

which Maxwell's velocity-distribution function is valid. An explanation is given of the method of characteristics which is applied to one-dimensional expansion waves and steady two-dimensional flow around the outside of a bend. Chapter 4 discusses non-isentropic flows, particularly in a shock wave and in the boundary layer at a flat plate. The remaining chapter is concerned with momentum and heat transfer in free-molecule flow, and the effect of slip and temperature-discontinuity at a wall in ordinary boundary-layer problems. The Knudsen number is supposed either to be fairly large or fairly small. The transitional regime, in which this number is comparable with unity, is one in which the problems, though interesting, are mostly unsolved, and only one or two allusions are made to them. The treatment throughout the book is mainly mathematical, but there are numerous comparisons with experiment.

The book ranges over an enormous scale of subjects, and attempts to develop most of them from first principles. Inevitably this means that there are omissions and difficulties in the argument, which are sometimes serious when physical explanations are concerned. A reader without previous knowledge could not derive from this book alone a correct idea as to when flow is isentropic, and his ideas on the relation of relaxation processes to bulk viscosity could scarcely be clear. He would certainly wonder how to interpret Fig. 16 on p. 62, and would have great difficulty in ascertaining what problem is being considered in section 5.8. For such reasons as these I wish that the author had tried to cover less, and to spread himself more on the rest.

The book is undeniably stimulating, but to derive full benefit from it one needs to supplement it by further reading, for example, from the numerous papers to which references are given.

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VITAMIN A

Vitamin A

By Dr. Thomas Moore. Pp. xx+645. (Amsterdam: Elsevier Publishing Company; London: Cleaver-Hume Press, Ltd.; Princeton, N.J.: D. Van Nostrand Company, Inc., 1957.) 76s.

IN 1915 McCollum and Davis took the initial step in the long journey towards the sub-division of the vitamins by postulating the existence of two factors, Fat-Soluble A and Water-Soluble B. Vitamin A was distinguished from vitamin D a little later, and thus it was found that cod liver oil which had been heated and aerated lost all its anti-xerophthalmic and growth-promoting power, but remained effective in curing rickets. Biological assays, mainly on rats, indicated a very wide distribution of vitamin A-active material in plant products and animal products such as butter, eggs, liver and especially fish-liver oils. An association between yellow colour and vitamin A activity was explored by Steenbock, von Euler and others, and it became clear that the plant pigment carotene was a potent source. Progress in another direction, however, had shown that the vitamin A-active fish-liver oils showed no parallelism between potency as measured by bioassays and yellow colour. The vitamin A of liver oils was characterized by its ultra-violet absorption

and by the blue colour test which it gave with antimony trichloride. In 1929 Dr. Moore himself carried out experiments which elegantly demonstrated that carotene is a precursor of vitamin A, in the sense that ingestion of this highly coloured fat-soluble hydrocarbon by animals deficient in vitamin A results in the appearance of colourless vitamin A in the liver.

Improved analytical methods, mainly spectrophotometric, led quickly to the discovery that some fish-liver oils were very rich sources of vitamin A, and also led to the recognition of a second active material designated vitamin A₂ and obtained more readily from the liver oils of certain freshwater fishes. Similarly carotene was sub-divided into α -, β - and γ -isomers. Organic chemists, led by Karrer, Heilbron and others, established the structures of the carotene isomers and of vitamin A₁ and that of vitamin A₂ followed after a considerable interval. It is possible to-day to purchase synthetic pure β -carotene and vitamin A at very reasonable prices. Behind this is remarkable technical achievement in which Isler played a big part.

The past thirty years have seen the fish-liver oil industry, once concerned only with cod, extended to halibut, shark and tunny and many other species. This expansion has served the general welfare by providing vitamin oils for human and animal prophylaxis. Synthetic vitamin A and carotene are added to margarine to the levels found in good butter. The part played by vitamins A and their aldehydes, retinene₁ and retinene₂, in the formation of visual pigments has become fairly clear but much less is known concerning the systemic mode of action of vitamin A.

The literature concerning this vitamin is now very large, but Dr. Moore's book is admirably selective. The chemistry of provitamins and vitamins A and various analytical problems are adequately described, and the author's experience and judgment are seen to great advantage in a very thorough discussion of the physiology and biochemistry of vitamin A and its provitamins. This section covers absorption, storage, mobilization and transfer from mother to offspring, as well as biological activity in relation to structure. Another section deals with the pathology of vitamin A deficiency or excess. This is followed by a long but very well-planned review of vitamin A in man. Chapters are devoted to special topics such as vitamin A in relation to sex, and vitamin A and the thyroid. The final chapter consists of a shrewd assessment of our present knowledge of vitamin A. This is followed by a number of useful appendices.

This book must at once take its place as the standard work on a subject with many ramifications. The presentation is lucid, and the author does not lose sight of the fact that his readers will differ greatly in training and interests. Dr. Moore has tried earnestly to recognize 'the originator of every important discovery' in the field and in this task he has demonstrated fairness and sound scholarship. The book is illustrated with well-chosen photographs and diagrams, and each section is fully documented. Research workers interested in vitamin A from almost any angle will find in Dr. Moore a safe guide to the frontier of knowledge. He does not often venture far over the frontier, but the urge to do so can often be read between the lines of the restrained and modest narrative.

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