Jack Heinemann QS Interview September 2024

https://www.quorumsense.org.nz/content/podcast/45-unintended-consequences-of-ge-and-gmos-with-prof-jack-heinemann?rq=Heinemann

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His Points:

- Terms used are used to encourage us to think about GE in a positive way, so it's manipulative. It's a sales pitch to influence HOW people react. Use of 'moratorium/ban' as a term. We don't have a ban – since 1996 we've had a process for approval of outdoor use. Need to meet a set of evaluations and safety determinations. There is a pathway to environmental release in NZ. There is not a ban or effective ban. No evidence that any crown research or university not produced viable gmo products because of cost or regulatory restrictions. He's waiting for quality evidence on any unique burden on producing GMOs in NZ because of our regulations.
- We can create all sorts of products in lab, but no guarantee that it can perform in the environment. If they don't work outside the lab no one wants to pay for them. Our agri ecosystem hasn't been held back by lack of any GMO product. In USA where there is the longest use of GMO's so far only a dozen plants have been commercialised. Only 3 crops are large enough in scale for USDA to report on: cotton, maize, soy monocultures – they have only two traits – herbicide tolerance and as an insecticide. Only 15% of USA land has GMO crops on it.
- Promises of all sorts of tolerances: heat, drought, nitrogen fixation, etc. from the 1970's but none produced. Either don't work out of lab or farmers don't want them.
- USDA published a recent report on development of drought tolerance plants through GE– 1000s of application but zero on the market. The purveyor of the only marketed GE plant for drought tolerant maize was convicted in South Africa of advertising fraud for GM maize distributed in Africa that didn't work.
- Meaningful gene engineering innovation is not happening anywhere….just the main herbicide/pesticide traits. If you say 'there's a ban', then you don't have to explain why there has been a failure to innovate/ deliver.
- Now touting a 'new' technique – gene editing/silencing which has actually been available since the 70's. You can apply these site-directed modifications to plants now. We had an awareness of this when the NZ regs were created in the 80's and 90's. Only difference is that this process is now more efficient. Properties of the techniques simply mean you can make changes in more species faster/more efficiently. Can happen so fast (*turnover of modifications*) that you can dramatically speed up the changes that happen in the genome. Increases the efficiency of the process, but efficiency doesn't mean safety.
- Now a repeated focus on 'precision,' site specific techniques, supposed more precise but these can concentrate the mutagenic potential where you want it to occur, but you can't stop it from being efficient where you DON'T want it to occur. We can't control this effect in biological systems. Changes will occur in other parts of the ecosystem. We can't be sure this won't the ripple out. The number of modified organisms that only have one change in their genome as a result of genetic engineering is vastly rare.

- The government proposes to change the regs to remove the safety step from these procedures. The new processes increase the likelihood of more unintended changes. Using these tools can result in wholesale exposure to GE constructs in the environment from the air. They're very

efficient tools for distributing the genetic carrier molecules on a massive scale. Many organisms in the environment affected at the same time.

If we could precisely control which organisms are exposed by these molecules, ok. But we can't. And these molecules do move up the trophic pathways to predators.

They say 'it's just like Nature's processes.' They focus on the similarities but not on the differences that result, like Nature doesn't encapsulate gene agents in chemical vectors. Made purposefully to be efficient in promiscuous delivery - in passing through skin, evading normal barriers of digestive system.

It is NOT the case that these outcomes are species specific. Intended outcome is species or site specific changes, but these are not. Can be adverse effects in other species. They include chemical reactants that prompt gene diffusion across cell membranes or throughout the environment.

These gene editing reactions act like a magnet, not like a lock with a specific key (*not precise)* model of transmission. However, this biochemistry works by having an affinity for a target gene site in the genome. Analogy of the sock with soil with various deposits of iron mixed in the sock which attracts the magnet as it moves along the sock. So it works like a magnet that binds in an analog manner, not a digital all or none reaction. First it binds with area of most iron and depletes that, completes, and then moves to next site of iron making modifications there. This programed attraction to a specific gene location doesn't discriminate between the sequences in the intended or target organism or any other organism. It is attracted to and can 'latch on to' that gene sequence in any organism in the environment. With the sophisticated encapsulation chemistry used now, these gene 'magnets' can be distributed in the air (*say sprayed on a crop to kill a pest*) but move off the field in the air, get into the water, land on children and affect them. *(Unintended targets and impacts*). None of these reactions are natural. None have natural turn-off mechanisms. The sneaky damage is obvious. All sorts of genetically modified changes can be distributed within these nano encapsulation technologies.

These go across all cells at once when exposed from bacteria, insects, animals, humans. And exposure is very simple to affect.

These experiments can look great in a lab but are very different when subjected to the diversity of chaos in the environment.

Efficiency gain from gene editing could produce potentially safe products, IF those people using them MUST use them in a contained lab facility with proper regulations so that nothing escapes before you have retrospectively and precisely described what you think it is and shown that it only what you thought it is. This is what our current regulations do. Nothing more. They are fit for purpose. We must ensure technology is fit for purpose. Then we could enjoy the benefits of these efficacy gains.

If you remove that requirement you don't know that someone went to the trouble of ensuring that the only changes in the GE product are ones they intended to create.

These are chemicals and tools involved are ones you can get on the internet.

'We don't regulate chemical and radiation breeding…' Not true, we can't get a chemical mutagen to use in your garage or a reactor to use in your corn field. These chemical and

radiation techniques are already regulated. Anyone doing chemical and radiation experimentation has is currently regulated by other agencies.

The tools involve chemical molecules that in of themselves are not really toxic, so we have had to regulate the GMO's itself. But now if we proceed with the proposed changes to our existing regulations, for the first time in human history you will have an advanced mutagenic technique of great efficiency and power, for which there are no regulations at all. This IS new.

GE Intended outcomes are specific but unintended outcomes (adverse effects) are not specific.

These gene tools are toxic because they facilitate the gene sequences getting into your cells. Normally DNA/RNA don't get into us very easily at all, except when we formulate them in a chemical package that causes them with high efficiency to get inside of us . That's when they can become 'toxic' because they can get access to make genetic changes in us. (*Explain that these genes aren't about the colour of your hair or eyes, but about the creation of proteins, enzymes and hormones – these are also controlled by our DNA – our genes).* We can't control all the genetic changes that these are capable of making and that's where the harm pathway comes from.

There have been tonnes of GE products that have demonstrated efficacy and commercial viability at the lab and glass house stage, but failed at the foetal trial and beyond stage.

We have had products that have gotten through their efficacy safety trials and were approved by Food Safety ANZ but are not on the market because the market didn't want them or they just didn't work.

What's different here is the massive amount of trying that could be done without ever having to demonstrate safety. With new gene editing techniques you can try and try repeatedly and hope to get lucky with the desired traits and yet fail a lot. And in all those failures, though you create the potential to harm something. *(If it was released into the environment*). So nobody would ever have to disclose that they were experimenting and you change massively the scale of trying if you deregulate the process. The existing regulations compel people to use them responsibly.

We don't use labs to keep us safe because the chemicals used are toxic. We use them because the previous techniques of GE are SO inefficient that up until recently that we needed lab to create the conditions that made these reactions work with at least the efficiency that made it possible to isolate these organisms – to get what we're looking for. These new tools are so efficient that we no longer need laboratories. Now the only purpose for a lab is to ensure regulations are met to keep us all safe and now just at that moment in time, the government wants to remove the requirement for laboratories.

The sales pitch has been since the 1970's that there would be a genetic utopia. Always the same unmet promises of stable crops with N-fixing, enhanced photosynthesis, drought tolerance traits. Every 10 years when there's an improvement in the tools available for GE, the old promises are wheeled out again. GE could hypothetically contribute something but the narrative is that these are genuine improvements for agriculture when they're not.

They assert that a 'good thing' that might come along, but won't come along now because of our regulations. I don't believe that. I think we are being asked to give up our legitimate entitlement to the safe use of this technology in exchange for exactly the same promises that have been made for 40 years and never delivered upon. I don't think that's a good deal. I think that if someone can make a really useful GMO they will achieve that with these regulations in place. And could have achieved it

with the regulations in place over the last 40 years but haven't. In countries that didn't have our regulations, gene engineers haven't delivered products either. If they could have been made, they should have been made already.

We need to ask – there will be all sorts of little novelty traits, different flesh colour on fruits, different shapes. Doesn't solve world problems, they only create novelty to entice consumers. These will not end hunger or control flooding. They will be little boutique market-based novelties of little values. There will be other uses such as the current patent for GE liquid to spray in the veggie aisle onto delay ripening of fruit and veggies = uncontrolled customer exposure for sellers' convenience.

Question of organic certification – can we be certain it doesn't move to adjacent properties? The argument about GE being equivalent to what Nature creates is being used against us. Government is arguing any particular GE change is indistinguishable from what is possible in Nature. You can't prove that the GE change has occurred because 'it's the same as natural.' (*We need a record of the genetic sequence of anything released in order to assign responsibility for harm done by release*.)

If you require that gmo's be created in a lab, that requires capital investment and maintenance, adherence to lab standards and that the existing requirement that organisms don't leave the lab without being assessed and sequenced accurately, then those expense are such that anybody who goes to the trouble of creating an organism will want to invest in securing intellectual property rights to the organism to recoup their investment. And in order to protect those rights they have to be able unambiguously identify their property. That is what protects organic certification. You will have the tools to ID these gmo's, because the genetic signatures/sequences are known so these products can be clearly identified if they cross over the fence for purposes of establishing liability for undermining the organic grower's competitive advantage (Section 47 of the NZ Commerce Act).

But if you allow them to be used in the environment without any info on what these products are targeting, you will have potential to be contaminating by these gmo's that you don't know anything about. Organic farmers will be frightened into thinking their approach is pointless and are encouraged to adopt these techniques, negating their certification. Maintain that choice of what they want to eat.

The IP that goes with gene editing, gives, are utility patents giving ownership of gene plasm to the patenter, wherever it is found in the environment. You have my DNA sequence stability in your plant, so it is my property. Up until recently, patents were reserved to physical objects but not living things and agriculture. But now if the manufacturer finds the signature in the plant, they own the plant.

This is a tool for us, because if you have to do GMOs in the lab – expense compels people to take the steps to describe their intellectual property and register their right. You only release products that have passed safety testing in the beginning. Only people who are going to register for IP, will undergo the expense of traceability. In Europe, Every GMO required to be gene sequence registered. So that if they move off target, they can be tracked and responsibility assigned. Judith Collins is limiting liability.

The challenges farmer now are as big as ever in history and it's time to make a decision. Are you going to continue to wait for several more decades based on the promises that have failed to be delivered over the last 4 decades on this gene centric approach to agriculture or are you going to look for agri-ecological solutions that have been working for the last 50 years and have been incrementally and significantly delivering higher yields, greater drought, heat and flood tolerance etc. These kinds of approaches which are not gene centric but are eco system centric those

approaches so far look superior to anything genetic engineering has delivered. If we focus on genetic engineering products, it will siphon off resources from delivering the kinds of products that Farmers need to do continue to do well.

European governments require the gene sequence from any GMO to be released for use in food, requires manufacturer to supply them the information for traceability. Judith Collins is eliminating traceability and manufacturer responsibility for their products

NZ is a top biotechnology country. The yields of our crops are about as high here as any country in the world, without genetic engineering. This is sophisticated bio tech that NZ is using now. To reserve the term bio-technology for these laboratory-based production lines is an insult to our farmers, our agronomists, our animal breeders who are doing a fantastic job. And they are doing that in part assisted by the use of the molecular biology also used by genetic engineers to make GMOs. It's just that they don't take the next step and MAKE the GMOs. The vast majority of the utility and value of that molecular biology is already really captured in NZ.

You just can't patent the use of molecular biology techniques with a utility patent.