obituary

Carl Peter Henrik Dam died in April 1976. He was born at Copenhagen in 1895 and educated there. He went to Graz (1925) to be trained in micro-analysis under Pregl and later worked with R. Schoenheimer at Freiburg (1932–33) and with P. Karrer at Zurich. He always tried to keep up his skill as a chemist while steadily widening his biological interests.

Early in his career (1929) Dam made the first observations that led by stages to the discovery of vitamin K and other 'bioquinones' and towards the end of his career his friends delighted to remind him "How far that little candle throws its beams".

He began by testing a claim that chicks could not thrive on an almost sterol-free diet. Some of his birds unexpectedly displayed haemorrhages under the skin, in muscles or other tissues, and the coagulation of their blood was much retarded. McFarlane in Toronto confirmed this. Dam's research was delayed by his visit to Freiburg, but on his return he and Schönheyder found that the chick symptoms were not due to sterol deprivation but to a dietary lack of anti-haemorrhagic vitamin from plants, first designated vitamin K and now known as phylloquinone. A chick bioassay was used to monitor the separation of lipid factors from alfalfa. Dam joined forces with Karrer in isolating and characterising the vitamin which was recognised (both at Zurich and in the USA) as 2-methyl-3-phytyl-1,4-naphthoquinone. With the methods then available this was a considerable feat. Phyloquinone is, quantitatively, a minor constituent of the quinones present in chloroplasts, and although the bio-assay successfully led to the vitamin, the more plentiful quinone congeners were missed.

It was found in the USA that putrefaction of ether-extracted fish meal changed it from a very poor to a very potent source of vitamin K activity. The formation of vitamin K by bacteria was followed up by Almquist and Stokstad and by Doisy's group. In addition to isolating phylloquinone they obtained a second vitamin K (at first known as vitamin K_2 but now as a menaquinone). The new form was a 2-methyl-3-polyprenyl-1,4-naphthoquinone which later turned out to be one member of a large family of menaquinones denoted MK-*n*, where *n* is the number of prenyl (C_5H_8) groups in the polyprenyl sidechain.

Vitamin K activity was also found in a number of simpler but related substances (for example 2-methyl-1,4-naphthoquinone, or menadione, and numerous esters of derived quinols). These substances were seen as provitamins K. A new facet to the larger problem was Link's isolation and characterisation from spoiled sweet clover hay of dicoumarol, a specific vitamin K antagonist. The number of antagonists is now large, some of the best-known being dicoumarol, Warfarin, phthiocol, sulphaquinoxaline and actinomycin D.

The coagulation of blood is envisaged as a complex but ordered succession of processes, and at least four of the many factors (prothrombin, proconvertin, Christmas factor and Stuart factor) are known to be dependent on vitamin K. Of these the deficient chick lacks only the Christmas factor. Dam's group studied neonatal bleeding disorders, and advocated the administration of vitamin K to mothers a few hours before parturition. They also noticed that cows' milk is much richer in vitamin K activity than human milk.

In 1940 Dam went on a lecture tour in the USA and Canada and then became a Senior Research Associate at the University of Rochester (1924–45) returning to Denmark in 1946. In 1943 Dam and E. A. Doisy shared the Nobel Prize for Physiology and Medicine. While still in the USA Dam had been appointed to the Chair of Biochemistry and Nutrition at the Copenhagen Polytechnic Institute which he held until his retirement in 1965. He also played a leading part in the work of the Danish Fat Research Institute (1956–63). He led a research school and published nearly 300 papers mostly concerned with cholesterol, vitamin E and vitamin K. His review articles were models of fairness and acumen as well as deep scholarship.

In 1966 the 4th Roche International Symposium was held at Elsinore in his honour. It was entitled 'Recent Advances in Research on Vitamins K and Related Quinones (Ubiquinones or Coenzymes Q and Plastoquinones)'. By that time the chemical diversity within the major families or bioquinones was evident and the central biological roles of quinones, quinols and chromanols had become as acceptable as they were surprising.

The 'prothrombin' synthesised by cattle given dicoumarol is not effective in blood coagulation and fails to bind calcium ions or phospholipids. Ten defined positions on the sequence 1–42 are occupied by glutamyl residues, whereas in normal prothrombin all ten are carboxylated to a previously unknown γ-carboxyglutamic acid. The vitamin K-dependent step in the formation of prothrombin is a post-synthetic γ-carboxylation of a precursor made in liver. Thanks to coalescing research from Denmark, Sweden, the USA and Britain, the principal role of vitamin K in the animal is perhaps now clear in the sense that what the vitamin does is established, if how it does it remains to be worked out.

At the symposium in his honour Dam was obviously gratified by developments arising from his original observations and it is very fitting that the recent work, entirely contemporary in its approach, should have come so near to rounding off his discovery.

Professor Dam travelled a good deal and was among the best known and most welcomed scientists in an ever-widening field.

R. A. Morton

announcements

Awards

The **William Bate Hardy Prize** of the Cambridge Philosophical Society has been awarded to **Dr F. Sanger, FRS**, of King's College for his distinguished work on the sequencing of DNA.

The Société Française de Physique has made the following awards:

Le grand prix de physique Jean-Ricard to **Georges Slodzian** of the University of Paris-Sud (Orsay)

Le prix Robin to **Jacques Prentki** of the College de France