PRESS RELEASE

A key moment for science

- *The Center for Cooperative Research in Biosciences CIC bioGUNE has managed to observe empirically for the first time a chemical species with a short lifetime that is generated during the formation and cleavage of sugars*

- *The experimental demonstration of the existence of this chemical species, called intermediate "glycosyl oxocarbenium", helps to know more about the formation of carbohydrates*

- *The study, which was presented in the prestigious Nature Chemistry journal, opens the door to the effective generation of sugars to research in the quest of new therapies.*

(Bilbao, 24 November 2015).- There are fleeting moments that are almost impossible to be captured, but just because they do not last enough time, it does not mean that they are not important. This seems to be the case during the chemical reactions of formation and cleavage of sugars, which are processes in which a series of short lifetime episodes, called intermediates, occur. Their existence was known in theory but, until now, no one had managed to observe them empirically.

Sugars or carbohydrates are essential to life. They are an energy source that is absorbed fast, they cover the cell surface and act as information transmitters and receivers in processes that are beneficial to the body; but they also act in harmful processes like the interaction between cells and pathogens, which lead to cancer, and infectious and inflammatory diseases. For this reason, knowing in depth the structure of sugars helps towards the progress of health sciences and the development of new therapies against ailments.

The Centre for Cooperative Research in Biosciences CIC bioGUNE has coordinated a research project in which it has managed to observe empirically for the first time ever the key intermediate species that is generated during the chemical reactions of formation and breakdown of these substances.

"In every chemical reaction, a series of steps take place in which chemical species with a short lifetime, called intermediates, are generated. These are hard to detect, but despite this difficulty, there is enough theoretical knowledge to infer their existence. However,

experimental demonstration is what enables the progress of science," explains the Scientific Director of CIC bioGUNE and research leader, Jesús Jiménez Barbero.

The study, which has been presented in the prestigious Nature Chemistry journal and has been carried out by a scientific team led by Yves Bleriot and Sébastien Thibaudeau, from Poitiers University (France), aims to discover the relationship between the chemical structure of sugars and their biological function.

"This project is part of the search for the common intermediate in all the chemical reactions that have to do with the formation and cleavage of carbohydrates in nature. The existence of this intermediate, called glycosyl oxocarbenium ion, had already been suggested in theory, but had never been detected experimentally. Thanks to our research we have been able to observe it empirically and determine its geometric shape," adds the scientist.

A complex study

Thanks to this research, this common intermediate (glycosyl oxocarbenium ion) has been isolated and observed by nuclear magnetic resonance, and it has enabled the team to prove the theory experimentally.

The geometry of four different ions from different sugars was determined in the experiment. The researchers' ultimate goal is to extend the study in the future to include more than 20 types of existing carbohydrates.

According to Jiménez Barbero, the most difficult part of the research was to create the experimental conditions in which to observe the ion.

"This intermediate is very unstable under standard temperature and pressure conditions, so we had to study several media to manage to stabilise it for as long as we needed in order to carry out the nuclear magnetic resonance experiments," explains the expert.

The team of researchers tried more than 30 different experimental conditions and eventually managed to isolate the intermediate by using a mixture of very powerful acids at a temperature of -40º.

"I think this research is an extremely important scientific milestone. For many years there have been hypotheses about the existence of this common intermediate and theories about its structure. There have been many research groups in the world that have tried to isolate and characterise it, but no one had actually managed it until now," says the scientist.

Just a spoonful of sugar

Sugars that are integrated in cells are involved in all the body's processes: fertilisation, infections, several metabolism aspects, blood groups and the development of certain diseases like cancer or inflammations.

In order to study the evolution of these phenomena and processes in detail in the laboratory and conduct the experiments, it is necessary to have large amounts of sugars, many more than the amount that can be isolated from mammals.

"This discovery should help to improve the sugar preparation methods in the lab, increase the amount obtained and increase the possibilities of generating the amount required of these molecules in order to study the phenomena that cause diseases," Jiménez Barbero adds.

About CIC bioGUNE

The Center for Cooperative Research in Biosciences CIC bioGUNE, with its headquarters on the Bizkaia Science and Technology Park, is a cutting edge Life Sciences research organisation in the interface between structural, molecular and cell biology, focusing especially on the study of the molecular bases of disease, to be used in the development of new diagnostic methods and advanced therapies.