

# Scientists Warn GE Insects Could Be Easily Weaponized

Analysis by [Dr. Joseph Mercola](#)

✓ Fact Checked

May 25, 2023

## STORY AT-A-GLANCE

- › Scientists and legal scholars question the rationale for the use of insects to disperse infectious GE viruses engineered to edit the chromosomes in plants, warning that the technology could very easily be weaponized
- › This DARPA program is the first to propose and fund the development of viral horizontal environmental genetic alteration agents with the capacity to perform genetic engineering in the environment
- › The \$27 million project, called “Insect Allies,” is trying to take advantage of insects’ natural ability to spread crop diseases, but instead of carrying disease, they would spread plant-protective traits
- › The opinion paper “Agricultural Research, or a New Bioweapon System?” argues that if plant modification were really the ultimate goal, a far simpler and more targeted agricultural delivery system could be used
- › There are also serious concerns about environmental ramifications, as the insects’ spread cannot be controlled. It would also be impossible to prevent the insects from genetically modifying organic crops

***Editor's Note: This article is a reprint. It was originally published October 23, 2018.***

Genetic engineering (GE) is being used in myriad ways these days, despite the fact we know very little about the long-term ramifications of such meddling in the natural order.

For example, the Defense Advanced Research Projects Agency (DARPA), an arm of the U.S. Department of Defense, is now planning to use insects to deliver GE viruses to crops, with the aim of altering the plant's genetic traits in the field.

The \$27 million DARPA project, called "Insect Allies," is basically trying to take advantage of insects' natural ability to spread crop diseases, but instead of carrying disease-causing genes, they would carry plant-protective traits. As explained by The Washington Post:<sup>1</sup>

*"Recent advances in gene editing, including the relatively cheap and simple system known as CRISPR (for clustered regularly interspaced palindromic repeats), could potentially allow researchers to customize viruses to achieve a specific goal in the infected plant.*

*The engineered virus could switch on or off certain genes that, for example, control a plant's growth rate, which could be useful during an unexpected, severe drought."*

## **Insect Allies Project Raises Concerns About Bioterror Use**

However, scientists and legal scholars question the rationale for the use of insects to disperse infectious GE viruses engineered to edit the chromosomes in plants, warning that the technology could very easily be weaponized.<sup>2,3,4,5</sup>

The opinion paper<sup>6</sup> "Agricultural Research, or a New Bioweapon System?" published October 4, 2018, in the journal *Science* questions DARPA's Insect Allies project, saying it could be perceived as a threat by the international community, and that if plant modification were really the ultimate goal, a far simpler agricultural delivery system could be used.

Jason Delborne, associate professor at North Carolina State University, has expertise in genetic engineering and its consequences. He told Gizmodo:<sup>7</sup>

*“The social, ethical, political and ecological implications of producing HEGAAs [horizontal environmental genetic alteration agents] are significant and worthy of the same level of attention as exploring the science underpinning the potential technology.*

*The authors argue persuasively that specifying insects as the preferred delivery mechanism for HEGAAs is poorly justified by visions of agricultural applications.*

*The infrastructure and expertise required for spraying agricultural fields – at least in the U.S. context – is well established, and this delivery mechanism would offer greater control over the potential spread of a HEGAA.”*

The team has also created a website<sup>8</sup> to accompany the paper, the stated aim of which is “to contribute toward fostering an informed and public debate about this type of technology.” On this site you can also find a link to download the 38-page DARPA work plan. DARPA, meanwhile, insists the project’s goal is strictly to protect the U.S. food supply. A DARPA spokesperson told The Independent:<sup>9</sup>

*“[S]prayed treatments are impractical for introducing protective traits on a large scale and potentially infeasible if the spraying technology cannot access the necessary plant tissues with specificity, which is a known problem.*

*If Insect Allies succeeds, it will offer a highly specific, efficient, safe and readily deployed means of introducing transient protective traits into only the plants intended, with minimal infrastructure required.”*

Scientists from the U.S. Department of Agriculture are also participating in the research, which is currently restricted to contained laboratories. Still, many are unconvinced by DARPA’s claims of peaceful aims.

The release of such insects could “play into longstanding fears among countries that enemies might try to harm their crops,” says Dr. David Relman, a former White House

biodefense adviser and professor of medicine and microbiology at Stanford. According to The Associated Press (AP):<sup>10</sup>

*“Guy Reeves, a coauthor of the Science paper and a biologist at the Max Planck Institute for Evolutionary Biology in Germany, says the technology is more feasible as a weapon – to kill plants – than as an agricultural tool. As a result, he said DARPA could be sending an alarming message regardless of its intentions.”*

## **Unforeseen Ramifications Abound**

Others are concerned about environmental ramifications, regardless of whether the genetic traits being delivered to the plants are perceived as beneficial or harmful. According to DARPA, none of the insects would be able to survive for more than two weeks, but what if such guarantees fail? What if nature finds a way? If so, the insects' spread could be near-unlimited.

Gregory Kaebnick, an ethicist at the Hastings Center bioethics research institute in Garrison, New York, told the AP he's concerned the project may end up causing unforeseen environmental destruction, as insects will be virtually impossible to eradicate once released. If it turns out the genetic modification traits they carry are harmful, there will be no going back.

Yet others, such as Fred Gould, an entomologist at North Carolina State University who chaired a National Academy of Sciences panel on genetically modified food, believe the project's stated goal of altering genetic traits of plants via insects is near-impossible in the first place.

However, while the research is still in its initial phase, they already have proof of concept. In one test, an aphid infected a mature corn plant with a GE virus carrying a gene for fluorescence, creating a fluorescent corn plant.<sup>11</sup>

## **Open Scientific Debate Is Needed**

Reeves questions why there's been virtually no open scientific debate about the technology. According to Reeves, who is an expert on GE insects, the Insect Allies project is "largely unknown even in expert circles," which in and of itself raises a red flag about its true intent.

He told *The Independent*, "It is very much easier to kill or sterilize a plant using gene editing than it is to make it herbicide- or insect-resistant."<sup>12</sup> Felix Beck, a lawyer at the University of Freiburg, added:<sup>13</sup>

*"The quite obvious question of whether the viruses selected for development should or should not be capable of plant-to-plant transmission – and plant-to-insect-to-plant transmission – was not addressed in the DARPA work plan at all."*

## **How Horizontal Environmental Genetic Alteration Agents Work**

As explained in the featured paper, the technology DARPA is using is known as horizontal environmental genetic alteration agents or HEGAAs. Essentially, HEGAAs are GE viruses capable of editing the chromosomes of a target species, be it a plant or an animal. The specificity of HEGAAs are dependent on:

- The range of species the GE virus can infect
- The presence of a specific DNA sequence in the chromosome that can then become infected

The image below illustrates how an insect-dispersed viral HEGAA would disrupt a specific plant gene. As noted on the team's website:

*"Interest in genetically modified viruses, including HEGAAs, largely stems from their rapid speed of action, as infections can sweep quickly through target populations. This same property is also a serious safety concern, in that it makes it hard to predict where viruses geographically disperse to or what species they eventually infect."*

*Probably due to the complex regulatory, biological, economic and societal implications that need to be considered little progress has been made on how genetically modified viruses should be regulated when the intention is to disperse them in the environment. It is in this context that DARPA presented its Insect Allies work program in November 2016.”*

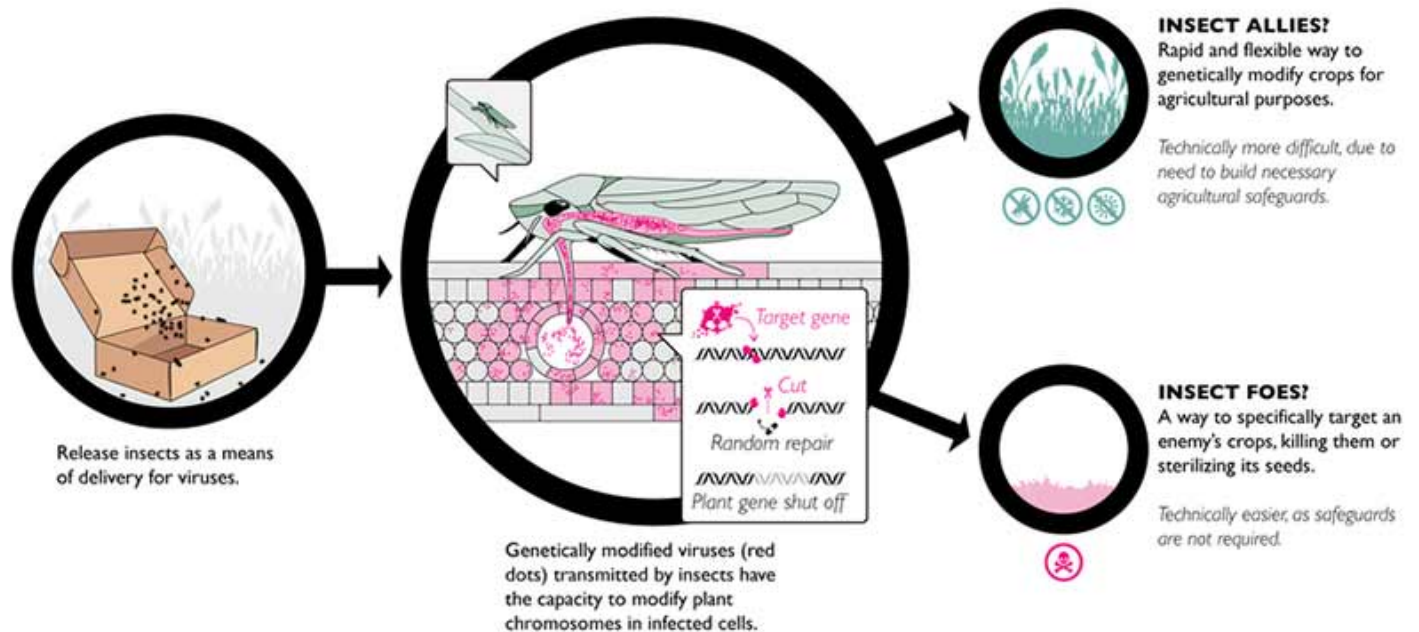


Image credit: Derek Caetano-Anollés

The team also notes the use of HEGAAs are ultimately not likely to be limited to agriculture, which is why it's so important to have an open discussion about the technology, its potential uses, misuses and ramifications – including unintended ones.

In 2018, three scientific publications discussed the development of "transmissible vaccines," i.e., vaccines that would be transmissible between humans and therefore would no longer require individual vaccinations. Such products would also remove any possibility of informed consent, which creates a really huge ethical dilemma. In the past decade, at least seven scientific papers have focused on transmissible vaccines.

The team also brings up the obvious point that insects will not be able to distinguish between conventional crops and certified organic crops, which do not permit genetic engineering. Just how are organic farmers to keep these insect vectors from altering

their crops? They can't, and this could effectively destroy the organic industry as we know it.

## **DARPA Technology May Violate Biological Weapons Convention**

According to DARPA, the technology does not violate the United Nations (U.N.) Biological Weapons Convention. However, according to the Science paper, it could be in breach of the U.N.'s convention if the research is unjustifiable. Silja Voeneky, a specialist in international law at Freiburg University, told The Independent:<sup>14</sup>

*“Because of the broad ban of the Biological Weapons Convention, any biological research of concern must be plausibly justified as serving peaceful purposes. The Insect Allies Program could be seen to violate the Biological Weapons Convention, if the motivations presented by DARPA are not plausible. This is particularly true considering this kind of technology could easily be used for biological warfare.”*

The Science team also call for greater transparency from DARPA in order to discourage other countries from following suit and developing similar delivery technologies as a defensive measure.

## **Gene Drive Technology Needs International Governance**

In related news, Simon Terry, executive director of the Sustainability Council of New Zealand, is calling for gene drive technology to be brought under international governance,<sup>15,16,17</sup> as this kind of technology can make an entire species infertile in a relatively short amount of time, depending on the species life cycle.

Gene drive is yet another application for CRISPR. In short, it's a genetic engineering technology that allows you to propagate a specific set of genes throughout an entire population, including its offspring, which allows you to genetically alter the future of an entire species. Gene drive has been proposed as a means to control pests, including mosquitoes and possum.

However, there's no known way to control it. As an example, while New Zealand would like to use gene drive to eradicate possums, it would be virtually impossible to prevent the spread of the gene drive to other areas, and in Australia, the possum is a protected species.

Gene drive has also been considered as an answer for barnyard grass, a pesky weed among Australian farmers, but a prized commodity in India. Likewise, Palmer Amaranth is considered a weed in the U.S. but an important food source in Central America, Africa, India and China. As noted by Terry, "One man's pest could be another's desired plant or animal," and creating national regulations for a technology that can wipe out an entire species globally simply isn't enough.

## **Should We Use Technology That Can Eradicate Entire Species?**

In a 2016 report,<sup>18</sup> the Institute of Science in Society (ISIS) discussed the creation of transgenic mosquitoes, carrying genes against a malarial pathogen. Using CRISPR/Cas9, a gene drive was created that makes virtually all progeny of the male transgenic mosquitoes' carriers of this antimalaria gene. However, the transgene was found to be unstable in female mosquitoes, and key safety issues were also raised, including:

- To what extent might crossbreeding or horizontal gene transfer allow a drive to move beyond target populations?
- For how long might horizontal gene transfer allow a drive to move beyond target populations?
- Is it possible for a gene drive to evolve to regain drive capabilities in a nontarget population?

According to ISIS, answering these questions is "crucial in the light of the instability of the gene drive in transgenic female mosquitoes." As noted in the report:

*"When these females bite animals including humans, there is indeed the possibility of horizontal gene transfer of parts, or the entire gene-drive*



*construct, with potentially serious effects on animal and human health.*

*Cas9 nuclease could insert randomly or otherwise into the host genome, causing insertion mutagenesis that could trigger cancer or activate dominant viruses ...*

*Finally, the ecological risks of gene drives are enormous ... As the gene drive can in principle lead to the extinction of a species, this could involve the species in its native habitat as well as where it is considered invasive. As distinct from conventional biological control, which can be applied locally, there is no way to control gene flow ...*

*[B]ecause the CRISPR/Cas gene drive remains fully functional in the mutated strain after it is created, the chance of off-target mutations also remain and the likelihood increases with every generation.*

*'If there is any risk of gene flow between the target species and other species, then there is also a risk that the modified sequence could be transferred and the adverse trait manifested in nontarget organisms.' (This commentary has not even begun to consider horizontal gene flow, which would multiply the risks manyfold.)"*

## **DARPA Brushes Off Concerns**

James Stack, a plant pathologist at Kansas State University and a member on the advisory panel of DARPA's Insect Allies project, believes the concerns raised in the Science paper are unfounded. He told The Washington Post:<sup>19</sup>

*"I don't understand the level of concern raised in this paper, and to jump ahead and accuse DARPA of using this as a screen to develop biological weapons is outrageous.*

*There's risk inherent in life and you just have to manage it well. And I think as we move into a more crowded planet it's going to put increasing demands on*

*our food systems, our water systems. We're going to need all the tools in the tool box that we possibly have."*

Unfortunately, recent history demonstrates we've not been very capable of managing these kinds of man-made risks very well at all. Just look at Roundup-resistant GMO food, for example, or electromagnetic field radiation from cellphones and wireless technologies, both of which have been shown to cause significant health and environmental problems since their inception.

There's virtually no evidence to suggest mankind is very good at predicting the potential outcomes of our technological advancements, so unleashing gene-altering technologies that cannot be recalled or reversed seems foolish in the extreme. As mentioned, the Insect Allies project may be particularly detrimental for organic and biodynamic farming, as it would be completely impossible to prevent these gene-altering insect vectors from infecting organic crops.

## Sources and References

---

- <sup>1, 2, 11, 19</sup> [Washington Post October 4, 2018](#)
- <sup>3, 7</sup> [Gizmodo October 4, 2018](#)
- <sup>4, 10</sup> [Associated Press October 4, 2018](#)
- <sup>5, 17</sup> [New Scientist October 5, 2018](#)
- <sup>6</sup> [Science October 5, 2018; 362\(6410\): 35-37](#)
- <sup>8</sup> [web.evolbio.mpg.de](http://web.evolbio.mpg.de)
- <sup>9, 12, 13, 14</sup> [Independent October 4, 2018](#)
- <sup>15</sup> [RNZ July 30, 2018](#)
- <sup>16</sup> [Radionz.co.nz July 30, 2018](#)
- <sup>18</sup> [Institute of Science in Society January 12, 2016](#)