Bacteria genome research could save orchards and assist blood transfusions

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Research led by the University Warwick into the genomes of two bacteria could save orchards from a previously almost incurable disease and also assist in treating complications arising from human blood transfusions.

The researchers were interested in how the bacteria naturally produced a family of chemicals called desferrioxamines. Desferrioxamine E is produced by the bacterium Erwinia amylovora. The bacterium uses it to damage apple or pear trees and acquire iron from them.

This allows it to establish an infection that leads to the economically-damaging agricultural disease known as “Fire Blight” that can sweep through an orchard if the infected trees are not removed. The bacterium Streptomyces coelicolor produces desferrioxamine B, which is used to treat iron overload in humans – for instance following extensive blood transfusions.

By studying the genomes of the two bacteria, the researchers were able to work out that each uses a similar biochemical pathway to produce desferrioxamines. In both cases they use a “remarkable” trimerisation-macrocyclisation reaction cascade in the key step. The researchers purified the enzyme responsible and showed that it could catalyse the reaction cascade in a test tube.

The current industrial process to create desferrioxamine B relies on the fermentation of the bacterium Streptomyces pilosus. The Warwick-led

research has identified how Streptomyces bacteria create it using only four enzyme catalysts and four different building blocks. In contrast, the laboratory synthesis of desferrioxamine B requires 10 steps and uses numerous chemicals. Harnessing the enzymes may result in much cheaper pharmaceuticals based on desferrioxamine B and manipulating them could lead to the creation of new orally-active analogues of this important pharmaceutical.

The new understanding of how desferrioxamine E is created by Erwinia amylovora opens the way for the creation of new chemical inhibitors that may prevent this bacterium from inflicting Fire Blight on orchards

Source: University of Warwick