Carbohydrate chemistry inspired by nature

The latest research into sugars from the University of Oxford's Chemistry Department takes inspiration from biology – and might revolutionize health care in the process.

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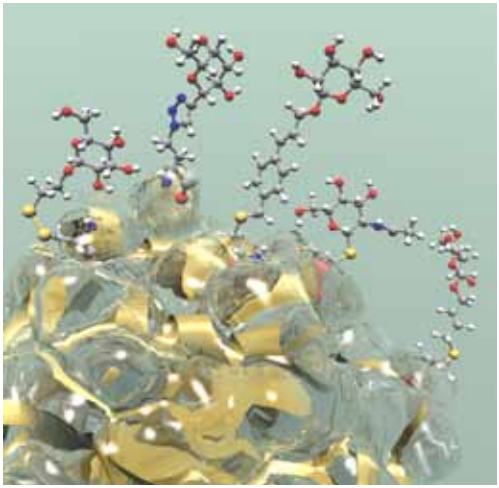

Professor Ben Davis approaches chemistry differently to most: he takes inspiration from basic biology, letting the natural world guide his research. That is why his team focuses on how to use chemistry to learn about biological processes – and create new, synthetic ones.

The Davis Group look at how carbohydrates become attached to organic molecules – a concept known as glycosylation – and new ways of building proteins using chemistry. Proteins are fundamental to life, so understanding this process could transform synthetic biology from laboratory-based speculation into useful technology. The fact that The Davis Group has developed a way of accurately modifying protein structures using, for example, sugars is having a profound impact on chemistry and biology.

In the same way that synthetic drugs mimic the properties of naturally occurring substances, this technique makes it possible to create synthetic proteins – a notion that could revolutionise medicine, since there is already evidence that they may be used to slow cancers or kill off HIV. The process shows such promise that Professor Davis created the spin-out Glycoform in 2003, with $2m in initial venture funding, to take the work to a commercial level.

But the Davis Group does not rest on its laurels. More recently, they have investigated how sugar molecules bind to areas of inflammation in the brain. These lesions can be the early warning sign of multiple sclerosis, but are difficult to spot until they're so large that it is too late.

Working with partners in the Department of Physiology, Anatomy and Genetics, and the John Radcliffe hospital, the group has created molecules that bind to lesions but show up better on MRI scans. Using the group's chemical techniques to attach iron oxide particles to sugars that bind to inflamed tissue, it is now possible to see lesions even a few cells in size. The concept might be used to identify early-stage brain-cancers too, an idea that spin-out Oxford Contrast are set to explore.

'The ability to produce carefully tailored proteins that are modified with carbohydrates will enable the clinical evaluation of these synthetic biologics as a potentially new class of therapeutics.'
Shankar Balasubramanian, Professor of Medicinal Chemistry, University of Cambridge and co-inventor of Solexa Sequencing

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