

strate feeding and the development of new methods of estimation of fermentation parameters will occupy a second place in improving yields in antibiotic production. Martin discussed new advances in gene amplification using molecular cloning techniques, and alteration of the regulatory mechanisms controlling antibiotic production, namely: induction, carbon and nitrogen catabolite regulation, feedback regulation and phosphate (energy charge) regulation. A large number of studies including those presented at the meeting by Z. Vanek (Prague) on the phosphate regulation of tetracycline biosynthesis and H. Pape (Münster) on the carbon catabolite regulation of tylosin biosynthesis, led to the conclusion that deliberate genetic removal of regulatory mechanisms involved in antibiotic biosynthesis is a useful tool to increase antibiotic production in the immediate future. On the other hand, there was a lively polemic on genetic engineering as a tool for the amplification and transfer of genes coding for antibiotic synthesis. While some scientists considered feasible, and perhaps convenient, the possibility of transferring the capability to produce antibiotics to microorganisms other than the natural producer, others contended that it may not even be desirable, let alone feasible, bearing in mind that so little is known about the genes for antibiotic biosynthesis.

Recent progress in the area of biosynthesis of specific groups of antibiotics (tetracyclines, rifamycins and macrolides) were described by Vanek (Prague), G. Lancini (Milano) and H. Grisebach (Freiburg) respectively. Also, advances in the field of  $\beta$ -lactam antibiotics were discussed in detail. E. P. Abraham (Oxford) presented recent results from his laboratory and from others on the complexity of the stereochemistry of ring-closure in the formation of penicillins and cephalosporins. New genetic and regulatory approaches to the development of penicillin production were reported by C. Ball (Ulverston). J. Nuesch and his coworkers H. J. Treichler and M. Liersch (Basel) reported unpublished results of his group at Ciba-Geigy on the methionine biosynthetic pathway in *Cephalosporium acremonium* that provide insight into the precursor and regulatory effect of methionine stimulation of cephalosporin production. All these reports in the field of biosynthesis and regulation of  $\beta$ -lactam antibiotics together with the discovery of new  $\beta$ -lactam antibiotics and  $\beta$ -lactamase inhibitors produced by species of *Streptomyces* and *Nocardia* (the cephamycins, nocardicin, thienamycin, clavulanic acid) point to a renaissance of interest in this interesting group of antibiotics.

Secondary metabolites with no antibiotic activity such as the alkaloids were also considered. Advances on the chemistry, biochemistry and the cell fusion of producer *Claviceps purpurea* strains using protoplasts were reported by Groger (Halle), C. Spalla (Milano) and H. Kobel (Basel). New examples of the use of microorganisms in the specific biotransformations of chemicals and pharmaceuticals were described by K. Kieslich (Berlin) and H. Leuenberger (Basel). These once more illustrate the great possibilities, the advantages and the limitations, of enzymatically catalysed reactions for the modification, as well as the total synthesis of natural products. □

## Nuclear quadrupole resonance spectroscopy

from J. A. S. Smith

The Fourth International Symposium on Nuclear Quadrupole Resonance Spectroscopy was held on 13–16 September, 1977 at the Takarazuka Hotel, near Osaka, Japan. The local Chairman was Professor H. Chihara of Osaka University.

THESE symposia review progress in a branch of radiofrequency spectroscopy very much concerned with structure and molecular motion in solids. There was an air of practicality about the proceedings of this year's conference, appropriate in the light of the ideas of the 8th century Japanese monk, Saicho, who considered that scholars should 'serve in such undertakings which benefit the nation.' The practicality appeared almost immediately in the description of a precise nuclear quadrupole resonance thermometer whose absolute accuracy was claimed to be  $\pm 2$  mK (A. Ohte, Yokagawa Electric Works).

The opening paper was given by E. L. Hahn (University of California, Berkeley), whose laboratory over the past 15 years has done much to stimulate the development of new instrumental techniques in radiofrequency spectroscopy; his paper was concerned with the double resonance detection of  $^2\text{H}$  quadrupole resonance in solids, with the minimum possible degree of enrichment—in this case, 1%. Such a proposal would have been unthinkable some 10 years ago, and

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illustrates the extent to which double resonance techniques have developed in recent years. In the following papers, the emphasis was very much on consolidation and application of these advances, from a triple resonance detection method for  $^{17}\text{O}$  in natural abundance (R. Kado, Kyoto Sangyo) to detailed studies of doped alkali-halide crystals (T. Taki, Tokushima). Later papers on the instrumental side laid much stress on pulsed techniques and R. A. Marino (Hunter College, CUNY, New York) described a particularly elegant pulsed system with Fourier transform capabilities for  $^{14}\text{N}$  quadrupole resonance detection, which is now being developed commercially. Together with the development of such instruments, the increasing use of relaxation measurements in chemical and physical problems was very obvious, with H. Chihara reporting on molecular motion in 1,2-dichloroethane, R. Hewitt (University of California, Riverside) on  $^{121}\text{Sb}$ ,  $^{123}\text{Sb}$  relaxation in the metal, A. Colligiani (CNR, Pisa) on  $^{14}\text{N}$  relaxation in benzonitriles, and Y. Abe (Tsukuba) on a careful investigation of structure and motion in hydrazine. Solid state effects were the subject of considerable interest with a survey by G. K. Semin (Institute of Organo-Element Compounds, Moscow) of the wide-ranging studies of electric field effects made by his research group in recent years, and a report by T. Kichi (Osaka) on intermolecular interactions in  $\alpha\text{-ICl}$ . Another current field of interest is the potential application to biological problems, a field as B. Lindman (Lund) showed where measurements of quadrupole relaxation times in solution have contributed much new information on ion binding in model membrane systems.

In inorganic applications, much new and important work was also presented. T. C. Waddington (University of Durham) reviewed recent work from his laboratory on the  $\text{ICl}_4^-$  and  $\text{AuCl}_4^-$  ions, which seem to show, in many of their salts, a kind of *trans* influence in their interionic interactions.

Several new Zeeman studies were reported, among which may be mentioned that of H. Negita (Hiroshima) on  $^{81}\text{Br}$  quadrupole resonance in  $\text{NaAl}_2\text{Br}_7$ , in which the bridging  $^{81}\text{Br}$  frequencies were definitely assigned; in an entirely independent set of experiments, A. Weiss (Darmstadt) had also made the same assignment by  $^{81}\text{Br}/^{27}\text{Al}$  double resonance (SEDOR) experiments, distinguishing between bridging and terminal signals by comparing their response to  $^{27}\text{Al}$  irradiation. Fine structure of the  $^{127}\text{I}$  resonance due to In-I spin-spin coupling was reported in  $\text{In}_2\text{I}_6$  (K. Yamada, Hiroshima) and theoretical analysis suggests that the J-tensor is not axially symmetric. □