Bacterial toxins harnessed for bioinsecticides and medicine

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New Zealand and Australian scientists have found a new way in which bacteria store and release toxins, and their discovery may be harnessed to develop new bioinsecticides for crop pests and even new medicines.

The team, led by Dr Shaun Lott from The University of Auckland and Dr Mark Hurst at AgResearch in Lincoln, studied how the bacterium Yersinia entomophaga kills crop pests such as grass grubs, diamondback moths and porina caterpillars.

In the process, they discovered a new way in which the bacterium packages its insect-killing toxin in a hollow protein shell. Their work was published overnight in the leading scientific journal *Nature*.

The work was done primarily by AgResearch-funded University of Auckland PhD student Jason Busby, as part of his doctoral thesis supervised by Drs Lott and Hurst. The scientists used high-resolution x-ray crystallography and electron microscopy to determine the three-dimensional structure of proteins produced by the bacterium.

They found that the proteins form a hollow shell that releases the toxin only when it encounters specific environmental conditions, such as those found in the gut of crop pests. This explains how the bacterium can produce toxins without harming itself, and release them only when needed.

The genetic sequence that provides the blueprint for the shell is also

found in many other species, including animals, and the researchers believe they have discovered a new biological mechanism by which toxins or other sensitive molecules may be stored and released.

Dr Lott explains that, based on the discovery, scientists may be able to generate new insecticides or even new medicines: "This is a mechanism for delivery, and you could pack whatever you want into the shell. You could develop different toxins for use as bioinsecticides, or package therapeutic molecules that you want to deliver only in specific conditions," he says.

The bacterium Yersinia entomophaga was originally discovered in the native New Zealand grass grub by AgResearch scientist Dr Hurst. It was subsequently found to affect other insect pests such as the diamondback moth which damages crop pests worldwide, and the potential for its use as a new form of insecticide piqued the researchers' interest.

Provided by University of Auckland