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[\[Genomics\] Academia Sinica's Researchers Synthesize Two Structurally Complicated Heparan Sulfate Octasaccharides, Help Understanding of Herpes 'Cold Sore' Virus Entry into Host Cells](#)

[Genomics] Academia Sinica's Researchers Synthesize Two Structurally Complicated Heparan Sulfate Octasaccharides, Help Understanding of Herpes 'Cold Sore' Virus Entry into Host Cells ([Chinese Version](#))

Academia Sinica Newsletter (2011/06/24) A Research Fellow at the Genomics Research Center, Academia Sinica, Dr. Shang-Cheng HUNG, and his colleagues have successfully synthesized two 3-O-sulfonated heparan sulfate octasaccharides, the first report of chemical synthesis of such molecules. This advance is significant as it helps understanding of the entry process of herpes simplex virus type 1 (the virus that produces cold sore) into host cells, and brings finding drugs to prevent infection by the virus one step closer. The research was published in the heavyweight scientific journal Nature Chemistry on June 19.

Certain "sugars" (carbohydrates, polysaccharides) on the cell surface are necessary for the entry of viruses into human cells, the first stage of viral infection. Heparan sulfate is one such sugar. A first step in the search for a way to stop viruses entering cells is to synthesize these sugars chemically; however, the chemical synthesis of carbohydrates is much more challenging than the synthesis of other biologically important molecules such as proteins or nucleic acids, with many technical challenges still to be overcome.

Dr. HUNG started to investigate the synthesis of cell-surface carbohydrates that play key roles during viral entry 13 years ago. He has subsequently published numerous research articles on developing new methodologies for sugar synthesis. In continuation of his efforts to prepare cell-surface influenza virus-binding sialic acid-containing trisaccharides via a combination of "Regioselective One-pot Protection" and "Stereoselective One-pot Glycosylation" strategies reported in the journal Nature in 2007, the current article is the first time that chemical synthesis of eight-sugar (octasaccharide) molecules has been achieved.

The synthesis of the two new octasaccharides, individually, took the researchers 47 and 57 steps to complete. The researchers used extensive chemical background knowledge to remove unwanted chemical reactions and optimize the synthesis. The lengthy and complex process was coordinated by Dr. Yu-Peng HU and Dr. Shu-Yi LIN, and required extraordinary endurance and attention to detail. Dr. HU and Dr. LIN, who contributed equally to the article, are currently the Postdoctoral Fellows at the Genomics Research Center.

After the members of Dr. HUNG's laboratory successfully synthesized the precise structure of the two octasaccharides, further biological experiments were conducted by Dr. Wen CHANG and Postdoctoral Fellow Dr. Cheng-Yen HUANG, both of Institute of Molecular Biology, Academia Sinica, to measure the extent to which the sugars could inhibit herpes simplex virus type 1 infection in cells from monkeys (Vero cells). The results showed that the two octasaccharides could inhibit more than half of the infected cells at concentrations of 5.4 and 3.9 micrograms per milliliter, respectively, thus increasing knowledge about the entry of herpes simplex virus type 1 into the cell.

Related website:

<http://www.nature.com/nchem/journal/vaop/ncurrent/full/nchem.1073.html>.

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