How Our Cells Cope with Toxic Small Molecules

In the journal *Nature Chemical Biology*, scientists Carole Linster (University of Luxembourg), Emile Van Schaftingen (Louvain University), and Andrew D. Hanson (University of Florida, Gainesville) review an important, but so far neglected, part of metabolism, namely metabolite damage-control. In their publication 'Metabolite damage and its repair or pre-emption', the authors present a comprehensive overview of the known reactions generating unwanted small molecules in the cell as well as of the corresponding control mechanisms, and discuss the importance of this ‘quality control’ for cellular and organismal health.

“Damage-control in metabolism represents an entirely new concept, that shifts our view from linear metabolic pathways sustained by highly specific enzymes to more complex networks that take into account numerous damage and repair reactions”, explains Dr. Carole Linster, a young group leader at the Luxembourg Centre for Systems Biomedicine (LCSB), and hopes that her and others new research findings will lead to a change of paradigm in metabolism.

The molecules that constitute living cells are constantly subject to damaging reactions and fixing this damage immediately is crucial for cellular health and survival. Damage-control must therefore have existed since the dawn of life, and the repair mechanisms that cells have adopted throughout evolution have been studied by scientists for decades. But until recently, most researchers have focused their attention on the repair mechanisms acting on large molecules such as DNA and proteins, while damage-control of small molecules, called metabolites, has mostly been overlooked. Linster explains this oversight: “Classical biochemistry taught us that, given the high substrate specificity of enzymes, metabolic reactions are very precise processes which don’t generate any useless or toxic by-products. But thanks to new technologies we have learned that this is not the case, and that the cell is likely to constantly produce damaged metabolites, which have to be eliminated or repaired.” A deficiency in metabolite repair can lead to fatal disease in humans.

The field of 'metabolite damage-control' is still in its infancy and biochemists are just starting to understand how the cell repairs damaged metabolites. This suggests that many metabolite damage-control systems remain to be discovered. “I hope that scientists who read this review will be convinced that metabolite repair is an important aspect of cell metabolism”, says Linster. “It should inspire researchers to look for yet unidentified reactions and thereby improve our understanding of the extent of metabolite damage-control and the physiological importance thereof.“

Source: University of Luxembourg [1]

Links:
[1] http://wwwen.uni.lu/the_communications_department/our_services_for_the_media/press_releases/how_our_cells_cope_with_toxic_small_molecules_30_01_2013