

## **Nobel Prize in Medicines 1964**



**Konrad Bloch**



**Feodor Lynen**

**The Nobel Prize in Physiology or Medicine 1964 was awarded jointly to Konrad Bloch and Feodor Lynen "for their discoveries concerning the mechanism and regulation of the cholesterol and fatty acid metabolism"**

Since the start of the Nobel Foundation the professorial staff of the Karolinska Institute has chosen the prizewinners in Physiology or Medicine. This year the Karolinska Institute has been reorganized into a medical university and the duties of the professorial staff have been taken over by the medical faculty of the enlarged Karolinska Institute. As the last item on its agenda the professorial staff was to decide this year's Nobel Prizewinners in Physiology or Medicine and on October 15 Professors Konrad Bloch and Feodor Lynen were awarded the prize for their discoveries concerning the mechanism and regulation of the cholesterol and fatty acid metabolism.

The word cholesterol means gallstone and the reason for this name is that cholesterol was isolated almost 200 years ago from human gallstones. Another connection between cholesterol and human diseases has been established more recently. During the last decade there has been a lively discussion, also in the newspapers, about the correlation

between atherosclerosis and the amount of cholesterol and other fats in diet and in blood. This discussion has perhaps concealed from many the fact that cholesterol is a necessary constituent of all our cells and that it fulfills important functions. The elucidation of its chemical structure is one of the foremost achievements in organic chemistry during the 1910's and 1920's. In 1928 the German chemists Windaus and Wieland received Nobel Prizes in Chemistry for their work on the structure of cholesterol and the closely related bile acids. The four-ring carbon skeleton characteristic of cholesterol was later found not only in a number of sterols of plant and animal origin but also in the precursors of vitamin D, in the male and female sex hormones, in the hormones from the adrenal cortex, etc.

Nothing was known about the way they were formed or about their interrelationships. When this year's prizewinners started their scientific career, Professor Hevesy had done his discoveries concerning the use of isotopes as tracers in the living organism. When first the stable and later the radioactive isotopes of hydrogen and carbon became available, they were first extensively used by a group at Columbia University that was headed by the late Rudolph Schoenheimer and in which Bloch played an important role. The work of the group with isotopically labeled compounds has laid the foundation of our general knowledge of the dynamic state in the living cell.

One of the fundamental discoveries was the elucidation of the role of acetic acid as a building block for cholesterol as well as fatty acids. Lynen, working in Wieland's laboratory on the metabolism of acetic acid, succeeded in isolating the so-called activated acetic acid, which is the precursor of all lipids in our body and the common denominator of a number of metabolic processes. With all possible refinements in the utilization of isotope techniques, Bloch and collaborators were able to show in a series of brilliant investigations how the two carbon atoms of acetic acid are used for the synthesis of a long hydrocarbon with thirty carbon atoms, squalene, which in turn is cyclized in a novel type of reaction to a steroid with thirty carbon atoms, lanosterol. This lanosterol is then transformed in a complicated series of reactions into cholesterol, which has twenty-seven carbon atoms. Of special interest are the reactions leading to the formation of the hydrocarbon squalene, and

the elucidation of these reactions, which are common for the biosynthesis of many other lipids and natural products, is due not only to Bloch and Lynen and collaborators but also to Popjak and Cornforth in England and Folkers and co-workers in the U.S.A. In connection with this work Lynen made two other discoveries of great importance to our understanding of the mechanisms of cellular metabolism: the elucidation of the mechanism of action of the vitamin biotin and the determination of the structure of cytohemoin.

At an early stage Bloch made another discovery of fundamental importance in showing that cholesterol is the precursor of bile acids and of one of the female sex hormones. These discoveries opened up a new field of research that has engaged a great number of scientists in different disciplines. We know now that all substances of steroid nature in our body are formed from cholesterol.

Mainly through the basic biochemical work of this year's prizewinners do we know today in detail how cholesterol and fatty acids are synthesized and metabolized in the body. These processes comprise series of reactions with a great number of individual steps. For instance, the formation of cholesterol from acetic acid is a process involving some thirty different steps. Derangements of this complicated mechanism of formation and metabolism of lipids are in many cases responsible for the genesis of some of our most important diseases, especially in the cardiovascular field. A detailed knowledge of the mechanisms of lipid metabolism is necessary to deal with these medical problems in a rational manner.

The importance of the work of Bloch and Lynen lies in the fact that we now know the reactions which have to be studied in relation to inherited and other factors. We can now predict that we, through further research in this field in the near future, can expect to be able to do individual specific therapy against the diseases that in the developed countries are the most common cause of death.

Professor Bloch, Professor Lynen. You have both started your research in Munich and you have proceeded the proud tradition of this town in a splendid way.

Feodor Lynen, you are now standing with dignity in the array of the earlier Munich Nobel Prizewinners, Adolf von Baeyer, Hans Fischer and Heinrich Wieland.

Konrad Bloch, you have like Emil Fischer and Richard Willstätter left Munich and continued your work in the New World.

You have provided us with detailed knowledge of many fundamental metabolic reactions. This knowledge forms the necessary basis for the study of the different medical problems in the field of lipid metabolism.

It can now be anticipated that in the near future we will learn how to deal with many of these diseases in a rational and successful way.

On behalf of the Caroline Institute I have the honour to congratulate you on your brilliant work and I now ask you to receive your prizes from the hands of His Majesty the King.

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

[http://www.nobelprize.org/nobel\\_prizes/medicine/laureates/1964/press.html](http://www.nobelprize.org/nobel_prizes/medicine/laureates/1964/press.html)