Manaaki Whenua
Landcare Research

MWLRWEBINAR

Our Land and Our Future – Tō tātau whenua, mō āpōpō

The pathway to precision pest control: toxin development using genome mining

The following questions were asked during our live webinar with Erica Hendrikse but due to time restrictions, we were unable to answer these in the session.

You briefly touched on cardiac functions of pests. Given they have a high heart rate, can the red blood cells of pests such as Mustelids be boosted using gene drive to cause early heart failure?

Gene drives do show some long-term promise, but there are significant challenges before they could be used in New Zealand. These include changes to government regulations and social acceptability, as well as the extensive research needed. Gene drives are more likely to work with animals with shorter generation times such as mice, rather than mustelids.

However, identifying toxins that affect the cardiovascular system is certainly a component of this research. Also note that PAPP, a toxin approved for mustelid control, affects the oxygen carrying capacity of red blood cells.

Marsupials in WA are resistant to 1080. How do you ameliorate risks of animals over time evolving such that therapies are no longer efficacious?

With any toxin, including those we are currently using, there is the risk that resistance develops. Using toxins strategically will help to mitigate this potential for resistance. For example, rotating toxins with different mechanisms of action. The availability of alternative toxins beyond anticoagulants or 1080 will be helpful for overall pest resistance.

Why have the genomes of these pests only recently become available? I thought the sequencing technology had been around for a while?

Sequencing technology has been around for a while - it has been 20 years since the human genome was first published. However, sequencing technology is improving all the time and becoming cheaper. It has only been recently that costs are within reach for species other than key model organisms. Genome assembly also requires a lot of computational power, which is now easier to access.

How do you validate chronic poisoning in non-target species as opposed to acute?

Assessment of chronic toxicity is a key part of the registration process for novel toxins. Generally, this is assessed in model species such as rats or mice. Chronic toxicity testing follows guidance from regulatory agencies and can take up to two years.

How far away is this work from being turned into a product that can be used?

This work is relatively early and focusses on the platform development. An estimate is about a decade for a commercially available product.

When do you think you will have your first toxin ready for production ?

As above.

Could this process and technique be used for aquatic pests? e.g., pest fish

Yes, we anticipate that this platform for identifying potential species-specific toxin targets could be used in a variety of different contexts.

This might be a silly question, but could this approach also be applicable to control/eliminate wasps?

As above.

Isn't the greatest risk to native species likely to be native mammals (i.e., bats)? Have these species had their genome sequenced?

The vulnerability of species depends on various factors, including their risk of exposure to the toxin, size and diet.

There are currently no genomes available for New Zealand bat species and few genomes for bat species in general. The NZ bats are on the list of species for the Bat1K genome project which aims to produce high quality bat genomes. If the NZ bat genomes become available, I will certainly add them in to the dataset. In the meantime, I can add the closest related bat species.

Really encouraging work. Once the toxins are developed, there is going to be huge demand from the conservation perspective to get them into the environment. But what work is being done to avoid backlash from those who object current toxins? Given that the opposition is not necessarily open to accepting scientific evidence... The facts and evidence about host-specificity may not do the trick for some vocal opposition... How do we make sure this work does not end up buried in the court of public opinion?

New toxins may not appeal to some of the more vocal opponents to toxins, and this is a complex issue. However, a common concern for many people objecting to current toxins is the risk to non-target species. Hopefully, we can address these concerns in a productive way when discussing a potential new toxin.

Is anybody working also on making the poison better for animal well-fare? E.g., by combining the poison with something palliative?

Animal welfare assessment is a key part of the screening process of any new compounds/toxins arising from this research. Producing toxins with improved animal welfare profiles is a high priority for this project, along with the goals of addressing non-target toxicity issues.

This is a broader question; what engagement/partnership building has taken place to gain and maintain credibility and legitimacy of the project and resulting products?

This project is an international collaboration of various key research institutions and Universities and has full support of several large and small industry partners - all who have confirmed the need for more specific pest control. The project has broad applicability - it is focused on not only key pests of New Zealand but also those of more global issue e.g. pest rodents in general, feral pigs etc. Once we have a validated platform the approach can be aligned to many pest species not only mammalian.

So, it's possible, in the future, that our toxin applications could consist of a "cocktail" or mix of baits each targeting specific pests?

Yes, this is one approach we are considering.