

Cum laude for cell factory builder

Biotechnologists can alter bacteria in ways that allow industrially useful compounds to be produced sustainably. Lyon Bruinsma obtained a doctorate with distinction for his attempts to modify the metabolism of *Pseudomonas putida*. The method he used is called growth-coupled selection.

The title of his thesis is *Restoring Life*; the cover illustration refers to *The Creation of Adam* in the Sistine Chapel. ‘I restore the life of bacteria,’ says Bruinsma, explaining the cover. ‘First I remove life by disabling part of the metabolism, and then I restore it by inserting different DNA so they can grow again. Growth is the selection criterion.’

One of the successful interventions in his study was to have the bacterium

run entirely on what is known as the shikimate pathway. The cell uses that route to make the aromatic amino

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‘But the yields are low,’ says Bruinsma, ‘as production is regulated rigidly in the cell. That’s a shame, because in principle this pathway will let you make hundreds of high-grade products.’

Perfume

Bruinsma developed a strain of bacteria that processes 90 per cent of the carbon in the food (glycerol) using the shikimate pathway. That makes it a

acids
tyrosine,
tryptophan and
phenylalanine.

promising vehicle for making aromatic products. Another success was the development of a bacterial strain that makes anisole from phenol. Anisole is used in the production of perfumes and medicines.

Previously, anisole could only be made using chemical processes. Now, Bruinsma has made it using natural processes. The enzyme he used comes from basil. ‘Metabolic pathways are often assumed to be very stable,’ says Bruinsma. ‘An enzyme turns substance A into substance B. But you can easily modify it to turn substance C into substance D. You can exploit that promiscuity of enzymes.’ ^{RK}