Protein crystallography

Protein Crystallography. By T. L. Blundell and L. N. Johnson. Pp. xiv+565. (Academic: London, New York and San Francisco, 1976.) £17.00.

FOURTEEN years after the award of Nobel prizes to Crick, Kendrew and Perutz, this is the first textbook to be published on protein crystallography by an established practitioner in the field. Perhaps this indicates the compulsive preoccupation of the protein crystallographer with the mechanics of his work, but in any case the event is to be welcomed.

One of the attractions of protein crystallography is that narrow specialisations are not allowed. Without sound grounding in mathematics, physics, crystallography, inorganic chemistry, organic chemistry, biochemistry and biology, one will constantly run into problems one cannot evaluate. The experimenter needs in addition a smattering of knowledge of instrument design, high vacuum technology, electronics, chemical engineering and computer science. Such versatility is demonstrated admirably by the authors.

The character of the book as a work of scholarship first emerges in a discussion of the selection of heavy metal compounds for introduction into proteins to provide isomorphous crystalline derivatives. The chemistry of different classes of transition metals and the properties of various categories of complex ion are related to the types of isomorphous substitution which have been obtained. Much of what is offered has not appeared in any review—it is an original arrangement and interpretation of the evidence leading to conclusions which are perfectly orthodox as inorganic chemistry, but which will profoundly change the strategy which protein crystallographers adopt.

Another penetrating analysis deals with an unresolved conflict in the literature between two methods for the exploitation of anomalous scattering effects, due to A. C. T. North and B. W. Matthews. The germ of the idea is traced back to an Oxford thesis by M. Harding; we are led forward to an analysis with no approximations by Singh and Ramaseshan; a tacit assumption in Matthews' choice of the positive value of a square root is pointed out, and his method is clearly related to the "FHLE" method.

In a survey which ranges from film developing technique and microdensitometry to the exploitation of electron diffraction and Mossbauer scattering there are many other stimulating and original insights. The expert will derive refreshment and pleasure from them. Unfortunately the beginner will be less satisfied. The authors have provided introductory chapters which seem to be aimed at students who know no biochemistry and no crystallography. These chapters make no concessions to the problems of teaching these subjects, and provide an inappropriate *hors d'oeuvre* to the main meal. Some of the obscurities are simply slipshod (that hydrolysis of proteins with boiling mineral acids yields mixtures of up to twenty amino acids), but others will cause serious confusion (the only definition of a Fourier transform is to use it as a synonym for diffraction pattern, for example).

In practice the price of the volume will keep it out of the hands of students, at least in Europe, and it seems a pity that the authors should have misdirected so much effort to cater for them. A good student text is still desperately needed. The book is splendidly up-to-date, including many 1976 references. For some reason the first few pages look rather as though they have been set on a pre-War typewriter, and occasionally one can see evidence of proof corrections, but otherwise the book is well produced. It was a surprise to see several familiar illustrations without acknowledgment.

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Plutonium and other actinides

Transuranium Nuclides in the Environment. (Proceedings of a Symposium organised by the US ERDA and the IAEA, San Francisco, 1975.) Pp. 724. (IAEA: Vienna; HMSO: London, 1976.) £22.88.

THESE 41 technical papers form an indispensable basis for assessing the "growing concern about man's ignorance of the biogeochemistry of [plutonium and other actinides] . . . in relation to long-term buildup, availability, and transport in the environment" (Noshkin). Nowhere is this concern more apt than the UK, which reportedly discharges to the Irish Sea some 0.3% of its Pu throughput—of the order of 10^4 Ci since 1960.

The message of these papers is clear: our ignorance of pathways is extensive for Pu and is virtually complete for the higher actinides (such as Am) that are more active biochemically and that may be the dominant hazard. Among the wide range of concentration factors for Pu and higher actinides—from none to several orders of magnitude per trophic level, and from strong discrimination to modest concentration in food chains—exceptions are more common than rules. Unexpected interactions with soil microbes, natural chelates, marine worms, mammalian digestive fluids, and fungi (some of which incorporate actinides into aerial spores) likewise falsify familiar axioms. Particle size is important to these effects, to astonishingly high mobility in soil, to resuspension and adsorption on plant leaves, and to human inhalation (generally a greater hazard than ingestion). Even the chemical behaviour of, say, ^{238}Pu and ^{239}Pu differ markedly. And Pu contamination is indeed ubiquitous: quoted ranges exceed 40 km for routine emissions of a US reprocessing plant, 80 vertical m for bomb residues in coral, and 500 km for dust from Nevada dispersion tests. Both on land and in water, Pu concentrations can be far lower *at* a point source than at distant sites of favoured deposition.

The most impressive and disquieting example cited is G. L. Meyer's celebrated account of Maxey Flats, Kentucky, a site containing some two-thirds of all US commercial low level nuclear wastes buried during 1963–74. Over 1.6 MCi, including over 80 kg ^{239}Pu and unknown amounts of 300-odd other nuclides, were buried in steel drums and in wood and cardboard boxes. The trenches, in a humid forest underlain by jointed and leaky strata, promptly flooded. Runoff, groundwater, and wind carried contamination off-site (hundreds of metres in a decade) by every 'normal' route plus a few new ones, raising "serious questions about knowledge and concepts of plutonium mobility in the environment"—to say nothing of management. But a British participant, rightly questioning the suitability of the site, was told it seemed preferable to marine discharge, and the marine pathway analyses in other papers hardly contradict this.

The book's attempt to deal not only with actinide pathways but also with the biomedical effects of exposure suffers from too little space and diversity. Although current standards, linearity, neglect of isotopic chemical differences and of gonadal dose, and conventional dosimetry are all properly queried, the brief and truncated reviews hardly do justice to the richness of the controversy. In summary, an important reference work with strong relevance to public policy.

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