Sweet as can be: How E. coli gets ahead

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Scientists at the University of York have discovered how certain bacteria such as *Escherichia coli* have evolved to capture rare sugars from their environment giving them an evolutionary advantage in naturally competitive environments like the human gut.

Microbes are well-known for their ability to grow in demanding and nutritionally poor environments, which has allowed them to colonise some of the most remote places on the planet. Bacteria living in theoretically nutrient-rich environments like the mammalian intestine face similar challenges due to intense competition between bacterial species in the intestine for the finite amount of available food.

Researchers led by Dr Gavin Thomas in the University's Department of Biology discovered that a protein present in the intestinal bacterium Escherichia coli was a unique sugar transporter.

Common sugars like glucose form a cyclic structure called a 'pyranose' when dissolved in water. All transporters for glucose recognise the pyranose form. But, for sugars such as galactose, which is commonly found in dairy produce, around 10 per cent is found in a different ring form called a 'furanose'.

Initial work on the unknown *E. coli* transporter by Dr Thomas's team suggested that it was a galactose transporter. The researchers knew that *E. coli* has a galactopyranose transporter already, so why should the bacterium have evolved another system to do exactly the same thing?

The answer to the problem was discovered when researchers led by Professor Keith Wilson in the York Structural Biology Laboratory solved the 3D structure of the protein, revealing that it was bound to the rarer furanose form of galactose. Experiments by Dr. Jennifer Potts in the University's Centre for Magnetic Resonance confirmed that the transporter was the first biological example to recognise furanose over pyranose forms.

Dr Thomas said: "The picture that emerges is that bacteria have evolved many related transporters to allow them to exploit every possible potential source of nutrient in their environment. Being able to use the extra 10 per cent of galactose available in the gut appears a trivial adaptation. But it is exactly the small change required to allow *E. coli* to grow a little bit faster when galactose is present in the gut, and so persist at the expense of other species of bacteria."

The work was published in the *Journal of Biological Chemistry*.

Source: University of York