L residues in poly-DL-alanine is very nearly random. Furthermore, Englander and Poulsen[9] have shown that hydrogen–tritium exchange rates of poly-DL-alanine (degree of polymerization = 29) are similar to those of random chain polypeptides and unhindered amide nitrogens. It seems reasonable to assume, therefore, that the DL-polymer used in the present studies is in a random coil, disordered conformation throughout the entire range of solvent compositions. Consequently, the resonance at 3.72 ppm in the DL-polymer in $CDCl_3$ and 3.9 ppm in $CDCl_3$–CF_3COOH mixtures cannot be an expression of a helical conformation. Furthermore, the simultaneous presence of two resonances in solvent mixtures containing acid cannot be ascribed to the simultaneous presence of two conformations, helical and random coil macromolecules in solution. These shifts, however, are thoroughly consistent with the view that addition of CF_3COOH to the polypeptide solution leads to protonation of the amide group.

Values of the chemical shifts of the α-CH proton of other synthetic polypeptides in various solvents are assembled in Table II. The δ observed is placed in the "helix" or "random" column on the basis of the diagnosis of conformation provided by optical rotatory dispersion measurements. For polybenzyl-DL-glutamate Tsuboi, *et al.*,[10] found that 70% of the residues are in the random conformation in the polypeptide with a degree of polymerization of about 80. Nevertheless, dissolved in $CDCl_3$, the disordered DL-polymer shows the same δ (3.95 ppm) as does the helical L-polymer.[11] Likewise, both show a shift in δ to 4.45 ppm in the mixed solvent CF_3COOH–$CDCl_3$.

We conclude, therefore, that the previous assignment of the α-CH nmr resonances to helical and random conformations is not tenable since DL- and L-polymers show essentially the same δ's. Similarly the attribution of low-field and high-field α-CH peaks to different molecular weight fractions of a polydisperse sample of polypeptide is also not likely since in essence this explanation also depends on the assignment of different δ's to helical *vs.* coil conformations.[5,12] On the other hand, the parallel behavior of DL- and L-polymer, particularly in the detailed study of polyalanine, is consistent with the interpretation of the effect of added strong organic acids as due to protonation of the amide groups.[3,4,13]

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Book Reviews

The Mathematical Theory of Non-Uniform Gases. An Account of the Kinetic Theory of Viscosity. Thermal Conductivity and Diffusion in Gases. Third Edition. By Sydney Chapman, F.R.S., Geophysical Institute, College, Alaska, National Center for Atmospheric Research, Boulder, Colo., and T. G. Cowling, F.R.S., Professor of Applied Mathematics, Leeds University. Cambridge University Press, 32 East 57th St., New York, N. Y. 1970. xxiv + 423 pp. 16 × 23.5 cm. $16.00.

This third edition of the "Mathematical Theory of Non-Uniform Gases," although extensively revised, continues in the same spirit as the two previous editions. As the authors state, the book is addressed to the mathematician and theoretical physicist but with an effort, which is by and large successful, to gather the results together in such a way as to be useful to experimentalists in physics and chemistry. The methods used are those of statistical mechanics so that an equally descriptive title would have been the Statistical Mechanics of Non-Uniform Gases except that it would have left out the bias toward analytical solutions. Thus the authors make no mention of the extensive numerical calculations now being made of the mechanical behavior of around a thousand interacting molecules. Such results are especially useful in checking analytical solutions of proposed models. However, the qualified readers will find here a clear, concise, self-contained theory of not too dense gases.

Classical mechanics is used in general, but quantum mechanical corrections are introduced where needed, and quantum theory is applied to transport properties in a direct workmanlike way in Chapter 17. The final chapter on electromagnetic phenomena in ionized gases is especially interesting and is in keeping with the high standards of the rest of the book. A final historical summary highlighting major developments in the theory of gases closes with Chapman and Enskog's development of the complete equations of diffusion on heat conduction in a mixed gas. The history after 1920 must be gleaned from the rest of the book. Anyone interested in the theory of gases cannot afford to be unacquainted with this book.

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The Chemical Physics of Ice. By N. H. Fletcher, Professor of Physics, University of New England, Armidale, New South Wales. Cambridge University Press, 32 East 57th St., New York, N. Y. 1970. x + 271 pp. 15 × 22 cm. $13.50.

In his preface Dr. Fletcher states that he has written the book for senior undergraduate and graduate students in physics or physical chemistry, and for scientists interested in ice for its own sake—glaciologists, cloud physicists, and the like. He further states that he has not tried to be encyclopaedic but has tried to produce a connected and well-documented account of what seems to him to be the major areas of interest. The reviewer's main thoughts are that he has succeeded magnificently in his objectives, that the book should be immensely useful to those for whom it is intended, and that anyone interested in ice will find this book extremely valuable.

The book is extremely well written and is very easy to read and understand. Dr. Fletcher shows great ability in critically reviewing the literature and extracting from it the more definitive information and ignoring, or clearly indicating, the more speculative conclusions. The author shows great courage by stepping slightly aside from the main purpose of the book and undertaking a review of the publications in the past decade on the structure of liquid water. This is a highly controversial area, filled as it is with postulates that are extremely difficult to prove or disprove experimentally, yet Dr. Fletcher sails through it easily, with a suggestion of his own prejudices showing.

One of the impressive features of the book is the range of topics covered. The book opens with a discussion of the properties of the water molecule, including theoretical studies of the electronic structure of the molecule and of intermolecular forces, and the information gleaned from spectroscopy. Discussion then turns to the structure of ice Ih (the ice with which most people are familiar) and of the many polymorphic phases of ice, reviewing the X-ray diffraction and vibrational spectroscopic studies. The structure of liquid water is reviewed next, followed by fairly detailed, yet easy to follow, accounts of the freezing process (nucleation) and crystal growth. Dr. Fletcher next discusses the thermal properties and lattice dynamics of ice, and the point defects that occur, and finishes with a presentation of the mechanical properties and a fairly long account of the electrical properties of ice, including thermoelectric effects. In several of the chapters Dr. Fletcher has succeeded admirably in introducing the reader to a subject and bringing him more or less up to date on the state of knowledge in that subject as it applies to ice.

The book is well referenced; the only omission that struck me forcibly was the lack of references in Chapter 7 on the question of the introduction of impurities into ice, which has been the subject of some debate. The book appears to contain few errors, although when a book contains the range of subject matter that this book contains relatively few people are competent to be definitive about this for all chapters. However, on page 137, the peak in the infrared spectrum near 3200 cm^{-1} in D_2O ice is assigned to combination band absorption, which is misleading because in the figure on page 136 the peak shown at about 3200 cm^{-1} in 95% D_2O ice arises from the O–H stretch of HDO molecules in the ice.

As is always the case when an author excellently reviews an active field, one regrets, to some extent, that publication occurs when it does, because very recent work is not included. In this case the references appear to cover the period up to 1967.

In summary, I thoroughly recommend this book to anyone who is interested in the chemical and physical properties of ice, and, as such a person, I am very grateful to Dr. Fletcher for writing a book that will be a well-used addition to my library.

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