Insights into new genetic engineering techniques from a New Zealand scientist and a non-GMO advocate

The following is an excerpt from “Why NZ ought to allow genetic engineering - and why avoiding it might be even better”

By John Mccrone, published in Stuff, Nov 25 2019

… At the University of Canterbury, professor of gene ecology Jack Heinemann has been tracking the twist and turns of the GM debate since he appeared as a technical expert at the 2000 Royal Commission.

Heinemann says the technology is indeed moving at breakneck speed.

Leaping up from his chair, he grabs a gene-altering sunscreen – Neova Damage Control – he has just brought back from a US trip.

The cream claims to repair DNA strands fractured by the sun's ultraviolet rays. "It's a chemical formulation with two different bacterial nucleases. Those nucleases are taken into your skin cells and act on your DNA."

Get it, he asks? This is doing GM on your own body. And under US laws, because it makes no specific medical claims, it can be sold unregulated.

Does it work? "Who the hell knows. But their patent says it does. And 50 bucks for two fluid ounces," he exclaims.

What worries him more is that if this sunscreen can deliver DNA-manipulating nucleases simply by being rubbed on your arms, what is stopping "biohacker" enthusiasts repurposing it to deliver anything else they might dream of?

This is the way it is going. Heinemann says GM is inspiring the same kind of "techno-fix" mentality as information technology. Biology is seen as machinery. So all you have to do is some clever re-programming – edit the genome like a document.

Silicon Valley now has its biohacker community. In a notorious stunt in 2017, an online seller of DIY gene kits injected himself live in front of a conference audience with a CRISPR formulation meant to promote muscle growth by knocking out his myostatin gene.

Nothing happened. But Heinemann says it illustrates the new mood behind calls for

deregulation. Innovation needs to be freed up, even if it gets a little crazy at times.

However Heinemann says what many people do not realise is – beyond the hype – just how little GM has actually delivered so far.

The truth is biology is complicated. Desirable traits are normally under the control of a maze of genetic factors. It is rare anything useful can be changed with single gene changes.

Heinemann drags out a journal article from 1972 forecasting how genetic-engineering was going to transform world crop growing.

"The roadmap said we would have crops that could fix their own nitrogen, crops that were resistant to drought, salt and heavy metals. We would have biofuels coming out of our ears because we would so massively increase plant yields."

Yet the same article has been basically rewritten every year since, he says. "Here we are almost 40 years later. And exactly zero of those products are available to us."

Heinemann says the irony is that traditional selective breeding has produced significant advances in these kinds of growing qualities. "Non-GMO techniques have increased drought tolerance by 20 to 30 per cent."

So society is being pressured to deregulate GM research on the fear of missing out. "But no reduction in regulations has ever resulted in these products. We've been told every decade we're going to fall behind. But it hasn't actually happened."

FIXES TO FIX THE FIX

An exception to the rule has been pesticide-related applications, Heinemann admits. There, single genes can be usefully targeted.

"That's the reason 90 to 99 per cent of all commercial GMOs are about pesticidal traits."

Either a plant is edited so it produces its own insecticides. Or as with Monsanto's Roundup Ready, the crop is engineered to be resistant to a herbicide like glyphosphate. You can then blast the weeds and leave the cotton or soy behind.

But Heinemann says this is really only important to the growers of bulk commodity crops. It is why the US and Canada have been more liberal with their own GM regulation..

Vast monoculture cropping is not even an end of the market New Zealand wants to be in. And we have been doing as well as anyone just using ordinary breeding methods to produce premium products like better-tasting apples or sheep.

So Heinemann says he doesn't see any burning need to roll back the highly precautionary approach built into the HSNO Act.

It could do with some updating because of the new techniques and possibilities. However repealing the legislation isn't going to suddenly turbo-charge New Zealand agricultural innovation.

Heinemann says if you want a cautionary story, look at one of the proposed uses for the latest development of site-directed nucleases (SDNs) – the "spray-on" GM trick being used by Neova sunscreen.

The US now has the problem it has used so much herbicide in growing its GM crops, the weeds have evolved their own glyphosate resistance.

So the next step in this war will be to spray the weeds with a gene-silencing nuclease that can soak through their leaves and switch that off.

"The product will knock out the resistance gene in the weed, but not in the GM crop plant. And that way, they can spray more glyphosate again."

Heinemann pauses to let it sink in. Techno-fix being piled on techno-fix.

Except now rather than doing the gene-editing to create a changed organism within the controlled conditions of a lab, this is using a topical GM spray to reset the DNA of plants already growing out in the wild.

It thus becomes an experiment with everything else it touches, Heinemann says.

"All the fungi, bacteria and insects living in that field. You don't know what the nucleases are doing to all those other species."

A POSITIVE ALTERNATIVE

Jon Carapiet, an Auckland market researcher and national spokesman for GE-Free NZ, says the calls for deregulation reflect a cavalier confidence about what science can control.

But also there is the problem that more attention is not given to GM's alternative, he feels.

The GM debate is regularly cast in the negative light of being about standing in the way of scientific advance. The anti's are framed as the out-of-touch luddites, Carapiet says.

However there is a positive story to be told – one he wishes the RS panel had devoted the same amount of attention to – about the science to be done in support of natural "regenerative" farming practices.

As Heinemann notes, says Carapiet, GM makes most sense for those focused on commodity monocultures – where biology is being imposed on a landscape with brute force.

But if New Zealand is staking its future on the market for premium foods and top-end customers, then – as a country – it ought to be putting its own research emphasis on agriculture at the exact opposite end of the spectrum.

"If we are talking about public interest science, we ought to be debating the alternative commercial arguments around being organic, sustainable, ethical, environmentally clean and green – which is really what the cornerstones for our market exports are."

Carapiet says it is no secret why researchers are agitating to do more GM work. "Let's be real. A lot of the drive behind wanting to deregulate is about the patents, intellectual property rights, profits and licensing fees."

By contrast, it is hard to monetise simple good husbandry techniques.

Yet for those concerned about climate change, things like rich and healthy soils are likely to lock up far more carbon than HME grass is ever going to save in methane emissions.

A regenerative or agro-ecological approach could be just as futuristic, just as exciting for the country, as dreaming about techno-fix GM, says Carapiet.

So it is another sound reason for continuing with a cautious regulatory approach to GM.

Radical change to GM policy might not be on the Government's agenda right at the moment.

But understanding what GM can and can't do could not be more important to deciding the long-term direction that "Brand NZ" might want to steer, Carapiet says.