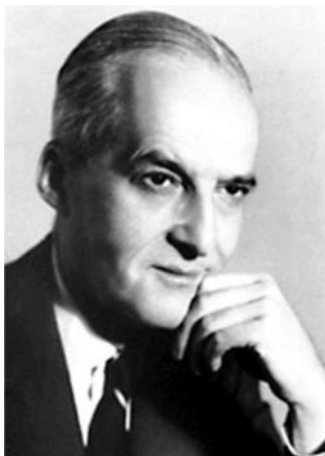


## **Nobel Prize in Chemistry 1970**



**Luis F. Leloir**

The Nobel Prize in Chemistry 1970 was awarded to Luis Leloir *"for his discovery of sugar nucleotides and their role in the biosynthesis of carbohydrates"*.

### ***RESEARCH INFORMATION:***

The 1970 Nobel Prize for chemistry has been awarded to Dr. Luis Leloir for work of fundamental importance for biochemistry. Dr. Leloir receives the prize for his discovery of the sugar nucleotides and their function in the biosynthesis of carbohydrates.

Carbohydrates, as everybody knows, form a comprehensive group of naturally occurring substances, which include innumerable sugars and sugar derivatives, as well as high-molecular carbohydrates (polysaccharides) like starch and cellulose in plants and glycogen in animals. A polysaccharide molecule is composed of a large number of sugar or sugar-like units.

Carbohydrates are of great importance in biology. The unique reaction, which makes life possible on Earth, namely the assimilation of the green plants, produces sugar, from which originate, not only all carbohydrates but, indirectly, also all other components of living organisms.

The important role of carbohydrates, especially sugars and starch, in human food and, generally, in the metabolism of living organisms, is well known. The biological breakdown of carbohydrates (often spoken of as "combustion") supplies the principal part of the energy that every organism needs for various vital processes. It is not surprising, therefore, that the carbohydrates and their metabolism have been the subject of comprehensive and in many respects successful biochemical and medical research for a long time. While working on these problems, Leloir made the discoveries for which he has now been awarded the Nobel Prize.

Before these discoveries were made, our knowledge of carbohydrate biochemistry was rather one-sided. The biological processes which break down carbohydrates, including the so-called combustion, have been well known for several decades. Over the years many Nobel Prizes have been awarded for chemistry and still more for physiology or medicine for discoveries about the reactions and catalysts involved. However, our knowledge about the innumerable corresponding synthetic reactions which occur in all organisms, was fragmentary. We had to resort to doubtful hypotheses; it was usually assumed that the syntheses were a direct reversal of the well-known breakdown reactions. The work of Leloir has indeed revolutionized our thinking about these problems.

In 1949 Leloir published the discovery which became the foundation for a remarkable development. He found that in a certain reaction, which results in the transformation of one sugar to another sugar, the participation of a so far unidentified substance was essential. He isolated the substance and determined its chemical nature. It turned out to be a compound of an unknown type, containing a sugar moiety bound to a nucleotide. Compounds of this type are now called sugar nucleotides. Leloir established that the transformation reaction does not occur in the sugars as such, but in the corresponding sugar nucleotides. To put it simply, one may say, that the linking with the nucleotide occasions an activation of the sugar moiety which makes the reaction possible.

The remarkable aspect of the discovery was not the explanation of a single reaction, but Leloir's quick comprehension that he had found the key which would enable us to

unravel an immense number of metabolic reactions. He ingeniously realized that a path had been opened to a field of research containing an accumulation of unsolved problems. In the twenty years that have elapsed since his initial discovery he has carried on his research in this field in an admirable manner.

Other scientists were quick to grasp the fundamental importance of Leloir's discovery; they realized that a vast field was now accessible to worth-while scientific investigation and started research along the path which he had opened. There can be no doubt that few discoveries have made such an impact on biochemical research as those of Leloir. All over the world, his discoveries initiated research work, the volume of which has grown over since. Leloir has been the forerunner and guide throughout; he made all the primary discoveries which determined the path and the objectives of the ensuing research work.

Leloir soon found that besides the sugar nucleotide first isolated, several others of the same type occur in Nature, and many have also been found by other research workers. Today more than one hundred sugar nucleotides which are essential participants in various reactions are known and well characterized. Some of them have an action similar to that of the first isolated, namely in the transformations of simple sugars to other simple sugars or sugar derivatives.

Still more important was Leloir's discovery that other sugar nucleotides have another action which occurs in the biological synthesis of compounds which are composed of or contain simple sugars or sugar derivatives. Leloir showed that all these syntheses are essentially transfer reactions. Sugar moieties from sugar nucleotides are transferred to accepting molecules which thereby increase in size. Probably the most sensational discovery made by Leloir was that the synthesis of the high-molecular polysaccharides also functions in this manner. The first example of the fundamental role of the sugar nucleotides in polysaccharide biosynthesis was found by Leloir in 1959 in the case of glycogen. It became clear that the polysaccharide biosynthesis is not a reversal of the biological breakdown, as had doubtfully been assumed earlier. On the contrary, Nature uses different

and quite independent processes for synthesis and breakdown. Later on the same extremely important principle was also shown to be valid with other groups of substances, for instance with proteins and nucleic acids.

Through Leloir's work and the work of others, who were inspired by his discoveries, knowledge of great significance has been gained in wide and important sections of biochemistry, which were previously obscure. It can be readily appreciated that Leloir's work has also had far-reaching consequences in physiology and medicine.

***For more details please visit:***

[http://www.nobelprize.org/nobel\\_prizes/chemistry/laureates/1970/press.html](http://www.nobelprize.org/nobel_prizes/chemistry/laureates/1970/press.html)