Landcare Research
Manaaki Whenua

Species Selective Toxins

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The need to control pests

- They threaten our economy, food safety, environment and health.




- Present issues that are highly relevant to our stakeholders, including primary industries, food handlers and processors, conservationists, Maori, regional councils and public health professionals.

- Control measures need to deliver to their various needs and values.

Disadvantages of current toxins?

- Have broad-spectrum or only partly selective toxicity
- Second-generation anticoagulant rodenticides are persistent in animal tissues
  - Environmental persistence can lead to non-target or food safety issues

- Many are relatively inhumane
- Sustainability credentials are a growing concern for consumers
  - Increasing international regulatory restrictions on rodenticide use
- Current applications seek to minimise the disadvantages of current tools while addressing an urgent need for new toxins that do not have any of these risk profiles

Species-selective toxins

Are likely:

- To have less impact on the environment
- Not to cause secondary poisoning if a dead pest is eaten
- Be safer than current toxins, both to humans and animals
- Aid in improving sustainability credentials
- Suitable for use in multiple environments including parks, hospitals, schools, shipping and food processing plants
- Pose less of an issue to the food chain

Anticipate that these characteristics will be welcomed by multiple stakeholders as meet many of their needs, and will align with the NZ "predator-free" initiative.

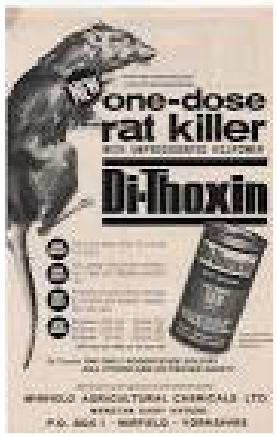
Initial Target – The Rat

- Rats are a global pest species
- Cause US$20 billion damage to agriculture in US alone
- World Health Organisation estimate that 20% of all food grown for human consumption is destroyed/spoiled by rats

Growing problem

Our Concept

- **Norbormide (NRB)** used as a rat-selective rodenticide in the 1960s. It induced an extremely acute reaction leading to a quick and humane death.

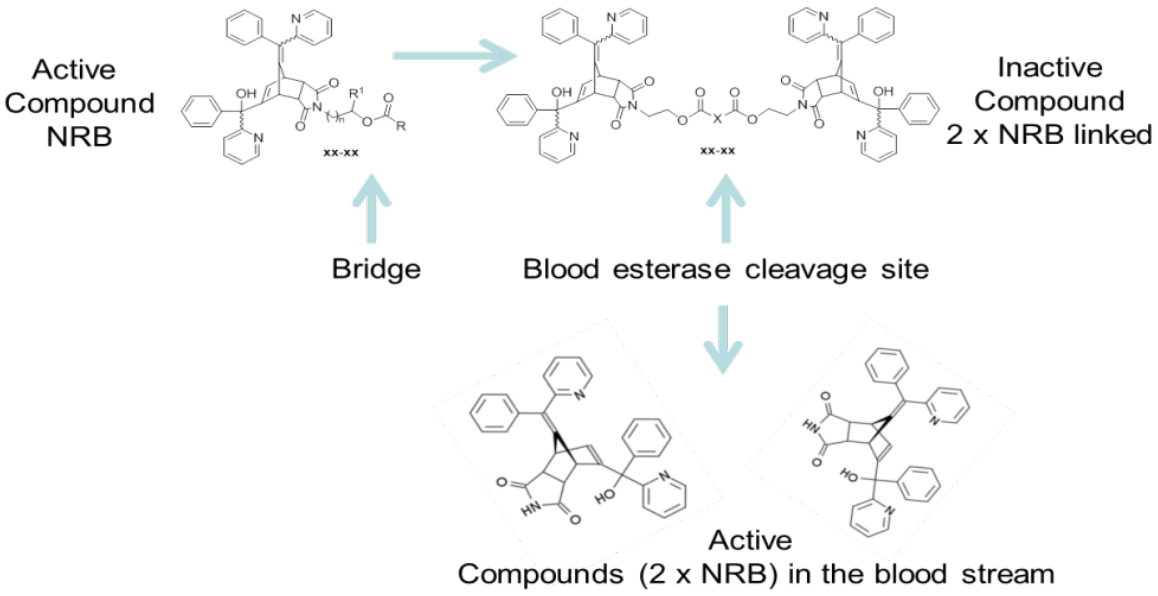


- **Failed** as onset of symptoms was too rapid leading to rats not eating enough to kill them.

- **Disappeared** from the market as there were inconsistent outcomes from rat control operations.

Our Approach

PRODRUGS: are inactive until broken down to active form by the action of enzymes or other chemicals within the body (blood esterase).



THE HYPOTHESIS: onset of symptoms will be delayed as compound needs to be absorbed, enter the bloodstream and get broken down before active is released, allowing extra time needed for the rat to consume a lethal dose.

Our Solution

- Onset of symptoms delayed

  10min → **90mins**

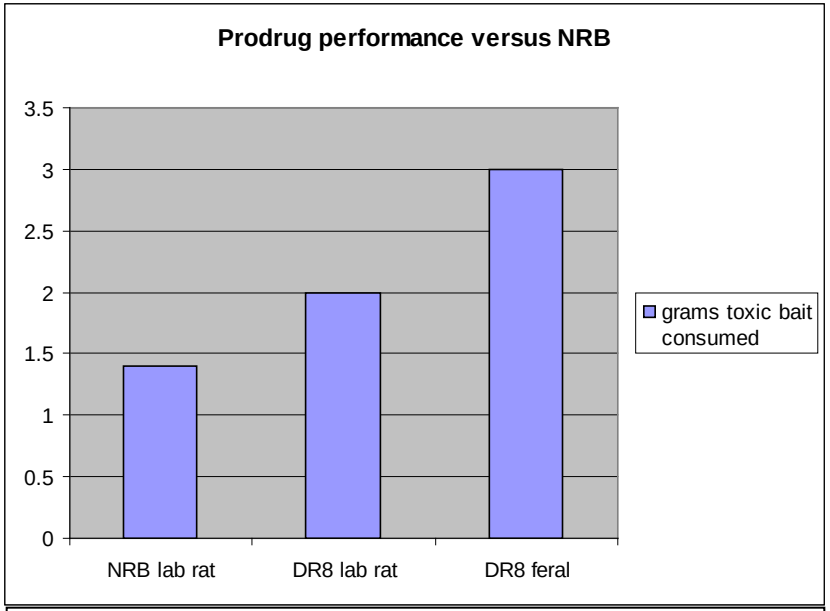
- Increase in toxic bait consumption

  1gm → **3gm**

- Increase in kill rate

  25% → **100%**

- Species-specificity and retained



Kill rate:			
	3/12	12/12	6/6
Active consumed:			
	36mg/kg	60mg/kg	70mg/kg

- Novelty secured – compounds and approach patented in NZ and International

Market failed compound → **Effective rat-selective toxin**

Under Industry evaluation trials in the US

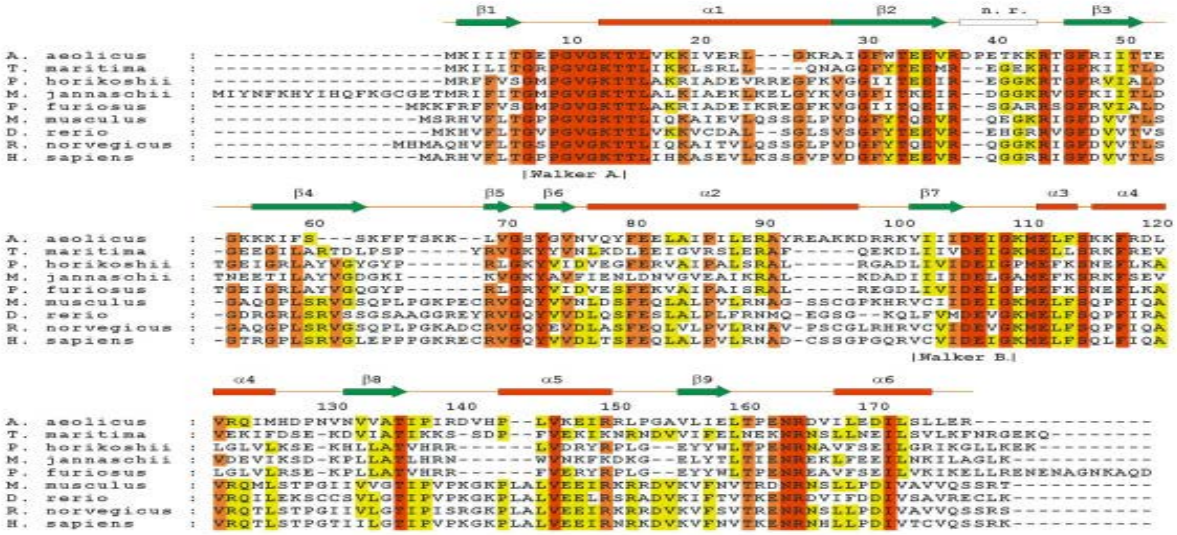
What Next ?

- **Transferring the NRB approach to other pest species**
  - — Making new compounds to target **MICE**.
  - — Investigating NRB's mode of action to develop novel toxins that target other species in a similarly selective manner.
- **Identifying other species-specific targets for new toxin development using genome comparisons.**

Genome Comparisons

- Comparing the genetic maps of pest species against non-targets.

- Enables identification of pest specific targets suitable for toxin design.



- Full genome comparisons are underway in a **POSSUM and PIG**.

In Summary

- We have made a step change in how toxins are discovered and developed, resulting in an humane, species selective toxin that actually works, and largely meets stakeholder needs.

- We are extending what we have learnt about NRB – its chemistry, mode of action etc., to other pest species – e.g. mice.

- Investigating genomics as a new way of identifying species selective targets per se – e.g. possum and pig.

Any Questions?