

Nobel Prize in Chemistry 1965



Robert Burns Woodward

The Nobel Prize in Chemistry 1965 was awarded to Robert B. Woodward "*for his outstanding achievements in the art of organic synthesis*".

RESEARCH INFORMATION:

In our days, the chemistry of natural products attracts a very lively interest. New substances, more or less complicated, more or less useful, are constantly discovered and investigated. For the determination of the structure, the architecture of the molecule, we have to-day very powerful tools, often borrowed from Physical Chemistry. The organic chemists of the year 1900 would have been greatly amazed if they had heard of the methods now at hand. However, one cannot say that the work is easier; the steadily improving methods make it possible to attack more and more difficult problems and the ability of Nature to build up complicated substances has, as it seems, no limits.

In the course of the investigation of a complicated substance, the investigator is sooner or later confronted by the problem of synthesis, of the preparation of the substance by chemical methods. He can have various motives. Perhaps he wants to check the correctness of the structure he has found. Perhaps he wants to improve our knowledge of the reactions and the chemical properties of the molecule. If the substance is of practical

importance, he may hope that the synthetic compound will be less expensive or more easily accessible than the natural product. It can also be desirable to modify some details in the molecular structure. An antibiotic substance of medical importance is often first isolated from a microorganism, perhaps a mould or a germ. There ought to exist a number of related compounds with similar effects; they may be more or less potent, some may perhaps have undesirable secondary effects. It is by no means certain, or even probable, that the compound produced by the microorganism - most likely as a weapon in the struggle for existence - is the very best from the medical point of view. If it is possible to synthesize the compound, it will also be possible to modify the details of the structure and to find the most effective remedies.

The synthesis of a complicated molecule is, however, a very difficult task; every group, every atom must be placed in its proper position and this should be taken in its most literal sense. It is sometimes said that organic synthesis is at the same time an exact science and a fine art. Here Nature is the uncontested master, but I dare say that the prize-winner of this year, Professor Woodward, is a good second.

Professor Woodward has a special liking for synthetic undertakings which are generally regarded as practically impossible. I shall here touch upon a number of his most famous achievements, some of the substances in question being well-known from the columns of the daily press. During World War II, Professor Woodward synthesized *quinine*, the well-known antimalarial. Later followed the steroids *cholesterol* and *cortisone*. The related substance *lanosterol* is perhaps less familiar but very important from the scientific point of view. The synthesis of the famous poison *strychnine* caused a great sensation some ten years ago. Still more remarkable is perhaps the synthesis of *reserpine*, an alkaloid of great medical importance. Several other examples from the chemistry of the alkaloids could be mentioned, substances with strange names and interesting properties: *lysergic acid*, *ergonovine*, *ellipticine*, *colhicine*.

In the field of antibiotics Professor Woodward has, among many other things, established the structure of *aureomycin* and *terramycin*. He has also cleared the way for synthetic work within this group of substances, the so-called tetracyclines.

A very notable piece of work is the synthesis of *chlorophyll*, the green plant pigment which absorbs and transforms the radiant energy of the sun, the existence of which is thus a necessary condition for organic life on Earth. This work has greatly increased our knowledge of the chlorophyll molecule.

Professor Woodward's activity has by no means been restricted to synthetic work. He has established the structure of many important compounds, for instance the peculiar fish poison *tetrodotoxin*, causing numerous fatalities in Japan, and he has made an original and promising approach to the synthesis of polypeptides. He has also developed very interesting ideas about synthetic activity in Nature, the genesis of complicated molecules within the living organism. These theories have been confirmed by experiments with labelled molecules.

Professor Woodward's research work covers vast and various fields in Organic Chemistry. A leading feature is that the problems have been extremely difficult and that they have been solved with brilliant mastery. He has attacked them with a maximum of theoretical knowledge, a never-failing practical judgement and, not least, a genial intuition. He has, in a conspicuous way, widened the limits for what is practically possible. As a stimulating example he has exerted a profound influence on the organic chemistry of today. Professor Woodward, I have here tried to give a brief survey of your more famous achievements in Organic Chemistry. It is sometimes said that you have demonstrated that nothing is impossible in organic synthesis. This is perhaps a slight exaggeration. You have, however, in a spectacular way expanded and enlarged the domain of the possible. It is also said that you stand out like a wizard. We know that in times long passed, chemistry was classified as an occult science. Anyhow, you have certainly not gained your scientific reputation by magical means, but by the penetrative intensity of your chemical thinking and the rigorous expert planning of your experiments. In these respects you hold a unique

position among organic chemists of to-day. In recognition of your services to Chemical Science, the Royal Academy has decided to confer upon you the Nobel Prize of this year for your outstanding achievements in the art of organic synthesis.

For more details please visit:

http://www.nobelprize.org/nobel_prizes/chemistry/laureates/1965/press.html