

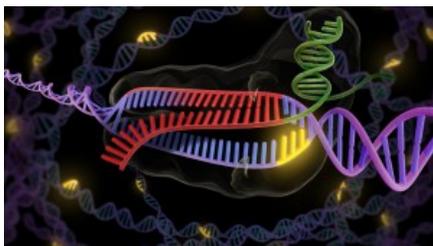


Can we regulate gene editing without killing it?

Tabitha M. Powledge | July 29, 2014 | Genetic Literacy Project

71 6

If there was really any hope that the new gene-editing techniques would be accepted as benign by anti-GMO activists, it has vanished.



Credit: Jennifer Doudna, UC Berkeley

Last week I wrote about how Chinese researchers used a gene editing method, the one called CRISPR, to silence three genes that make bread wheat susceptible to the fungal disease powdery mildew. And how another researcher argued that, since this research did not involve transgenics—the transfer of foreign genes into an organism—perhaps both regulators and opponents of GMOs would find it acceptable.

That optimism is evidence that at least some scientists really haven't grasped a central (if somewhat vague) worry about genetic engineering: that the very idea of altering organisms' genes is unnatural and therefore unacceptable. There are other objections too, of course, the political and economic ones, but let's ignore them for now.

The point is that, for those who are concerned about GMOs, the methodology for genetic modification of an organism is irrelevant. The problem, for them, is the modification itself, not how it is done.

Seven billion people depend on genetic modification

Logically, of course, that's ridiculous. It ignores at least 15,000 years of human history. As I wrote here at GLP last fall, we invented dogs via selective breeding of wolves at least that long ago (and some think this first human genetic experimentation took place much earlier, 30,000 years or more ago.) To say nothing of agriculture, which began a little later but has created, for good and ill, this warming planet and its 7+ billion people.

The GMO opponents don't seem notice that conventional breeding techniques are also "unnatural." That is genetic modification too, just like gene transfer and gene editing based in molecular biology. Or maybe they are just accepting the reality of a done deal. It's no exaggeration to point out that targeted genetic modification of plants and animals underlies everything we are and do, and has done so for several thousand years. Barring an apocalypse, there's no going back, not ever.

Gene editing, gene transfer, and gene drives

It's quite clear that gene-editing techniques are applicable to procedures far more complex than just disabling disease-related genes, as the researchers did with bread wheat. They can certainly involve not just gene editing but gene transfer, creation of the anathema transgenic organisms.

Harvard scientists recently proposed using CRISPR plus gene transfer to modify mosquitoes so that they would be unable to infect people with the malaria parasite. Preventing malaria is a worthy goal if ever there was one, but this approach—genetic modification of an entire vector species—is breathtaking.

Carl Zimmer wrote about the mosquito gene-drive proposal in his weekly New York Times column, which included his trademark brilliantly clear explanations of how the technique would work. He pointed out that

Browse by

Authors Sources

or try our Advanced Search

More from this Author

Tabitha M. Powledge

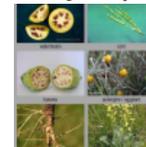
- DNA testing under fire in wake of fake herbal supplements investigation
That 'Precision Medicine' initiative? A Reality Check
Where are the missing females? Do skewed sex ratios in China, elsewhere lead to social problems?
Buzz on how the housefly genome will help cure human disease
Melting pot? Not in the USA. Yet. But coming soon?
Scientists urge revamped regulations for genetic engineering
Alcohol in moderation good for you? Accepted wisdom may not be wise and other myth-busting alcohol truisms
Alcohol and human genes, together for 10 million years
Left-handedness: Genes and a matter of chance
Gay genes discovery coming soon?
Why does your cat love you...sort of? DNA unravels feline mysteries
Why do we gain weight or remain slim? Genes, microbes and now genes for microbes
Does the human "warrior gene" make violent criminals--And what should society do?
Risk and science: Should some virus research be forbidden?
Egg freezing: Smart career move?

More from this Source

Genetic Literacy Project

- DNA testing under fire in wake of fake herbal supplements investigation
The Original Frankenfoods
Would you--should you--clone your pet?
Rethinking "pro-GMO" and "anti-GMO" labels
Wine as magic elixir? The debate thickens
Will Tanzania follow Burkina Faso in embracing GM crops to fight ravaging diseases?
Past week's top 6 stories on #GeneticLiteracyProject
Genes tell new story: Alcohol in moderation only benefits 15% of population
Anti-GMO sociologists mute attacks on biotech, urge greater sensitivity to cultural impacts
Drugs from where?! Female genitals may be source of uniquely effective antibiotic

Today's Popular Articles



How your food would look if not genetically modified over millennia



10 studies proving GMOs are harmful? Not if science matters



Pasta? Ruby grapefruits? Why organic devotees love foods mutated by radiation and chemicals



Keith Kloor on Bill Maher, vaccines and GMOs: "Nobody makes liberals look like asses more than Maher"



What turned the organic movement against GMOs?



New Yorker editor David Remnick responds to Vandana Shiva criticism of Michael Specter's profile



How your food would look if not genetically modified over millennia?



Rethinking "pro-GMO" and "anti-GMO" labels



Washington Post: Denying scientific consensus on GMOs victimizes developing countries

mosquitoes are not the only possible target for this approach. “The new technology could potentially be used against a wide range of other species that are deemed a threat, like invasive predators, herbicide-resistant weeds and bat-killing fungi.”

To their credit, the researchers who proposed this ambitious plan are aware of its implications and potential dangers—not to mention the uproar projects like this will generate. So they have called for public discussion and possible new regulatory approaches. The scientists described the gene-drive project in a [paper in the journal eLife](#) and also in an [open-access blog post at Scientific American](#). Their [regulatory proposals appeared in an open-access paper in Science](#).

Zimmer quoted a couple of other scientists who had reservations about the Harvard scientists’ proposals. One was Jennifer Doudna, who pioneered CRISPR in her lab at Berkeley. “Realistically, it’s not going to go as easily as they make it sound,” she said. But she also thinks the long-term prospects are good, at least in some species. Alison A. Snow, an ecologist at Ohio State University, was more alarmed, concerned that some proposals for gene drives could cause ecological havoc.

Gene editing and human disease

Meanwhile, potential applications of CRISPR are proliferating. HIV infects people by nestling into their DNA, making the virus enormously difficult to get rid of. Last week, scientists at Temple University reported using [CRISPR to cut out key portions of the virus in infected cells](#) and then repair the DNA. [John Timmer described the process simply](#) in a blog post at Ars Technica.

This approach is experimental, not yet ready for HIV therapy. Alan Cann, author of the textbook *Principles of Molecular Virology*, [described the paper approvingly but observed](#), “In spite of the breezy optimism of this paper (and this is progress), the work described has only been carried out on cultured cells in vitro. It is not clear whether or how easily it will be to replicate this finding in animals, and we’re still along way away from clinical trials which will be needed to show if this approach works in HIV-infected people.”

One problem, Timmer notes, is getting the CRISPR package into infected cells efficiently. “It’s rather easy to do in a culture dish, but it’s another thing entirely to do it efficiently in the human body,” he says. He also points out that a different gene editing technique for dealing with HIV is already in clinical trials. In this case the target is not HIV itself, but disabling a human gene encoding a protein that HIV uses to get into cells.

Public discussion and regulation, and resurrecting RAC

When I wrote about CRISPR and other gene-editing techniques for the first time here at GLP in February, I noted that [CRISPR makes possible targeted modifications of almost any gene](#). Specific genes can be turned off, turned on, and/or edited. The potential applications of the CRISPR system can hardly be overstated. And, to make it irresistible, CRISPR is simpler and cheaper than any other current approach to genome modification.

I described gene editing’s potential applications for gene therapy, for the study of gene functions, for making epigenetic modifications that can turn genes off and on in precise ways, and for “smart bombs” that can target disease-causing bacteria without harming benign bugs.

Gene editing can also make genetically modified animals—including attempts at improving our own species. It’s an impressive—and sobering—list even without the sweeping proposals from the Harvard researchers, which would modify entire species and ecosystems.

It’s not a moment too soon to adopt the Harvard researchers’ suggestion to get cracking on “public discussion of environmental and security concerns, research into areas of uncertainty, and development and testing of safety features” of gene-editing techniques and gene-drive systems. As they point out, this lead time “allows adaptation of regulations and conventions in light of emerging information on benefits, risks, and policy gaps.”

The venerable Recombinant DNA Advisory Committee (RAC), put together decades ago to oversee basic research on and clinical applications of genetic modification, has been more or less moribund for some time, and was essentially declared out of business when the National Institutes of Health

- Pasta? Ruby grapefruits? Why organic devotees love foods mutated by radiation and chemicals
- Circadian desynchrony: Can obesity be treated with electricity?
- Is there a future for eco-friendly genetically engineered fish and animals? Maybe not.
- Anti-Vaxx? Anti-GMO? Or just simply Anti-science?
- Why do foodies love organics? Because they taste like McDonald’s!

decided in May that RAC no longer needed to approve clinical trials of gene therapy.

That decision was the result of a recommendation from the Institute of Medicine. At the same time, the IOM also recommended “that NIH consider replacing the RAC with a similar body that [would also review other types of risky clinical research](#),” according to Jocelyn Kaiser at ScienceInsider.

Whatever happened to that very sane proposal? Your move, NIH. White House? Somebody? There will never be a better time. Or a better reason.

Even the scientists doing the research think so.

Tabitha M. Powledge is a long-time science journalist and a contributing columnist for the Genetic Literacy Project. She also writes [On Science Blogs](#) for the PLOS Blogs Network. Follow her [@tamfecit](#).

Posted in: [Animal Biotechnology](#) | [Biotechnology](#) | [Crops & Food](#) | [Epigenetics](#) | [Featured: Human](#) | [Newsletter Human](#) | [Regulation & Bioethics](#) | [Synthetic Biology](#)

1 Comment [Genetic Literacy Project](#)  Login ▾

Sort by Best ▾ [Share](#)  [Favorite](#) 



 **Bill Thompson** · 6 months ago
Deploying gene drive mechanisms in natural populations really DOES need discussion and regulation. But CRISPR is only one of several methods that could be used to do that. We made the mistake of regulating a method, rather than an application, once before, and it cost us years of lost progress.
1 ^ | ▾ · [Reply](#) · [Share](#) ▾

 [Subscribe](#)  [Add Disqus to your site](#)  [Privacy](#)



Please consider making a tax deductible donation to the GLP to support our independent reporting on biotechnology

- | | | | | | |
|--------------------------------------|--|--|---|--------------------------------|---------------------------------|
| About | Human | Agriculture | Special Sections | Resources | Browse By |
| Mission | Ancestry & Evolution | Animal Biotechnology | Biotech Gallery | External Links | Authors |
| Our Team | Bio Drugs | Biotechnology | Gene-ius | GLP Newsletter | Tags |
| Advisory Board | Biotechnology | Crops & Foods | GeneTrends: | Archive | Sources |
| Contributing Writers | Epigenetics | Green Genes & Sustainability | Food & Agriculture | | Advanced Search |
| Donate | Personalized Medicine | Regulation & Bioethics | GMO: Beyond the Science | | |
| Contact | Regulation & Bioethics | | | | |
| | Stem Cells | | | | |
| | Synthetic Biology | | | | |
| | Transhumanism | | | | |

 [GLP on Facebook](#)  [GLP on Twitter](#)  [GLP RSS Feeds](#)
©2015 The Genetic Literacy Project.