ISSN:2249-5347
IJSID
International Journal of Science Innovations and Discoveries
An International peer Review Journal for Science

Nobel Prize in Chemistry 1938

Richard Kuhn

The Nobel Prize in Chemistry 1938 was awarded to Richard Kuhn *"for his work on carotenoids and vitamins"*.

RESEARCH INFORMATION:

When Richard Kuhn in 1926 took over the Chair for General and Analytical Chemistry at the Federal Institute of Technology Zurich he set in motion a comprehensive series of investigations into the so-called conjugated double bonds which make up the essential arrangement of the atoms of the polyenes.

The group of the diphenylpolyenes had at this time aroused especial interest because the presence in the carotenoid Crocetin of a chain of double bonds had been successfully demonstrated. Kuhn's sixth report on conjugated double bonds already contains structure determinations of polyene dyes from vegetable materials. With his syntheses of over 300 new materials belonging to this group Kuhn has by no means sought merely to liberate new substances. In this work he was much more concerned to clarify the general relationships between the chemical structure of these unsaturated substances and their optical, dielectric, and magnetic properties. The results which he has obtained in this respect form the starting-point for new lines of development in organic chemistry.

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Kuhn's work on polyenes led him straight into the chemistry of the carotenoids. In 1930 Karrer clarified the constitution of carotene. The elementary composition of carotene, $C_{40}H_{56}$, had previously been ascertained by Willstätter. In 1931, R. Kuhn (at that time already Professor at Heidelberg), Karrer in Zurich, and Rosenheim in London discovered simultaneously and independently of each other the fact that the carotene in carrots consists of two separate components: one of these, -carotene, rotates the plane of polarized light to the right, while the other, -carotene is optically inactive. In 1933 Kuhn discovered a third carotene isomer which was called -carotene.

The great physiological and biological significance of carotene lies in the fact that it is hydrolysed in the liver of certain animals so that from one molecule of -carotene or from two molecules of -carotene two molecules of Vitamin A, Axerophtol, are formed. This substance is necessary for growth in higher animals and especially for maintaining the normal condition of the mucous membranes.

With several collaborators Kuhn carried out a large number of investigations into the occurrence of carotenoids in the animal and vegetable kingdoms. Among his most important results, his discoveries of the following carotenoids and their structure determination should be mentioned:

Physalien from berries of species of *Physalis*, Helenien, Flavoxanthin, isolated from species of *Ranunculus*, Violaxanthin from *Viola tricolor*, unstable Crocetin from saffron, Taraxanthin, Cryptoxanthin from *Zea Mays* Rubixanthin.

Kuhn also had an important share in establishing the composition of Rodoxanthin and Astaxanthin as well as in discovering the connection of this latter carotenoid with the chromoproteids of the Crustaceans.Of great interest also are the many contributions Kuhn and his school have made to the perfection of the chromatographic method which is one of the most important aids to the isolation and synthesis of the different representatives of the carotenoid group

Kuhn's second great field of activity concerns the clarification of the Vitamin B complex. Kuhn has the great merit, together with von Szent-Györgyi and Wagner-Jauregg,

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of having been the first to isolate the extraordinarily important substance Vitamin B_2 (Lactoflavin or Riboflavin). He has made very important contributions to the elucidation of the chemistry of this substance.

From 5,300 litres skim milk Kuhn and his collaborators succeeded in liberating about 1g of a pure yellow substance, Lactoflavin, whose composition was found to be $C_{17}H_{20}O_6N_4$. A breakdown product of the Lactoflavin, which was called Lumiflavin, could be identified with a substance previously prepared from the yellow ferment occurring in yeast. By drawing up a structural formula for Lumiflavin later confirmed in various ways, Kuhn furnished a key to the chemical clarification of Lactoflavin. He himself demonstrated the Lumiflavin formula, which had been found by analytical methods, by a synthesis - namely through the condensation of an odiaminobenzene derivative with Alloxan.

At the beginning of 1939 Kuhn made his second significant discovery in relation to the Vitamin B complex. Together with Wendt, Andersag, and Westphal, he succeeded in isolating that component of the Vitamin B complex which is designated Vitamin B_6, the antidermatitis vitamin, and in a remarkably short time he was able to establish its chemical composition and structure (*Ber.*, 71 (1938) 1534; 72 (1939) 309). The substance which Kuhn thus elucidated, which he called *Adermin*, proved to be 2-methyl-3-hydroxy-4,5 - dihydroxymethylpyridine *.

For more details please visit:

http://www.nobelprize.org/nobel_prizes/chemistry/laureates/1938/press.html