

## **Nobel Prize in Medicines 1943**



**Henrik Carl Peter Dam**



**Edward Adelbert Doisy**

**The Nobel Prize in Physiology or Medicine 1943 was divided equally between Henrik Carl Peter Dam "for his discovery of vitamin K" and Edward Adelbert Doisy"for his discovery of the chemical nature of vitamin K"**

The Nobel Prize for Physiology or Medicine has been awarded this year for theoretically and practically important discoveries regarding the clotting or coagulation of the blood. The Danish investigator Henrik Dam received half of the 1943 prize for his discovery of the so-called vitamin K; and the American investigator E. A. Doisy received the other half of the same prize for the pure preparation, the determination of the chemical nature, and the synthetic production of that vitamin.

In 1929, at the Biochemical Institute of Copenhagen University, Dam was engaged on experimental studies on chicks, who received a diet extremely poor in fat. He then observed that the chicks after some time showed hemorrhages in different parts of the body and also, in one of them, that the blood sample coagulated slower than normally. In 1931 and 1933 American investigators made similar observations (Roderick, Holst, and Halbrook). Dam supposed at first that it was a question of scurvy, i.e. a deficiency of vitamin

C, but found, on continued investigation, that neither this nor any other known vitamin, nor cholesterol, could prevent or check the hemorrhagic tendency in the laboratory animals.

In cooperation with F. Schønheyder, it was found by Dam in 1934 that an addition of hempseed to the food prevented the bleedings. This forced him to the conclusion that hempseed must contain a still unknown substance which has a protective effect against certain hemorrhages. This substance, which was found to be necessary for the coagulation of the blood, is termed by Dam the coagulation vitamin or vitamin K. Dam moreover found that this vitamin occurs not only in the vegetable kingdom, for example in the seeds of cabbage, tomatoes, soya beans and lucerne, but also in certain animal organs, especially in the liver. Dam and the American investigator Almquist showed almost simultaneously that activity follows the non-saponifiable lipoid fraction. Vitamin K is formed also by bacteria in the intestinal canal, as was shown in 1938 by Almquist and his co-workers. The organism's need of this vitamin may thus be satisfied either by supply with the food, or by its formation in the intestinal canal.

The clotting of the blood in a wound is the result of a long series of processes. During the coagulation a fine-meshed network of fibrin is precipitated. This substance is formed from a protein body in the blood, termed fibrinogen, by the action of a ferment called thrombin. The latter, in turn, is developed from prothrombin, a substance formed in the liver. It was now found that vitamin K is essential for the formation of prothrombin. Deficiency of vitamin K leads to a lack of prothrombin and thus to a lack of thrombin. In consequence, the fibrinogen cannot be formed into the fibrin necessary for the coagulation of the blood.

Extensive continued investigations, in which Dam as well as many other investigators in different countries, especially in Denmark and America, took active part, have shown that a lack of prothrombin, due to a deficiency of vitamin K, occurs in certain liver and intestinal diseases in man as well as normally in newborn babies, and that this deficiency can be made good by the supply of vitamin K.

Concurrently with these researches, great efforts were made in several quarters to ascertain the nature of vitamin K. As far back as 1938, Dam himself succeeded in preparing from lucerne an oil with a high content of vitamin K. He afterwards collaborated with a group of Swiss investigators under the leadership of the famous vitamin chemist Karrer, winner of the 1937 Nobel Prize for Chemistry. In America the problem was taken up in several leading biochemical laboratories and there was a regular race to solve the riddle of vitamin K.

The other winner of the Nobel Prize for 1943, Edward A. Doisy, of St. Louis, already a world-renowned biochemist, was the first to arrive at the goal. Together with his collaborators, he succeeded, in 1939, in preparing vitamin K or rather two different K vitamins, namely K<sub>1</sub> from lucerne seed and K<sub>2</sub> from fish meal, in a pure crystalline form. In the very same year Doisy reported that, together with his associates, he had succeeded not only in determining the chemical structure of vitamin K - it was found to be a naphthoquinone derivate - but also in synthetically preparing in his laboratory a K vitamin identical with the natural one. This, which was achieved at about the same time also by other American investigators, has greatly facilitated the medical use of vitamin K.

It was in fact soon found that this vitamin was to assume great importance in the treatment of hemorrhagic diseases in man. Certain diseases of the liver and gall ducts with jaundice are characterized by a marked tendency to hemorrhage, and it was found that this tendency, being due to a lack of prothrombin, could be remedied with vitamin K. In this way operative treatment in such cases has become much less risky than before. Also in certain protracted intestinal diseases there is a hemorrhagic tendency, due to insufficient absorption of vitamin K through the intestine. These cases too have been successfully treated with vitamin K.

It is, however, in the checking of hemorrhages in newborn babies that this vitamin has assumed its greatest practical importance. At this early age, hemorrhages - sometimes involving menace to life - occur far oftener than in more advanced stages. A great many of these cases have proved to be due to deficiency of vitamin K and can be cured by the supply

of that vitamin. What is more, by treating the mother shortly before delivery, or the newborn child immediately afterwards, it is possible also to prevent the occurrence of such hemorrhages. Even if there are also neonatal hemorrhages which are not due to a lack of vitamin K and therefore cannot be cured by the supply thereof, the number of cases of such deficiency in the neonatal stage is rather large, and then vitamin K often conduces to save life. Indeed, it may be said that the discovery of vitamin K has revolutionized the treatment of these not uncommon cases.

The discovery of vitamin K, the elucidation of its nature and its synthetic preparation are medical discoveries of high rank and of great importance both in theory and in practice. We have been brought nearer the understanding of the complicated process involved in the coagulation of the blood, and light has been cast on the etiology of previously obscure hemorrhagic diseases both in adults and in children. Finally, we have obtained an extremely valuable remedy for the prophylaxis of these hemorrhages as well as for their treatment. The splendid discoveries regarding vitamin K, for which the Caroline Institute this year has had the gratification of awarding a prize, are truly in the best conformity with Nobel's magnanimous desire to reward discoveries which have been of great benefit to mankind.

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

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