

Efficient synthesis of lycotetraose, the tetrasaccharide constituent of the tomato defence glycoalkaloid alpha-tomatine.

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Glycosylation is a common post-translational modification in biological systems with many natural products carrying carbohydrates. Due to the intrinsic complexity of higher oligosaccharides determination of their structure is difficult and mass spectrometry techniques occupy an important place in the analysis. In our synthesis of lycotetraose, we relied heavily on analytical data provided by Swansea Centre because results obtained by common techniques such NMR spectroscopy were often too complicated and gave ambiguous information. The analyses performed were beyond the capability of the hardware (and manpower) available to us in house. This project could not have been completed without input from the Swansea team.

The following text comes from a *Chemistry World* article relating to some of our plant carbohydrate work:

Super tomatoes fighting off killer fungi sounds like the plot for a bad sci-fi movie, but could be closer to reality than we thought. Chemists in the UK have found a way to make the pathogenic fungi-repelling compounds used by tomatoes. The unique carbohydrates that make up saponins – produced by plants when under attack – are complex and have until now been difficult to make in the lab. Sergey Nepogodiev and colleagues, from the University of East Anglia, came up



with a simple route to the saccharide part of tomatidine, the tomato's own anti-fungal saponin. Nepogodiev and his colleague Robert Field claim that their one-pot, double-coupling method allows them to quickly assemble four monomeric carbohydrates into a complex branched tetrasaccharide portion of tomatidine. The tomato-attacking fungi, when they encounter tomatidine, make a range of enzymes to deactivate the saponin, in what Nepogodiev and Field have dubbed a 'chemical conversation' between plant and fungus. By creating the sugars in tomatidine synthetically, the aim is to understand how saponins behave both in this instance and more generally, especially in their pharmacological antiviral and anticancer applications.

Saponins are made in low quantities in nature, making it difficult to decipher how they work, so this latest information from synthetic sugars will be useful, according to Nepogodiev. 'The availability of pure materials from chemical synthesis is crucial to enabling key studies to understand the ecological relationship between plants and fungi,' he said. Attack of the killer tomatoes it may not be, but Nepogodiev suggests that this line of research might help future tomato crops: 'it may prove possible to breed tomato strains for improved fungal resistance, and hence greater crop yield and longer shelf life.'

Publications:

- *Chemistry World*, **2005**, 9, 19.
- Efficient synthesis of lycotetraose, the tetrasaccharide constituent of the tomato defence glycoalkaloid alpha-tomatine. N. A. Jones, S. A. Nepogodiev, R. A. Field, *Org. Biomol. Chem.* **2005**, 3, 3201-3206.