to an innocent amylopectin chain on page 53.

The book has several excellent sections, especially on medical aspects. The agricultural section is fine, but the dangers of pesticide abuse are not mentioned. The chapter on biochemistry and commerce is compelling, particularly the section on sewage disposal. (I was intrigued to see a photograph of our local rural district council's activated sludge plant.) The experimental investigations look good.

Ethanol and other Alcohols is a straightforward, highly competent programmed text containing a large proportion of practical work.

The film loops are much better than their O-level counterparts. They limit themselves to one topic and work at it thoroughly. The accompanying notes are very lucid. *Rates of Reactions* provides a convincing demo using the Dainton/Fisher ping-pong ball machine. *Hydrolysis of Bromoalkanes* makes good use of models, and the diagrams in the *Born–Haber Cycle* are bright and clear. My only criticism is the cost of these films. MARTYN BERRY

X-Ray Diffraction

Interpretation of X-ray Powder Diffraction Patterns. By H. Lipson and H. Steeple. Pp. viii+335+3 plates. (Macmillan: London; St Martins Press: New York, May 1970.) £4.

THE textbook *Interpretation of X-ray Diffraction Photographs,* by Henry, Lipson and Wooster, itself the distillation of much teaching experience, has been a standard reading and reference work for many generations of undergraduates and of postgraduates learning to use crystallographic techniques. But since it was first published the subject has developed enormously and new methods, both experimental and interpretative, have become both available and standard.

To have revised the original book would have been to produce a textbook both too unwieldy and too expensive; and the decision was therefore made to rewrite the book in separate parts, making each complete in itself. For the practical study of many important solid materials that do not form single crystals of adequate size for individual examination, or that can only be obtained as a mass of randomly oriented crystallites less than, say, 10 μm in individual size, powder diffraction methods are essential. Moreover, X-ray photographic methods have been supplemented or, for some purposes, replaced by counter-diffractometer techniques including those of neutron diffraction. To the metallurgist and the solid state physicist, the geologist and those concerned with phase diagrams of all kinds, or simply with the identification of unknown materials, the powder diffraction pattern is invaluable. The technique is, in general, non-destructive and requires less than 1 mg of material; or it can be used with massive specimens *in situ*. It is therefore of the utmost practical importance. The preface implies that this is an undergraduate textbook: but it is much more than that.

Nevertheless, it is aimed in the first place at undergraduates and it begins therefore at the beginning, with crystal lattices and crystal symmetry, with the geometry of X-ray reflexion and the nature and production of X-rays. Some of the diagrams in this section are less than satisfactory. Fig. 3.2 would give a student a very weird idea of the spectrum from a copper target run at 35KV, and fig. 3.6 that of both the intensity of radiation and absorption of very short wavelength X-rays. These are followed by methods of recording and measuring powder patterns and of interpretation, with descriptions of standard and special-purpose equipment. It is a pity that although measurement of coefficients of thermal expansion is mentioned as an application, nothing is said about the absurdity of claiming to make accurate dimensional measurements (a limit of one part in 100,000 is mentioned) unless the temperature of the specimen, and not merely the ambient temperature, is measurable and is recorded.

The chapters on applications make one wish for more.

A new feature is the section of undergraduate problems (with solutions), but there follow the useful appendices and tables, with subject, references and author indexes that will certainly extend the use of the book beyond that of the undergraduate. KATHLEEN LONSDALE

(This review was completed by Dame Kathleen Lonsdale before she died earlier this year.)

Analysis by Activation

Principles of Activation Analysis. By Paul Kruger. Pp. xi+522. (Wiley: New York and London, August 1971.) £11.75.

RADIOACTIVATION analysis, a by-product (or should it be a spin-off to be really up to date?) of research in nuclear science, is now well established in its own right as an important tool in science and technology. In this book, Kruger discusses some of the applications in his final and longest chapter and devotes a good fraction of it to the analysis of trace elements, an appropriate choice in view of the very high sensitivity of activation analysis. In this day and age, industry and the environment were almost bound to be mentioned, and they are, but sensibly and with reasonable detail. Oxygen in metals, the logging of oil wells and on-line techniques are the main examples from industry; here, as in the other fields which I do not have the space to cover, the examples are clothed with extensive numerical information.

It is important for materials analysts, particularly those with a background in nuclear physics, to realize that the nucleus is not the only part of the atom capable of emitting identifying radiations, as I am sure the optical and X-ray spectroscopists would quickly point out. With this in mind, I was pleased to see that Kruger's section on trace element analysis includes a comparison of activation analysis with other methods; the electron probe is not among the others but, even so, the reminder to think broadly is there.

These comments have arisen just from Kruger's final chapter, but what of the rest of the book? The three chapters on the practices and limitations of activation analysis and on radiochemistry, which together form more than a third of the whole, are thorough and should be very helpful to the serious student of the subject. How to select the stimulating radiations, how to use the stimulated ones, whether to include chemical methods, how computers can help—these are the broad issues and in each case there is enough information to satisfy the budding professional. Here he can learn about the complexities of gamma-ray spectra, the problems of spectral stripping, the ways to deal with interfering reactions and a number of other features, and at the end of each chapter he has a few problems to sharpen his teeth on.

This, then, is a book with much useful information, and it is elegantly produced with clear diagrams and tables, but the cost is high for the individual buyer, at least in the United Kingdom. There is no doubt that half the book is well worth half the cost, but less introductory material and a lower total cost would have been a better balance, in my view, because this would have made the book more widely available. After all, Kruger's own excellent bibliography makes it clear that there are already several texts covering this first part of the work. Moreover, cuts in this section could have removed the few slips and ambiguities which are there (resonance scattering of neutrons is not synonymous with inelastic scattering; the relationship between thermal neutron fluxes and fast neutron yields is not as simple as implied; a conventional neutron flux, not the one defined, must be used with tabulated cross-sections to obtain reaction rates; in a Maxwellian distribution at room temperature, 0.025 eV is the energy associated with the most probable speed, not the most probable energy).

JOHN WALKER