Bacterial toxin research could improve pesticides and help treat cancer

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Structure of the YenTcA toxin complex looking down through the central channel. Credit: University of Queensland

Research into an intricate toxin delivery system found in bacteria could overcome the problem of pesticide resistance in insects, and might even lead to new cancer treatments.

An international team led by Dr. Michael Landsberg at The University of Queensland has revealed the detailed inner workings of the newest member of a family of naturally occurring insecticidal toxins.

"This toxin, known as YenTc, is a highly effective toxin-delivering nanomachine," Dr. Landsberg said.

"We used a high resolution microscopic imaging method known as electron cryo-microscopy to reveal the complex molecular structure that injects highly toxic molecules into targeted cells, triggering cell death."

The toxin was isolated from a naturally occurring bacterium that targets many commercially significant insect pest species, including the diamondback moth, and has been earmarked as a new biopesticide.

"We found that YenTc contains unique features which decorate its structure, much like baubles that distinguish the appearance of Christmas trees," Dr. Landsberg said.

"We believe these decorations determine which hosts are susceptible to toxins.

"This selection mechanism will ultimately be crucial to the safety of any future biopesticide technology.

"But understanding it might also allow us to engineer bio-inspired toxins that could be used for therapeutic purposes."

UQ's Dr. Sarah Piper, said the findings had helped researchers understand why YenTc specifically targeted insects.

"This is an important step, which may eventually allow for YenTc or related toxins to be engineered to target different insect species, or perhaps even selectively target and kill unhealthy cells in animals or people, such as cancer cells, without harming healthy cells," she said.

"So what began with the goal of trying to prevent insects from destroying

vegetable crops might one day lead to us having the capability to design and test new therapeutic approaches for treating cancer."

The work involved researchers at UQ's School of Chemistry and Molecular Biosciences and the UQ Institute for Molecular Bioscience, Griffith University, AgResearch New Zealand, the University of Auckland, the University of Basel and the Cambridge Institute of Medical Research.

The study has been published in *Nature Communications*.

More information: Sarah J Piper et al. Cryo-EM structures of the pore-forming A subunit from the Yersinia entomophaga ABC toxin, *Nature Communications* (2019). DOI: 10.1038/s41467-019-09890-8

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