

If Mother Teresa was a Genetic Engineer

by John Marshall

This is the public face of genetically modified foods today. Charles Montgomery Burns. And for those of you who don't know who he is, all you need to know is that he's from a show called The Simpsons, he owns a nuclear power plant, and he spends his days thinking about how he can squeeze even more money out of the general public.



Most people envisage Frankenstein when they think about genetically modified (or GM) foods. And it's true that we have to be exceedingly careful not to create monsters, like Frankenstein did, when we merge together disparate organisms and bring them to life. But the truth is that the early creations of genetic engineering have been far more about making money than making monsters. Today's GM foods have been less dramatic than Mary Shelley's Frankenstein novel, but they have led to fairly dramatic profits. And it's for this reason that I'd like to nominate Mr Burns as spokesperson for today's GM food industry.

But I'd also like to contend that it doesn't *have* to be this way. That genetic engineering has always been promised as a technology that would feed the poor, and there's no reason why it can't be used for this. Today, people hear these claims and think to themselves, "Heard that one before!" And quite frankly, justifiably so, with Mr Burns in control. But what if we had a genetic engineer who actually cared about people, not money. Who lived by the slogan, "Make love not money," and that's "love" in the affectionate, caring, missionary position sense of the word. What if Mother Teresa was the genetic engineer?

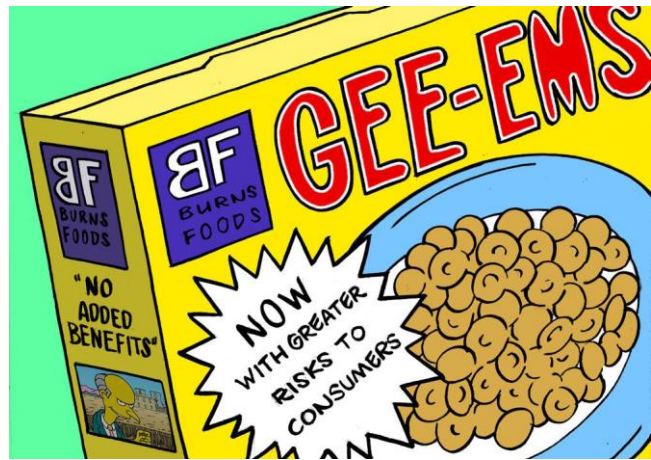


A colleague of mine, Luke Alpey, developed a mosquito strain to control dengue fever, and his company, Oxitec, have now tested it in the Cayman Islands, Malaysia and Brazil. Before the trials, Luke approached Greenpeace to tell them about this technology and to see what they had to say about it. They thought about it for a while, and then they responded, "Actually, we're against *everything* genetically modified."

This demonstrates how genetic engineering has become a hugely polarized issue in our society. There are people who are entirely for it, and then there are people who claim that, no matter what the product is, they're against it. My contention is that, with the right people in the

lab coats, there are some really great things we can do with genetic engineering; but its reputation has been harmed by what's known as the "first generation of GM crops," or alternatively, the kind of crops that Mr Burns would have made. Burns foods.

These crops make money for the corporations that sell them, and for the farmers that grow them; but the consumers get very little benefit while bearing the human health risks. It'd be unfair to say that the present GM foods don't have any benefits – they do increase productivity, which reduces prices, and in some cases they reduce reliance on toxic pesticides, and some of these benefits are invisible to the public, which doesn't help for public approval. But in countries which already have a food surplus – for example the US and most of Europe – non-GM foods were already perfectly adequate and proven healthy. So when GM foods came along, there was really no reason to choose them.

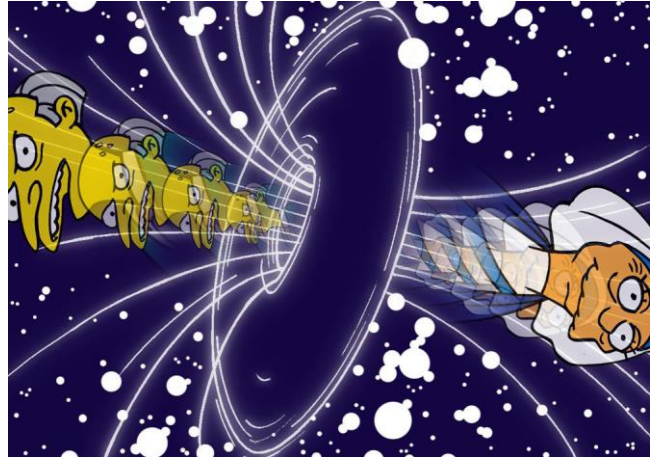


What they saw was GM crops sold by agricultural giants, such as Monsanto. That Monsanto sued a farmer by the name of Percy Schmeiser whose fields were contaminated by GM seeds from a neighboring field. That Monsanto made money out of genetic engineering, and large amounts of it. That Monsanto developed GM crops that were resistant to their very own, patented herbicide, requiring you to buy both the herbicide and the GM crops. That Monsanto developed plants that were unable to produce fertile seeds, thus requiring farmers to buy seeds from them every single season. So in summary, what they saw was Mr Burns – a corporate entity who they didn't really trust.



My contention is that these are not problems with genetic engineering itself, but rather the genetic engineer, and its quite unfavorable public image. And that, if we had a different genetic engineer – a more generous public face for the technology – the public attitude may also change.

At this point, I'd like to invite you into an alternate reality where Mother Teresa, not Mr Burns, is the public face of genetic engineering. In this reality, instead of starting a new religious order with hundreds of missions around the world, she starts a multinational genetic engineering enterprise. And for her efforts at relieving the terrible burdens of poverty and disease, she wins the Nobel Prize... in Physiology and Medicine. In this reality, Mother Teresa is really Dr Mother Teresa. Genetic engineer, and chairperson of... Monsanto.



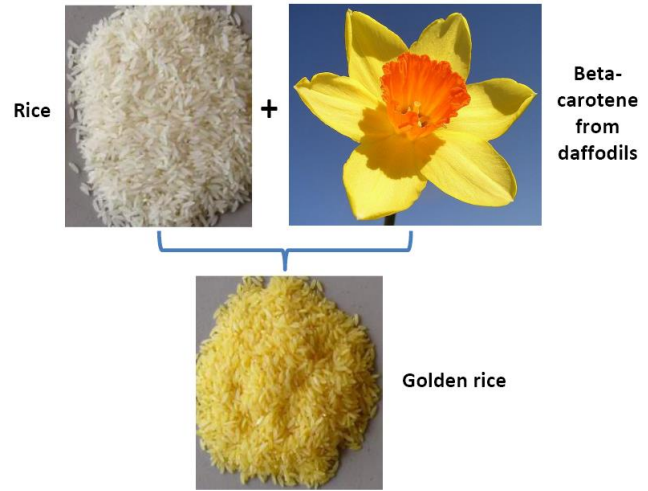
Monsanto is the genetic engineering enterprise of the parallel universe, and with Mother Teresa at its helm, it produces technologies that benefit the poor. Its first goal is to address the nutritional deficiencies of developing countries. Goal number two is to increase global food yields, thereby decreasing world hunger. Goal number three is to go easy on the environment – to fight global warming and minimize greenhouse gas emissions. And goal number four is to prevent the spread of some of the world's most deadly diseases. For the rest of my talk, I'm going to outline each of these goals in a bit more detail; but to start with a little spoiler, the great thing is that many of these goals are already well underway.

Let's start with goal number one – nutrition. And specifically, golden rice. This is a variety of rice designed to fight one of the biggest scourges of the world today – vitamin A deficiency. Here in the West, we tend to take vitamin A for granted – if you don't have enough, you can always take a supplement. But in developing countries, it's actually a huge problem, with a worldwide



death toll of several thousand every day. That's actually equivalent to a Fukushima tsunami on a daily basis. Vitamin A deficiency is also a leading cause of blindness among young children, many of whom die shortly afterwards.

Swiss Professor Ingo Potrykus and colleagues figured rice would be an excellent way to deliver vitamin A to the most needy. This is because, while rice is a staple food for half the world's population, it's a poor source of many nutrients, vitamin A included. They found a way to genetically engineer rice with beta-carotene – a molecule which is converted into vitamin A after people eat it. It's also the nutrient that gives daffodils their yellow color, and has a similar affect on rice, hence why "golden rice" is golden. This is a great example of a technology designed specifically to address a pressing social need, and in true Monsanto spirit, it has been made freely available to any country willing to take it. I give it, if I may, Mother Teresa's posthumous seal of approval. And that's the benefit of having a CEO who has moved on to the afterlife.



Now moving onto goal number two – food supply. The ability to provide sufficient quantities of food for the world's population is becoming increasingly relevant as the human race has taken the Biblical command to "be fruitful and multiply" perhaps a little too seriously. Currently, the world's population is increasing by about 6 million people every month, which is an increase more than the total population of my home country, New Zealand. Every month. People say there's enough food to go around right now, and that the current problem is more one of distribution. And they may be right. But to feed an additional New Zealand every single month, we're probably going to need to increase food efficiency in every way possible at the same time as facing increased droughts due to global warming.

One way to improve food productivity is to minimize losses due to poor storage, handling and distribution. But genetic engineering has an important contribution to make when it comes to preventing crop losses due to viruses, bacteria and insects that destroy crops and put a major dent into the global food supply.

Take the banana, for example. This is a key source of sustenance for Africa, and in particular, Uganda, where it provides about a third of the daily calorie intake. People in Uganda eat bananas for *every* meal. But a few years ago, a devastating bacterial disease hit the crop, affecting most farms, and in some cases, wiping out entire fields. Ugandan scientists reacted by engineering a disease-resistant GM banana able to fight off



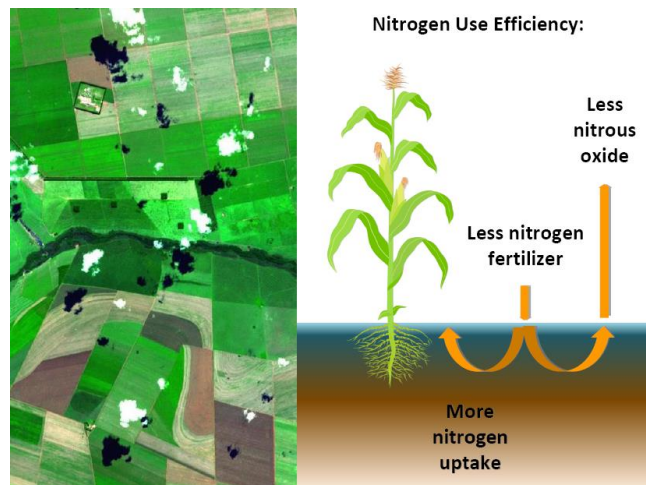
the disease with hopes of protecting the crop throughout the continent. Disease-resistant GM papaya and sweet potatoes, and insect-resistant GM wheat and sugar beet are also being used or developed, with the ultimate goal of protecting the global food supply and feeding the hungry.

And with the increased threat of global warming, particularly in temperate zones, drought-resistant crops are also under development. One way scientists are confronting this problem is by genetically restricting leaf pores from opening too much, thus allowing them to retain what little water may be available at times. In Australia, a drought-resistant GM wheat has recently been developed, which is quite important because up to half of the world's wheat fields are in areas of drought risk.

But at the end of the day, these are short-term fixes. A much better, long-term approach is to address the causes, rather than effects of climate change. Which brings me to goal number three on the Monsanto agenda – treading lightly on planet Earth.

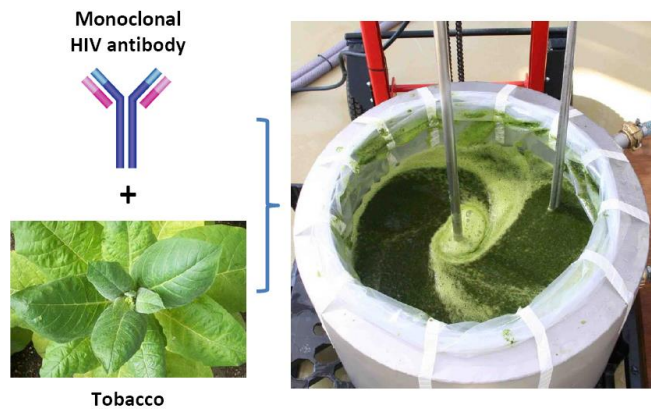
The potential of GM crops to curb global warming must not be overlooked, as agriculture accounts for over 87% of global consumptive land use. This means that, by making agriculture more efficient, we can have a huge impact on the environment. One of the biggest contributors to global warming is nitrogen fertilizer, the use of which produces the environmentally-devastating nitrous oxide – a greenhouse gas 300 times as potent as carbon dioxide. Less fertilizer means less nitrous oxide, which in turn means less global warming.

Arcadia Biosciences, a California biotech company, have been using genetic engineering to reduce greenhouse gas emissions. They isolated a trait called “nitrogen use efficiency,” which enhances nitrogen uptake from the soil, therefore decreasing the amount of fertilizer required for agriculture. For GM canola, it has been shown to reduce fertilizer requirements by two-thirds. And to put this into perspective, a reduction in fertilizer use of one-third would have a bigger effect on greenhouse gas emissions than grounding every single aircraft on the planet. Monsanto have purchased a license to this technology because, by reducing fertilizer usage, it also increases profits, leading to a rare shared interest between the Mr Burns and the Mother Teresa of agriculture.



Clearly, genetic engineering is an extremely versatile tool, which is why it's so important that we don't outlaw it across the board. The challenge is to assess each application on a case-by-case basis, and to choose those that truly benefit society. Which brings me to the fourth goal on the Monsanto agenda – disease control. We've already talked about the promise of golden rice to address vitamin A deficiency. But for HIV, scientists have taken a slightly more imaginative approach – GM tobacco and the GM living condom, both of which perhaps require a little explanation.

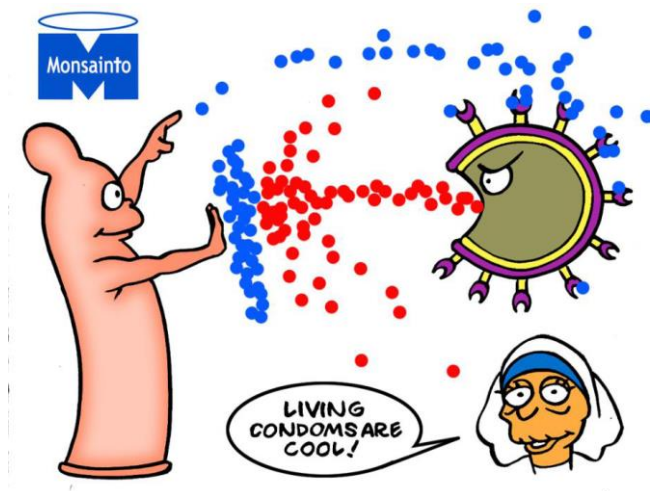
The approach genetic engineers have taken for HIV control is to produce antibodies that neutralize the virus before it's able to infect someone. The gene that produces these antibodies has been isolated and inserted into the tobacco genome, and is expressed in tobacco leaves. Tobacco plants are then grown in greenhouses and their leaves, which contain the antibodies, are shredded and pulverized into a green sludge, not to be confused with broccoli and spinach soup.



But this sludge is not to be eaten. Tobacco was actually chosen because people don't make soup out of it. Tobacco soup, may not be the most impressive entree for a dinner party. There's been talk for some time about engineering vaccines into food; but the problem is some people would end up eating vaccines without wanting to. So instead, the antibodies are extracted, purified and used to create an HIV-fighting gel which can be administered by women before sex. It's a great strategy for fighting HIV because it gives women control over their health outcomes.

An alternative approach is the GM living condom. Here, instead of engineering tobacco leaves, vaginal bacteria are modified to produce proteins that prevent HIV infection. The GM vaginal bacteria are then applied in the form of a gel, which provides a condom-like barrier against HIV lasting for weeks rather than hours, meaning that it can be applied days before sex.

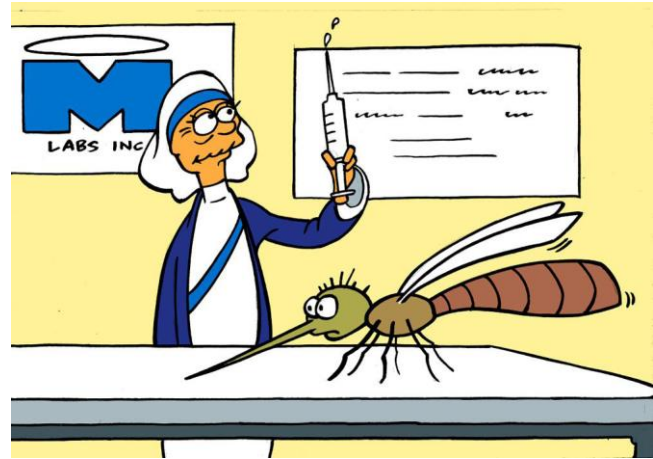
A lab in Itlay, not far from the Vatican, recently engineered a living condom with the strongest HIV inhibitors known to man. They asked me what Mother Teresa would have done if she heard about their research. And the truth is that she also opposed condoms, while opening AIDS hospices. But she never said anything about *living* condoms. So in her absence, I gave them an enthusiastic green light.



And finally, to fight malaria, there's the GM mosquito, which is the project I contribute to. Mosquitoes have a surprisingly important role in global health, because they kill even more people than people do. We've been doing gene therapy on mosquitoes for years, engineering them with genes that prevent them from catching malaria, which means they can't give it to people. We've also been working on ways to spread these genes into populations, so that all mosquitoes may one day be malaria-free. We believe that Monsanto would support this project, as malaria is primarily a disease of the poor, and also one that Mother Teresa has personally

suffered from.

So there you have it – the 2012 Monsanto development line. Feeding the planet, curbing greenhouse gas emissions, and fighting the world’s most deadly diseases. And although I’ve been using Mother Teresa as Monsanto’s front woman, the truth is that we *can* do it without her as well. All we need is a body double. Do we have an elderly Albanian nun in the audience?



But seriously, all of the examples I’ve given here are inventions of people in this universe, not a parallel universe, realizing the remarkable potential of genetic engineering and using it for the public good. My request is that we support these technologies and encourage the genetic engineering industry to steer itself in this direction too. And it doesn’t have to mean sacrificing profits. In fact, there’s a whole host of examples where corporate generosity has led to improved customer loyalty. Genetic engineering has so much to offer, if only we can improve its public image. And with Mother Teresa, at least figuratively, in the driving seat, I can’t imagine a better person to play God.

