

Nobel Prize in Medicines 1955



Axel Hugo Theodor Theorell

The Nobel Prize in Physiology or Medicine 1955 was awarded to Hugo Theorell "for his discoveries concerning the nature and mode of action of oxidation enzymes".

The Collegium of Karolinska Institutet has this year awarded the Prize in Physiology or Medicine to Professor Hugo Theorell for his discoveries concerning the nature and mode of action of oxidative enzymes.

More than a hundred years ago the vast field of research within which Theorell's work has been carried out was opened up by a Swedish investigator, Berzelius, who advanced the concept of catalysis and postulated that vital reactions were brought about by means of catalysts, subsequently called enzymes.

Let us as an example consider sugar, dissolved in water. It is not acted upon by oxygen outside the organism, but in living cells it is rapidly broken down by means of oxygen and enzymes, with the simultaneous liberation of energy in a form suitable for use in further reactions.

During the latter part of the 19th century the catalysts postulated by Berzelius were detected - enzymes that quicken dull and sluggish molecules such as oxygen and sugar

which will not spontaneously interact. The enzymes bring about this change in the behaviour of the sluggish molecules, called activation, by contacting them for a moment and then releasing them - now in an active form - into the whirls of the molecular dance where they originate new compounds. The enzyme will contact one molecule after another without itself being changed or directly participating in the dance. It is like a tool in a production line, activating the inert material delivered to it by the belt so that a maelstrom of rapid reaction is created beyond it. But such a maelstrom can never come to rest since other tools are soon encountered, each of which maintains the motion and adapts it to a new rhythm. Thus the substances to be metabolized are brought into a sequence of rapid transformations by a versatile machinery built up of strictly specific units, the enzymes.

It is of fundamental importance to know the nature and mode of action of everyone of these truly life-giving enzymes. Their number is still unknown but it is certainly very great - Berzelius' intuitive idea has been fully confirmed in this respect.

In this field a Swedish investigator has once again substantially enlarged our knowledge.

Hugo Theorell realized from the first the importance in scientific investigation of seizing and keeping the initiative. He has realized, too, that «live and let live» is a fertilizing principle for teamwork. The able must not for long remain mere collaborators. They must themselves show initiative and become independent activators. An enzyme can give life to sluggish material in such a way that a new independent enzyme is created. Theorell's scientific work deals with active enzymes, but he is himself an efficient activator on the more complex human level.

His first discovery was made during the period 1933-1935 which, as a Fellow of the Rockefeller Foundation, he spent with the foremost pioneer in enzyme research, Otto Warburg. He arrived with his own idea and with his own technical means of substantiating it. He now made his great classical discovery of the splitting and recombination of the yellow enzyme. «Meister der Enzymforschung», Warburg called him after this scientific achievement. Since then Theorell has illuminated and clarified our understanding of

several of the enzymes necessary for life, and in a passionate search for truth and fact in science has spared neither thoroughness nor effort.

Following a logical plan of investigation and with continuous refinement of technique he has clarified and enlarged that field of knowledge in which he is an outstanding leader.

The iron atoms built into many oxidative enzymes constitute functional centres, and many aspects of their intricate linkages to other parts of the enzyme have been revealed, as well as other important routes for the transport of electrons involved in the functioning of oxidative enzymes. He and his collaborators have shed light on the iron-containing enzymes called peroxidases. Before Theorell began his investigations, our knowledge of these substances was little more than guesswork. The extremely high velocity of their reactions demanded the skilful application of a range of advanced technique. It can safely be predicted that the profound analyses thereby performed will be decisive for the future integration of the role of the peroxidase system into the pattern of action of living organisms. The function of another group of iron-containing enzymes, the cytochromes, began to emerge towards the end of the last century, and here again Theorell has achieved an incisive analysis. The nature and function of the muscle pigment were also established through his investigations. He showed it to be an oxygen reservoir which comes into action when the oxygen content of the blood is depleted. It is a source of a «second wind».

A most important part of Theorell's researches has been concerned with the velocities of enzyme reactions and the factors which influence them, factors which determine the directions into which the enzymes force the processes in living organisms. These experiments are not only of basic importance but may be considered model investigations in enzymology.

Professor Hugo Theorell. A fertile imagination. An undeviating and critical accuracy. An astonishing technical skill.

All scientists possess some of these attributes. Very few have all. You are one of these few. In accordance with your gifts you have chosen the most important of all tasks in

biology. The purification and the characterization of enzymes are essential prerequisites for progress within the realm of biological research. You have managed to bring about a decisive advance in this fundamental field, and in so doing you have brilliantly taken up and tended the heritage from Berzelius.

On behalf of Karolinska Institutet I ask you to receive your Nobel Prize for Physiology or Medicine for 1955 from the hands of His Majesty the King.

For more details please visit:

http://www.nobelprize.org/nobel_prizes/medicine/laureates/1955/press.html