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Nobel Prize in Medicines 1962



Francis Harry Compton Crick **James Dewey Watson** **Maurice Hugh Frederick Wilkins**

The Nobel Prize in Physiology or Medicine 1962 was awarded jointly to Francis Harry Compton Crick, James Dewey Watson and Maurice Hugh Frederick Wilkins"for their discoveries concerning the molecular structure of nucleic acids and its significance for information transfer in living material

An attempt to explain the significance of the discovery which has led to this year's Nobel Prize award in Physiology or Medicine could begin at a point which seems to be far from the precise world of biophysics and biochemistry. We could ask the question: «How do we define a fine portrait or a good caricature?

A caricature is a drawing - or sometimes a sculpture, a piece of prose or poetry - in which the individual characteristics of the person being portrayed are emphasized. This something, strongly individual, could be a strange contour of the nose, a wild hair or a protruding chin. We all know, that we are very sensitive about the accuracy of the caricature. It must have qualities beyond those of a true picture. If the artist succeeds in producing the individual's specific variations of a common feature, the caricature becomes exciting and full of life, it is genuine. Thus, the artist must fuse the common general with the individual specific features.

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When the scientist tries to disclose the physical and chemical characteristics of living matter in order to understand and to explain the great variety of living forms, he must always bear in mind this combination of generality and individuality. He can distinguish a number of general properties which are common to all living forms, for example the ability to extract nutrition from the environment and to multiply so that the offspring is given a life pattern similar to that of the parents. Thus he sees an extreme regularity. Further, when the scientist studies the physical and chemical characteristics of the organism or of its cells he discerns new signs of strict organization and internal order. But he cannot neglect noticing that each individual in one or more respects differs from other individuals of the same species. Within the framework of strong order there must be space for individual irregularities.

The discovery of the three-dimensional molecular structure of the deoxyribonucleic acid - DNA - is of great importance because it outlines the possibilities for an understanding in its finest details of the molecular configuration, which dictates the general and individual properties of living matter. DNA is the substance which is the carrier of heredity in higher organisms.

Deoxyribonucleic acid is a high polymer composed of a few types of building blocks, which occur in large numbers. These building blocks are a sugar, a phosphate, and nitrogen-containing chemical bases. The same sugar and the same phosphate are repeated throughout the giant molecule, but with minor exceptions there are four types of nitrogenous bases. It is for the discovery of how these building blocks are coupled together in three dimensions that this year's Nobel Prize in Physiology or Medicine has been awarded to James Dewey Watson, Maurice Hugh Frederick Wilkins, and Francis Harry Compton Crick.

Wilkins investigated deoxyribonucleic acid of various biological origins by X-ray crystallographic techniques. Such techniques are the most powerful tools which can be used to investigate the molecular structure of matter. Wilkins' X-ray crystallographic recordings indicated that the very long molecular chains of deoxyribonucleic acid were arranged in the form of a double helix. Watson and Crick showed that the organic bases were paired in a specific manner in the two intertwined helices and showed the importance of this arrangement.

The deoxyribonucleic acid molecule can also be looked upon as two interwoven spiral staircases, forming one staircase. The outside of this staircase consists of the phosphate and sugar molecules. The steps are formed by the paired bases. If it were possible to stain each base

separately, that is each half-step, and if it were also possible for a person to climb this staircase, this person would get an impression of a tremendous variety. Soon he would discover, however, that red always was coupled to blue, and black to white. Also, he would notice that the steps sometimes had black to the right, and white to the left, or the reverse, and that the same variation was true also for the red-blue steps. The climber, who in molecules of human deoxyribonucleic acid had to ascend millions of steps, would see an endless variation in the sequence of red-blue, blue-red, black-white, and white-black steps. He would ask, what is the meaning of this, and he would realize that the staircase contained a kind of message, the genetic code.

Deoxyribonucleic acid is no staircase in which one can climb; it is a very active biological substance. It has been shown that a number of the steps - most likely three - via another nucleic acid, ribonucleic acid, regulates which amino acids shall be coupled into a protein chain during its synthesis. Thus the order of amino acids in a protein is fundamentally determined by a certain sequence of bases in the nucleic acid. Thus the nucleic acid controls the production of the highly specific proteins, which are the specialized workers of the organism. All the various types of proteins produced take part in a team-work which is subordinated to the needs of the whole organism. Certain characteristics of this team-work, certain specific features in some of the proteins, make the individual unique.

The code contained in the deoxyribonucleic acid is transferred in cell division, that is in the normal growth of the organism, and also in the fusion of the sexual cells. In this way the code of the deoxyribonucleic acid can start and control the development of a new individual which has striking similarities with its parents.

Today no one can really ascertain the consequences of this new exact knowledge of the mechanisms of heredity. We can foresee new possibilities to conquer disease and to gain better knowledge of the interaction of heredity and environment and a greater understanding for the mechanisms of the origin of life. In whatever direction we look we see new vistas. We can, through the discovery by Crick, Watson and Wilkins, to quote John Kendrew, see «the first glimpses of a new world».

Dr. Francis Crick, Dr. James Watson, and Dr. Maurice Wilkins. Your discovery of the molecular structure of the deoxyribonucleic acid, the substance carrying the heredity, is of utmost importance for our understanding of one of the most vital biological processes. Practically all the

scientific disciplines in the life sciences have felt the great impact of your discovery. The formulation of double helical structure of the deoxyribonucleic acid with the specific pairing of the organic bases, opens the most spectacular possibilities for the unravelling of the details of the control and transfer of genetic information.

It is my humble duty to convey to you the warm congratulations of the Royal Caroline Institute and to ask you to receive this year's Nobel Prize for Physiology or Medicine from the hands of His Majesty the King.

For more details please visit:

http://www.nobelprize.org/nobel_prizes/medicine/laureates/1962/press.html