systems for the transport of different groups of amino acids, and S. J. Gray and collaborators present the first proof that these systems operate in man. It is evident from their work, however, that normal transport capacity across the intestinal wall is far in excess of the quantities of amino acids obtained from food.

D. H. Elwyn's discussion of the modification of plasma amino acid patterns by the liver, Wool and Scharff's description of the effect of insulin and diabetes on amino acid transport in muscle, and H. N. Munro's masterly Allison Memorial Lecture are particularly useful. Munro analyzes the evolutionary differences between rat and man in a way which rationalizes the differences in amino acid metabolism and its response to diet in the tissues of these two species. A. Lajtha and co-workers' finding that different regions of the brain vary in free amino acid pattern and amino acid uptake has already stimulated research on the origin of these differences.

The usefulness of the book for its intended audience of research workers in related fields would have been improved by inclusion of some of the discussion which took place at the conference and by an index.

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Nuclear Motion

Collective Models of the Nucleus. J. P. DAVIDSON. Academic Press, New York, 1968. xiv + 238 pp., illus. $12. Pure and Applied Physics.

In the study of collective models of nuclear behavior, attention focuses on modes of motion such as the rotation of the nucleus or the vibration of the nuclear surface, which clearly require the cooperation of a large number of individual neutrons and protons. In the original formulation of such models by A. Bohr and in their development by Bohr, Mottelson, and their collaborators at Copenhagen, a liquid-drop analogy played a fundamental role, both suggesting the general forms of the phenomenological analysis and providing provisional estimates for some of the constants (collective parameters) occurring therein. It has since been realized that the general form of the collective models is quite independent of the hydrodynamic underpinning. Moreover, much deeper theories of the collective parameters, based on the shell model, have been developed to supplement or replace the more naive classical estimates.

To the practicing nuclear theorist, these developments have meant that he could conceive and enjoy a passion for the concepts of collective motion within diverse traditions. J. P. Davidson is mainly known for his assiduous efforts in developing the consequences of the purely phenomenological theory. This is an essential task. For nuclei in the range of atomic numbers $150 \leq A \leq 190$, $A \geq 225$, the so-called deformed regions, the attendant nuclear model is the most precise and successful one we have. It is based on a picture of the nucleus as having an ellipsoidal shape which can slowly rotate. At somewhat higher excitation, the surface can vibrate, preferentially preserving the ellipsoidal symmetry, though more complicated (octupole, hexadecupole, and so on) modes of vibration and individual nucleon degrees of freedom may also manifest themselves. Only recently have experimental results become sufficiently precise and extensive to permit a careful study of the mutual influence of the rotational and vibrational degrees of freedom.

Davidson's monograph is a more than adequate presentation of the concepts and results necessary for the understanding of these developments. It is the only essentially complete account of the purely phenomenological part of the theory to appear between hard covers, though several review articles of comparable quality, including a fairly recent one by Davidson himself, are to be found in the periodical literature and as parts of larger studies. Excepting the influence of the collective degrees of freedom on nuclear reactions, all important topics are at least mentioned. The treatment of fundamentals is concise, thorough, and noticeably lacking in pedantry.

Despite its virtues, *Collective Models of the Nucleus* lacks any sense of excitement. Partly this is due to the author's deliberate exclusion of the microscopic parts of the theory. (Though he cites monographs which include accounts of the latter, these are equally monolithic in *their* interests and equally lacking in perspective.) Another deficiency is the tendency to treat the hydrodynamic prediction of parameters too seriously. The impression this leaves is heightened by the absence of any real moderating influence of more recent theories. For these reasons the volume can be recommended without reservation only to the experienced worker who can supply his own perspective and for whom it can serve as a most useful compendium of results and as a source of references. The neophyte can benefit from many excellent accounts of details of the subject, but will need outside help to emerge with anything deeper and broader.

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Helium outside the Laboratory

Technology of Liquid Helium. R. H. KROPSCHOT, B. W. BIRMINGHAM, and D. B. MANN, Eds. National Bureau of Standards, Washington, D.C., 1968 (available from Superintendent of Documents, Washington, D.C.). x + 374 pp., illus. $2. NBS Monograph No. 111.

This book appears just 100 years after the discovery of the element helium. Unlike most books on liquid helium, which concentrate on the remarkable physical properties of this fluid and their bearing on some of the most fundamental problems in physics, this book attempts to present a detailed basic discussion of the technology associated with large-scale production, storage, and use of this cryogenic medium.

The two most striking developments associated with the technology of liquid helium over the past two decades are, undoubtedly, the "Collins cryostat" and the vast use of cryogenic fluids in the space program. The Collins cryostat, by putting liquid helium within the reach of virtually every physicist, led to an enormous increase in the amount of experimental research conducted at very low temperatures. The demands of the space program, on the other hand, led to a concentrated attack on increasing helium production from natural-gas sources and on techniques of refrigeration, distribution, and handling. The tremendous impact of these developments is apparent in each chapter of this book.

Eight chapters, written by a number of specialists, including Samuel Collins,