

Edible Antibiotics in Food Crop

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Imagine that a large land-grant university has partnered with a major agricultural company to create a consortium to produce low cost, high quality phytopharmaceuticals. Phytopharmaceuticals are compounds that can be and are used as drugs, and can be natural products as well as genetically modified products derived from plants. In this case, corn was bioengineered to produce large quantities of a vital antibiotic: penicillin. The production of this crop containing the antibiotic in the seed will largely benefit developing nations by providing a steady, reliable supply of cheap product that can easily be consumed orally. Ultimately, the cost of the drug will be 10% of the cost of producing penicillin using current production methods. Storage and transportation of antibiotic will be simplified by eliminating the need to refrigerate the drug. The use of needles and their associated risks will also be removed. In the United States, strict rules concerning genetically modified food crops exist and are routinely enforced. Presently, the USDA, FDA, and EPA have approved the modified maize for human consumption under prescription in the United States.

Opponents of the GM crop have raised the following issues. The potential for contamination of other, non-GM, crops is very high when a GM crop like corn expresses an allergenic compound. The reason is that corn is wind-pollinated. In addition to pollen drift, storage contamination and the potential for contamination through mixing of supplies raise serious risks for those allergic to antibiotics. Because of the seriousness of the consequences, it has been suggested that the risks be evaluated using the precautionary principle as opposed to risk assessment, the standard method currently relied on by regulatory agencies. Dosing and intake control have surfaced as major problems with consuming antibiotic in a food crop. Development of antibiotic resistance in infectious agents could pose serious risk. Potential environmental impacts include cross contamination of neighboring maize fields with the GM crop pollen. Isolation and refugia (a 'refuge' of GM crop among non-GM crop) of the genetically modified maize crop becomes undisputedly necessary.

An anti-GM activist group advances the claim that the consortium is not proposing the new crop as an altruistic action. Rather, the consortium is proposing the new crop in order to make huge profits in the animal feed industry in the US. The idea is that the new crop would be grown primarily, on large acreages, in the US. The major use of the new crop, in other words, would not really be for disease treatment in developing countries but rather for market animal growth promotion. In the US, low levels of antibiotics are used in animal feed. These antibiotics modify the microorganisms in the gut of the animal, thereby improving the animal's weight gain and feed efficiency.

Genetically modified 'traditional' pharmaceuticals are already in use and are widely accepted by consumers in the US. These pharmaceuticals have been deemed safe by the relevant US regulatory agencies. Recombinant insulin, for example, is widely used by diabetics. As a result of GM in the medical industries, insulin is now much cheaper and in greater supply.

What ethical issues are at stake here?

1. Consider each of these potential complicating factors:

Wind pollination; humans with allergies; underlying issues of giving away the product, yet acquiring large profits from animal uses in the U.S.; dosing of the 'drug' and following up with taking entire prescription; control of who eats it and shares it; regulatory issues; issues surrounding growing the crop in developing nations, including use of chemical and fertilizer inputs, intensive row cropping and weeding, to produce a sufficient quality and quantity of a crop for production to be profitable; resistance issues.

2. Should we be doing this?

3. How should it be regulated?

4. Will your agronomist become your pharmacist? Will your grocer become your pharmacist?

5. Should the GM maize be limited to human use? To animal use? How would such a limitation change the risks and benefits?

6. Is the opposition based on the actual risk implied or only on the alleged immorality of producing GM organisms?

7. Should the university receive benefits, financially or otherwise, from this product?
8. Should the consortium be allowed to patent, and thus control, the product?
9. If industry won't support this type of, or exact research, should the federal government subsidize the research? If this is to help developing countries then are we morally obligated to do it? Should government support depend on industry support?
10. Should the targeted users/audience have a say in the process? Should it pass through international aid agencies or the governments of the developing countries?
11. Should U.S. agencies (USDA/FDA/EPA) or other agencies {for example the WHO (World Health Organization) or FAO (Food and Agriculture Organization)} regulate the product?
12. What might the effects of different cooking/culinary methods on the antibiotic imply for the consumer who is ill and needs the full benefit of the drug?

Resources:

Articles

W. H. R. Langridge. Edible Vaccines. Scientific American, 2000.

Web sites

<http://biotechknowledge.com>

- Monsanto (industry) educational site

www.eurekaalert.org

- Various articles on many scientific and technical topics, searchable content

<http://scoped.educ.washington.edu/gmfood/>

- Controversy Forum sponsored in part by the AAAS (Science magazine)
- Has facts, email list, discussion group, and an extensive resource/reference list

www.columban.com/gencon.htm

- A nice essay written from a religious perspective

<http://216.129.146.198/Lauren's%20Lit%20Review>

- A literature review written by a student on internship (Dietetic Intern)

www.anth.org/ifgene/proscons.htm

- A table of pros and cons of various aspects of genetic engineering

www.psra.st.org/ecolrisk.htm

- risks of genetically engineered crops to the ecosystem

www.newswise.com

- Searchable content of various news articles on science topics
- See “Are Genetically Engineered Foods Natural?”

www.cast-science.org/

- Center for Agricultural Science and Technology
- CAST is an excellent source for issue papers and reports eg. “Applications of Biotechnology to Crops: Benefits and Risks”

www.ers.usda.gov/publications/aib766/