complexes, voids and dislocations. Positrons can be trapped at all these defects and decay with a longer lifetime than in the perfect crystal, because of the lower electron density in the neighbourhood of the defect. The angular correlations or the line width of the decay γ rays can also be measured. By measuring the lifetime (or other properties) as a function of temperature, vacancy concentrations can be deduced. These techniques complement older equilibrium techniques, and vacancy parameters deduced by several groups were in substantial agreement with each other and with older observations. A very considerable increase in positron lifetime was found by one group for samples containing voids, and another group is attempting to deduce binding energies of vacancy-impurity complexes in alloys. Although the chief effects in this new field are now clear, many details certainly remain to be unravelled, and the accuracies of parameters deduced seem rather uncertain at present.

A most impressive account of FIM work on point defects in irradiated and quenched metals was given by Professor D. N. Seidman (Cornell University). The FIM has emerged as a quantitative technique in recent years; an automated data collection and analysis system, such as the one developed at Cornell, is essential because of the extremely low proportion ($\lesssim 10^{-3}$) of defective lattice sites present, which must be individually counted in this technique. A ciné film was shown of the damaged regions after heavy ion bombardment and of the annealing of single interstitial atoms in tungsten.

The development of HVEM has clearly contributed much to the study of clusters of point defects, presently spurred on by the observation of voids (three-dimensional vacancy clusters) in materials used in fast reactors. Irradiation in the HVEM can be used to accelerate these processes and to study the defects produced under a wide variety of conditions. Other clusters can also be studied at very high resolutions using the recently developed weak beam technique. Analytical and quantitative interpretation of the pictures obtained has become much more important in the past few years.

The developments of the theory and practice of diffuse X-ray scattering complement the HVEM observations, for this scattering is sensitive to cluster sizes that are too small to be seen in the electron microscope. In a review by Professor W. Schilling (Jülich), he showed that this technique reveals the coarsening of interstitial clusters which occurs when irradiated metals are warmed up from low temperatures; the symmetry of the strain field of the defects can also be determined.

A conference such as this would not be complete without the continuing saga of whether two types of interstitial atoms exist in simple metals or only one. This minor yet persistent topic has all the characteristics of a paradigm debate in the Kuhnian sense, with the two sides talking through each other, selecting different data as important and having different criteria for satisfactory explanations. This state of affairs has persisted as long as it has because the field is complex and because of spirited, yet incomplete, defences on both sides. The new theoretical and experimental techniques discussed at this conference may well be able to resolve these problems of interpretation, at the same time as providing the more accurate defect parameters which are needed in many practical materials applications.

NUCLEAR QUADRUPOLE RESONANCE

A Step Forward

from a Correspondent

THERE has been a considerable revival of interest in nuclear quadrupole resonance in the past two or three years, if the number of people attending the recent International Symposium on Nuclear Quadrupole Resonance Spectroscopy at Queen Elizabeth College, London, between September 28 and 29 (about 120) is anything to go by.

Although the first nuclear quadrupole resonance experiment was performed more than twenty years ago by Dehmelt and Krieger in 1951, the technique has never acquired the popularity of later techniques such as nuclear magnetic resonance, Mossbauer spectroscopy and electron spin resonance. This is a pity because any isotope of an element with a spin of 1 or greater has a nuclear electrical quadrupole moment, and in principle quadrupole resonance spectra can be observed in its compounds. This means that more than 75 per cent of the elements in the periodic table are candidates for study. The resonance frequencies of the signals too are remarkably sensitive to the chemical and crystal environments of the atoms. Thus for chlorine the ^{35}Cl signals range from near zero in ionic chlorides such as NaCl to 54.1 MHz in molecular chlorine, with most carbon-chlorine bonds giving signals between 30 and 40 MHz.

The great difficulty has been the detectability of these signals; the signal-to-noise ratios have often been very low and the problem has been to spot the signal amongst the background "grass".

To judge from the papers presented at the symposium, however, the situation is now much happier. Professor J. A. S. Smith (Queen Elizabeth College), who organized the conference, presented an extremely interesting paper

Abnormal Haemoglobin Synthesis

IN *Nature New Biology* next week (October 25) Rowley and Kosciolek report a set of experiments which strongly support the idea that the hereditary anaemia, β-thalassaemia, which is characterized by a slow or negligible synthesis of β-globin chains, may result from more than one sort of genetic defect in the machinery for synthesizing proteins in immature red blood cells. Persons from the Ferrara region of Italy who are homozygous for β-thalassaemia fail to make β-globin chains. When, however, cell-free systems obtained from the reticulocytes of Ferrara β-thalassaemics are supplemented with supernatant factors from the cells of normal people β-globin chains are made. Presumably therefore the Ferrara β-thalassaemia is not the result of a defect in β-globin mRNA molecules but is some essential translation factor.

By contrast Rowley and Kosciolek have found that cell-free systems from the reticulocytes of Sicilian and Neapolitan β-thalassaemics do not respond to added supernatant factors; this suggests that β-thalassaemia in these southern Italians results from a defect in β-globin mRNA molecules rather than a defect in a translational factor. As they point out, similar investigations of Negro β-thalassaemics will be of particular interest now that it seems that the syndrome in different populations may stem from different sorts of genetic defects.

The precise nature of the translational factor which is defective in Ferrara β-thalassaemics remains to be elucidated, and the experimental system which Ostertag and his colleagues describe in the same issue of *Nature New Biology* may well prove useful to those determining the minutiae of globin synthesis. They have found that when leukaemic spleen cells infected with Friend leukaemia virus are cultivated in the presence of low concentrations of DMSO the cells begin to differentiate along the erythrocyte line and reach a stage at which as much as about 25 per cent of the newly synthesized soluble cytoplasmic protein is α and β-globin. Furthermore the appearance of globin correlates with the appearance of a new 9S species of cytoplasmic RNA which is no doubt globin messenger. It would be interesting to test whether or not supernatant fractions from these murine cells would stimulate β-globin synthesis in cell-free systems from Ferrara β-thalassaemics.