

Research on active substances in breast milk can begin

28 June 2017, by Pnas Publication: Proof Of Principle For The Synthesis Of Almost All Complex Sugars Found In Human Breast Milk

Hundreds of unique sugars comprise the difference between cow's milk and human breast milk. Some of these sugars are already known to contribute to the baby's immune system, but until recently, more detailed research into individual ones was impossible as the sugars could not easily be obtained in pure form. Researchers at Utrecht University and the University of Georgia have now developed a method to do just that. The publication about their findings were published in the scientific journal *PNAS* last week.

In the article, the researchers describe their proof of principle for the synthesis of almost all complex sugars found in [human breast milk](#). "The current collection of approximately 100 synthetic sugars makes it now possible to start examining the influence of each individual one on the baby's health. In the future, it may even be possible to enrich baby formula with some of these sugars, resulting in substantial health benefits," research leader Prof. Geert-Jan Boons explains.

Approximately 10 percent of human breast [milk](#) consists of 500 or more complex sugars that do not occur in [cow milk](#). These sugars are chemically related to sugar that we use as a sweetener, but they have much larger and more complex structures. These complex sugars contribute to the baby's health and for example, scientists know that some can prevent viral and bacterial infections, while others stimulate healthy gut flora.

The outer membranes of our body's cells are also covered by complex sugars, but research in this area, which is termed glycoscience, is still in its infancy. "In fact, we're just starting to discover how important complex sugars are," Boons adds. "So we need tools to detect, analyse and produce them."

10 building blocks and 10 enzymes

Until now, it had been extremely difficult to isolate individual complex sugars from breast milk, so synthesising them seemed to be the best solution. To do so, the researchers examined the biosynthesis of the complex sugars, and they discovered that almost all sugars can be made from a combination of a set of 10 [building blocks](#), similar to the way that the 20 amino acids are the building blocks for all proteins.

The sugars that result from these combinations are also dependent on enzymes - biological catalysts - which control their construction. There are many complex [sugar](#) synthesizing enzymes, each with its own role. What the researchers have now shown is that most of the complex sugars in human [breast](#) milk can be produced in the lab with a combination of the 10 building blocks and a set of 10 enzymes, using them in the correct order.

"We spent five years uncovering the synthetic route for the first 100 complex sugars, but now we can make many others to study their contribution to human health. We expect that this research will not only lead to better infant nutrition, but also to new therapeutics for a variety of diseases," Boons said.

More information: Synthesis of asymmetrical multiantennary human milk oligosaccharides, *PNAS*, 20 June 2017, [DOI: 10.1073/pnas.1701785114](#), [www.pnas.org/content/early/2017/06/20/1701785114.abstract](#)

Provided by Utrecht University Faculty of Science

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