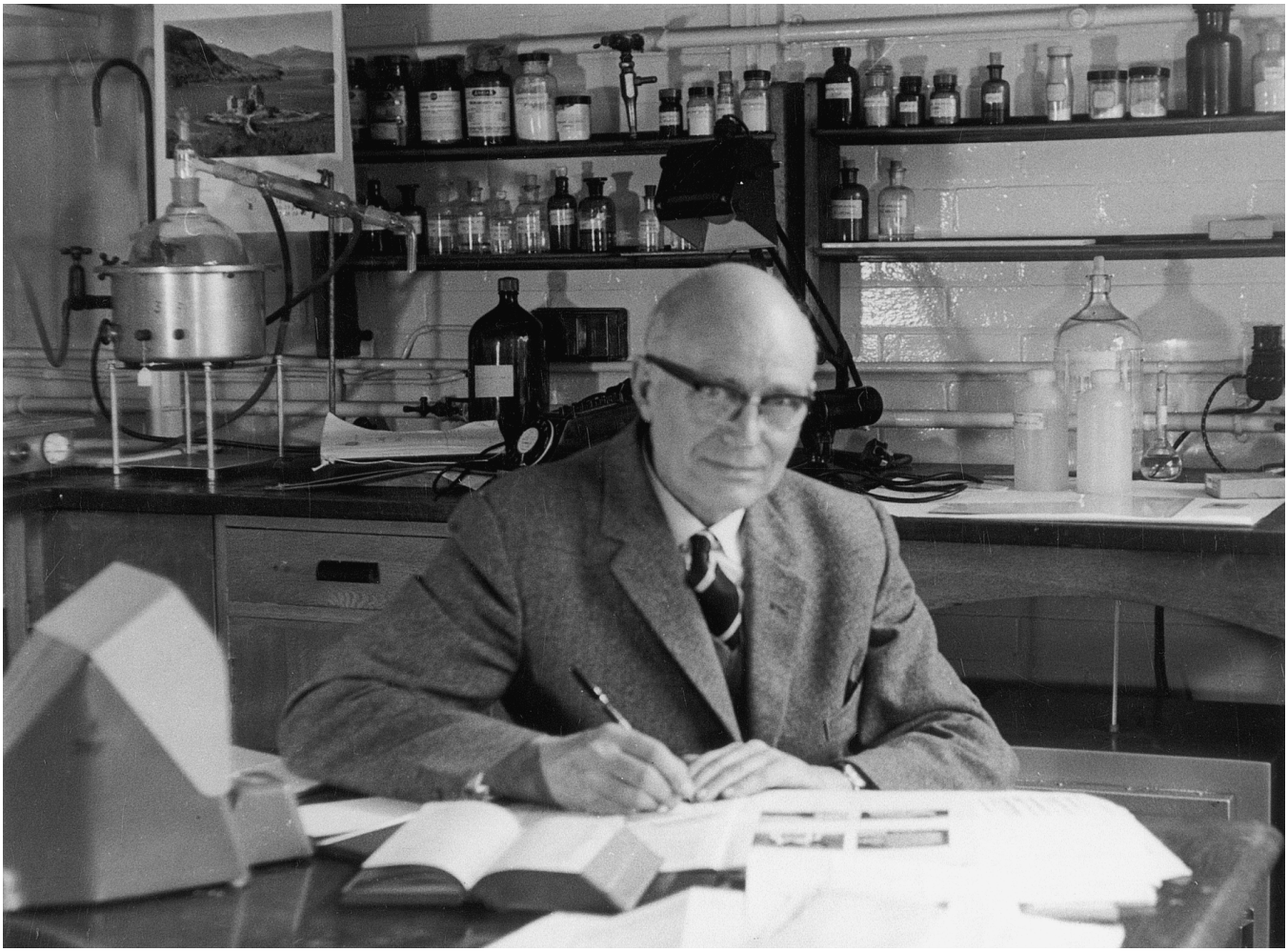
An appreciation

Thomas Moore
Sc.D., D.Sc. (Queen's University, Belfast), PhD (Cambridge), F.Inst Biol., F.R.S.H.
1900–99
Deputy Director, MRC Dunn Nutritional Laboratory, 1927–65



Thomas (Tommy) Moore was born on 1 January 1900, and he died at the age of 99 years and 6 months exactly, on 1 July this year. His work at 'The Nutritional Laboratory, Cambridge', later the 'Dunn Nutritional Laboratory' will be most widely remembered for his discovery that carotene can be converted to vitamin A in animals, thus establishing a pathway that is crucial both for nutritional biochemistry and for public health.

Tommy's father was Professor Benjamin Moore, D.Sc., F.R.S. (1867–1922), who was the first Professor of Biochemistry in the whole of Britain at the University of Liverpool, who founded the *Biochemical Journal* there, and who later taught at Oxford University.

Before arriving in Cambridge, Tommy had already received a doctorate from Queen's University, Belfast. On his arrival in Cambridge in the late 1920s, he joined Sir Frederick Gowland Hopkins at the newly-built University Department of Biochemistry on Tennis Court Road. Hopkins was building upon his own earlier work on 'accessory food factors', focusing on the newly-emerging vitamins. He decided to encourage the MRC to build a new research laboratory where animal-based work could more

https://doi.org/10.1017/S0029665199001019 Published online by Cambridge University Press

easily be pursued, on the northern side of Cambridge. Funds were still available from the Sir William Dunn Estate, after the new Biochemistry Department had been completed.

When Tommy arrived at Hopkins' department he began by drying large quantities of stinging nettles on the marble floors, in order to extract the xanthophyll pigments, and then feed them to his rats. This may have slightly strained relationships, and perhaps helped to ensure that his future would lie at the new research laboratory rather than in the teaching department! Together with Dr Leslie Harris, who was appointed as the first Director of the Nutritional Laboratory in 1927, Tommy thus began a lifetime of work on the fat-soluble vitamins, initially in conjunction with Leslie Harris, but soon pursuing the vitamin A story on his own.

It had already been established that cod-liver oil was a rich source of the fat-soluble vitamins, of which there were two known members: A and D. It was suspected that the plant carotenoid pigments might be precursors of vitamin A, but contemporary work in other laboratories had failed to detect any growth-promoting activity of a supposedly pure sample of plant carotene, in a vitamin A-deficient rat model. It is probable that this failure was due to rapid oxidative destruction of the carotene in the oil used to dissolve it. The experimental procedures available then were fairly basic: they relied heavily on rat growth studies (which are demanding, time-consuming and not very precise or reliable), and crude colorimetric assays, using a device for comparing the intensity of coloured solutions with those of coloured glass, known as a 'Lovibond tintometer'. However, by using a combination of these techniques, and the newly-developed 'Carr-Price' assay for vitamin A, which depended on the formation of a transient blue colour after its reaction with antimony trichloride in chloroform, Moore was able to show that purified plant carotene, given in sub-milligram amounts to vitamin A-deprived rats, resulted in the hepatic accumulation of new material with the characteristic properties of vitamin A. On 24 August, 1929, this was described in his paper in *The Lancet*, entitled: 'The Relation of Carotin to Vitamin A'. In the same year he showed that carotene can efficiently restore the growth of vitamin A-deprived rats, and that light is not needed for the carotene–vitamin A conversion (in contrast to the cholesterol–vitamin D conversion process).

Both vitamin A deficiency and the toxicity resulting from vitamin A excess were studied extensively at this time (and the same was true for vitamin D, which was separately studied by Harris and his colleagues). Moore found that certain sources of animal liver, notably those of seals and polar bears from the Arctic, contained such large amounts of vitamin A that they were toxic to rats and (by report) also to man. However, plant carotenes did not exhibit this dangerous toxicity, even in very large doses.

During the Second World War, Moore contributed to the important wartime studies on human vitamin requirements which were carried out at the Sorby Institute in Sheffield. He measured the vitamin A and carotene contents of human plasma and liver autopsy samples from many different parts of the country. Fortunately, it transpired that there was little evidence of a deleterious effect of the wartime diet on the vitamin A status of the population. However, he was able to demonstrate intriguing regional and sex differences in the status indices. He also measured vitamin A status of patients with a very wide variety of specific diseases, to explore the possibility that vitamin A might have a part to play in therapeutic practice.

A single German bomb fell near the Cambridge laboratory during the war; it failed to damage the laboratory or harm its occupants, but it did demolish Tommy's leek crop, much to his chagrin!

His 'tour-de-force' 654-page monograph on 'Vitamin A' was published by Elsevier in 1957. In the Preface he writes: 'The contents of drawers of reprints, several feet thick, cannot easily be condensed between the narrow covers of a book. It is difficult for a single author to follow his subject into widely different branches of science, including chemistry, physiology, biochemistry, pathology, medicine and spectroscopy'. Few would attempt such a task today! – but his book remains a very valuable compendium of the older literature on vitamin A, which is not accessible through electronic searches.

Apart from his wide-ranging work on vitamin A, Tommy pursued many other challenges, especially from other fat-soluble vitamins and nutrients, notably vitamin E. During the 1930s, a young graduate, A. J. P. Martin, joined his group from the Biochemistry Department, to tackle the demanding task of isolating vitamin E from wheat-germ oil. To do this, Martin developed a new countercurrent distribution apparatus, the principles of which led later to the development of paper chromatography and gas–liquid chromatography, for which Martin was later awarded the Nobel prize together with R. L. M. Synge.

Tommy continued his studies of vitamin E, in partnership with Dr Ivan Sharman and other colleagues. They showed, for instance, that the pathological effects of chronic vitamin E deficiency in rats eventually become irreversible, and that the high levels of polyunsaturated fat present in cod-liver oil impose an extra requirement for vitamin E to achieve maximum protection against tissue damage. They also found that selenium and certain redox dyes can protect animals against some of the effects of vitamin E deficiency.

Clearly, Tommy's scientific career was a long, eventful and exciting one. He had the foresight to select a subject which was just about to 'take off' in the late 1920s, and he pursued it with vigour and imagination. He will also be remembered as one who loved company, and as a family man who was devoted to his Irish wife Jane, and his four children, Jennifer, Ben, James and Elisabeth. A friend of the family recalls that his birthday, on 1 January each year, was always marked by goose for dinner, followed by a visit to the Arts Theatre. He was also a poet in his spare moments, and one of his most devastatingly witty poems, written at the age of 94, was printed in *The Lancet*.

Tommy will be remembered with affection by all who knew him. He has also inspired a generation of scientists worldwide, to tackle the unsolved challenges that were first defined during the formative years of modern vitamin research.

Chris Bates

https://doi.org/10.1017/S0029665199001019 Published online by Cambridge University Press