based on a post from earlier this year on a popular back-to-nature website that, among other things, promotes “natural medicine”. It maintains, falsely, that foods through GM can be less safe that other products, that rennet produced using GM was barely tested, and that Pfizer used a technical loophole to get its rennet approved by using what it says is a loophole in the federal GRAS law. “Pfizer was spared the pre-approval procedures that are applicable to other novel food additives that are not GRAS,” it claims. There was no “sparing”; there are no GMO ingredients in the final product.â??none of which is true.
The Non-GMO Project, which has makes hundreds of millions of dollars a year by offering manufacturers the use its label as a marketing gimmick, does consider cheese with FPC as a GMO and refuses to authorize its label—and many opportunistic companies leverage that misrepresentation.

Cheese made using GM in the process may be an unambiguous product of genetic engineering, but it is two steps removed from the genetically modified organism responsible for its existence and has no trace of the GM product that helped make it. FPC is not allowed in organic cheese based on the certification rules in the United States, Europe and Canada, providing an option for consumers who wish to avoid FPC. Cheese with FPC are also considered a GMO by the Non-GMO Project.
Jon Entine, executive director of the Genetic Literacy Project, has been a journalist for more than 40 years, as a writer, network television news producer and author of seven books, four on genetics and risk. BIO. Follow him on Twitter @JonEntine

XiaoZhi Lim is a freelance journalist and former GLP editor and writer