(addressed to both MAHYCO and regulatory agencies), and then some general comments (on his points 4, 5, 10).

It is reassuring to learn that (i) *Cry1Ac* is the best gene for Indian conditions (although Barwale does not give us citations for results from field studies); (ii) no minor pests became major ones in the US over a period of 5 years of *Bt*-cotton growing; (iii) there is no reason to expect that non *Bt*-cotton fields adjacent to *Bt*-cotton fields will suffer greater insect damage than normal; and (iv) extensive studies on pollen escape, outcrossing, germination, weediness, etc. have been conducted in India: Again, citations are not given for results from these studies. Further clarification on time taken for backcrossing is requested: Were the 3 backcrosses done using multiple molecular markers to select the desired genetic background? Unaddressed questions pertaining to the MAHYCO project include: Adequacy of 1 acre plots and 2 seasons at the stage of field trials. General points (not part of the *Bt*-cotton project) not discussed include the need to broaden the pool of genes as emphasized by Sharma and Oritz and, apparently, being pursued by ICAR scientists (*Businessline*, 10 April 1999; 11 February; 2000).

A major point of concern continues to be that of resistance management. It is true that resistance has not arisen as rapidly as anticipated in Arizona (USA), but that might only mean that the models used to predict early evolution of resistance were missing a critical parameter, not that resistance will not evolve in the insect pests in the near future (Tabashnik, B. E., pers. commun.). Therefore, while it is reassuring to hear that strategies for management are being planned '. . . appropriately modified to suit local conditions', it would be even more reassuring to hear some details: What are the elements of the management plan? Would it be essentially the same as those in the US and Australia? Are there enough background data to enable appropriate modification as proposed? Given Barwale's familiarity with difficulties in pest management, I am sure he can understand the anxiety of those who are familiar with the complexities of the issue, but not with the strategies planned to handle these complexities. For instance, Sharma and Oritz (*Curr. Sci.*, 2000, **79**, 421–437) suggest that variability of *CryIAc* gene expression may be the cause, for instance, of *Bt*-cotton failure in Australia. Should we also expect such failures under Indian conditions? How likely is it to occur? At a time when transparency is desirable, so as to separate the technological from the societal factors, it is very important that the former are clearly spelt out.

Since some of the societal issues in the problem of cotton farming in the past apparently come from inadequate pest management, anxiety on this point is not unreasonable. It would also be useful for the public to be informed as to which part of the regulatory process is responsible for overseeing the plans for management. Will it be the GEAC that will evaluate the current field trials? How detailed a management plan does it require? Who will be responsible for implementation?

My paper tried to use the *Bt*-cotton case as a point of reference in order to generate general public discussion on biotechnological applications in agriculture in India. In this context, I would like to clarify two points that appear to have been misunderstood by responses to the paper: One (as mentioned above), the '*Bt*-cotton case' includes the '*Bt*-cotton project'; therefore discussion of the former will necessarily include not only the latter, but also other factors. In trying to understand how public perception was piqued, moulded and distorted, we need to consider all factors that went into the process. If we want to clear up public (mis)understanding, then the technological and other aspects need to be discussed separately. Since I tried very hard to do this, I am puzzled as to how, exactly, my paper 'obfuscates the truth'. Two, the polarization I mention refers to differences in positions taken by the forces that oppose GM technology in the West (where the technology itself is of prime concern), and in countries like India (where intellectual property rights issues tend to be emphasized). Obviously, there is considerable support for the technology in both societies; understanding differences in the factors that move public perception must help in understanding where the overlap, if any, lies (A brief account of these aspects can be found at http://life.bio.sunysb.edu/ee/geeta/Bt-Cotton.htm). Discussion on all these issues needs to be kept alive so that decision making is fully transparent and in the interest of the public at large.

GEETA BHARATHAN

MEETING REPORTS

Recent trends in crystallography*

To commemorate the birth centenary of K. Banerjee, one of the pioneer crystallographers of India, a two-day symposium was organized at the Indian Association for the Cultivation of Science (IACS), Calcutta. The inaugural ceremony was attended by more than 200 participants, including J. R. Helliwell, University of Manchester and the Editor-in-Chief of *Acta Crystallographica*, special invitees, past students and family members of Banerjee. S. K. Sikka, Chairman of the Indian National Committee on Crystallography (BARC, Mumbai) inaugurated the symposium. In his Welcome Address, D. Mukherjee (Director, IACS) highlighted the role of crystallography in interdisciplinary research and mentioned the golden heritage of IACS marked by the contributions of C. V. Raman, M. N. Saha, K. S. Krishnan, K. Banerjee, S. Bhagavantam and many others. The Chairman of the Organizing Committee of SRTCRA 2000, and a member of the Commission on Powder Diffraction (CPD) of IUCr, S. P. Sengupta, pointed out the importance of holding the symposium in

*A report on the 'Symposium on recent trends in crystallography and its applications' (SRTCRA 2000) held at the Indian Association for the Cultivation of Science, Calcutta during 15–16 September 2000.

Professor Kedareswar Banerjee – The Crystallographer (15 September 1900–30 April 1975)

Professor Kedareswar Banerjee, a pioneer X-ray crystallographer, was born in Bikrampur, Dacca (now in Bangladesh) on 15 September 1900. After a brilliant academic career in Dacca University and later at the University of Calcutta, Banerjee, in 1923, joined the research group of C. V. Raman at the Indian Association for the Cultivation of Science (IACS). Subsequently, he worked in various capacities in different institutions like India Meteorological Department, Dacca University and Allahabad University; finally he retired as the Director of IACS in 1965.

Prof. Banerjee explaining a point to Dr H. J. Bhabha (21 Dec. 1956)

Banerjee laid the foundation of X-ray crystallographic research in India. In 1924, when only a few crystal structures had been determined throughout the world, Banerjee's work on the determination of atomic arrangements in crystalline naphthalene and anthracene received considerable attention around the world. He was awarded the D Sc degree by the University of Calcutta in 1930. He had close association with almost all the leading crystallographers of his time like W. H. Bragg, W. L. Bragg, J. M. Robertson, P. P. Ewald, J. D. Bernal, K. Lonsdale, N. V. Belov and M. Avrami. In 1933 Banerjee proposed a new approach to the solution of crystallographic phase problem, which not only broke new ground beyond the 'trial and error' structure solution method of that time, but also heralded the extremely powerful direct methods of crystallography of the modern era. His seminal paper (*Proc. R. Soc.*, 1933, **141**, 188) on the direct method has received due mention in the Nobel Lecture of Jerome Karle in 1985.

Apart from structural X-ray crystallography, Banerjee's research pursuits covered a wide field of crystal physics. His research contributions in various fields like low-angle scattering, thermal diffuse scattering of X-rays from crystals, diffraction of X-rays by liquids, jute fibre and organic polymers, structures of coal and glass, determination of elastic constants of crystals by X-rays, theoretical modelling of vibration spectra of crystal lattice and some topics in crystal optics have received international recognition. Perhaps his most significant contribution for the advancement of science in India was the creation of active schools of research wherever he went, leaving behind a band of young, energetic research workers who in turn, became the torch-bearers of his scientific tradition.

Banerjee received several honours. He was elected Fellow of the Indian Academy of Sciences and National Academy of Science (NASc). He was the sectional President for Physical Science Group at the Indian Science Congress in 1947, Vice-President of NASc during 1958–1960 and General President NASc in 1967. He was a member of the first National Commission for Cooperation with UNESCO during 1947–1951, a member of the Scientific Advisory Committee of the Planning Commission during 1953–1956 and a member of the review committees and advisory boards of several national laboratories. In 1948, he was invited as a 'Guest of Honour' to the Inaugural Conference and General Assembly of the International Union of Crystallography.

Apart from being a front-rank scientist, Banerjee possessed a rare and pleasing personality, kind and affectionate yet strong in his convictions. Banerjee died at Barasat, a suburb of Calcutta on 30 April 1975.

memory of Banerjee who initiated modern crystallographic research in India and played a key role in establishing various active research centres across the country. Messages had been received from the world's eminent crystallographers like H. Hauptman, J. Karle, M. M. Woolfson, H. Schenk and others on this occasion, appreciating Banerjee's pioneering contribution in the development of the present day direct methods of solving crystal structures. A. K. Sharma (President, IACS) paid rich tributes to Banerjee and emphasized the importance of crystallographic research in the current context of genome project. To mark the occasion he released the book *A Collection of Professor Banerjee's Work*, containing research publications and lectures delivered by Banerjee at various national seminars on the scientific policy of independent India. Sharma also unveiled a bronze relief of Banerjee at the IACS campus. In the technical session, M. Vijayan (Indian Institute of Science, Bangalore) delivered the keynote address on 'Structural diversity and functional specificity of proteins – A case study involving lectins'. Apart from the poster session, there were twenty-one invited talks in the symposium by speakers from various centres of India and abroad on different aspects of crystallography and materials science. The lecture of Helliwell, on 'Complementarity of neutron and ultra-high resolution synchrotron X-ray protein crystallography' gave an overview of the various techniques and some recent advances in the field of high-resolution protein crystallography. T. P. Singh (AIIMS, New Delhi) presented the three-dimensional structure of phospholipase A_2 and a structure-based design of its inhibitors. Other speakers in the macromolecular crystallography sessions, A. Banerjee (Bose Institute, Calcutta), A Banerjee (IACS) and D. Mukherjee (SINP, Calcutta) discussed molecular design in living systems, reverse turns in proteins, synthetic peptides and pseudo-peptides and crystal structure and function of a chymotrypsin-inhibitor protein isolated from the seeds of winged bean.

K. Lal (NPL, New Delhi) and S. K. Sikka (BARC) in their lectures highlighted some recent advances in dynamical diffraction from crystals and high pressure studies using synchrotron radiation sources, while the talk by Pandey (BHU, Varanasi) was on structural phase

transition in mixed perovskites. Other speakers in the materials science session, D. Chakraborty (IACS), K. Chattopadhyay (IISc), J. K. Bhattacharjee (IACS) and A. Mukherjee (SNBNCBS) delivered lectures on nanoscale magnetic heterostructures, quasicrystals, second-order structural phase transitions and properties of materials from first principles.

The lectures by M. Mukherjee (IACS) and D. Velmurugan (University of Madras) were on *ab-initio* phasing of proteins by multisolution direct methods and combination of direct methods with anomalous scattering/isomorphous replacement. The topics of the last session with speakers G. D. Nigam (IIT Kharagpur), A. K. Mukherjee (Jadavpur University), S Paul (North Bengal University) and S. Gupta (IACS) were on some aspects of probability distribution functions, crystallographic disorder and structures of liquid crystals.

A 'Reminiscences' session on K. Banerjee was arranged in the evening of 15 September 2000 with some of his senior students Amal Roy Chowdhury, R. K. Sen, S. C. Chakraborty, K. C. Banerjee, A. K. Datta and A. K. Pant as speakers chaired by B. S. Basak.

An endowment fund was established by the family members, students and admirers of Banerjee with a proposal to arrange an annual memorial lecture in his name. Helliwell, the recipient of Professor Banerjee Silver Medal, delivered the first Professor Banerjee Endowment Lecture on 'New opportunities in biological and chemical crystallography' on 19 September 2000 at IACS.

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Organic synthesis in drug discovery and development*

A workshop on 'Synthetic organic chemistry in drug discovery and development' was held at the B.V. Patel PERD Centre as a part of its continuing education programme. A total of 35 participants (30 from the industry and the rest from academics) attended the workshop.

The chemical industry has shown a much higher growth rate compared to other industries as a whole during the last century. The triggers for this excellence and high productivity have been the ability of the synthetic chemical industry to judiciously and gainfully utilize the emerging new knowledge, new science and new technology and/or invent new chemical reactions to devise more cost-effective, safe chemistry, green chemistry and sometimes even chemistry with atom economy. Harish Padh (Director, PERD), while inaugurating the workshop emphasized these aspects and also the theme of the workshop with respect to the significance of synthetic organic chemistry in shaping various molecules, which are used as therapeutic agents.

K. Nagarajan, in his plenary lecture outlined the current therapeutic scenario, which is witnessing rapid strides due to advances in biological sciences. He outlined the synthetic strategy being followed to build some of the recently developed molecules, which have come about both due to the pull of medical needs and the push of new knowledge. He cited that now newer drugs derived from biotechnology are few in number compared to those derived by synthetic means.

Various other topics relevant to the theme of the workshop were dealt with by other speakers well-versed in the art of organic synthesis in process development and the science of drug discovery. The topics covered included unusual reactions which could provide opportunities in designing new structural entities and/or developing patentable process technologies, the wide array of methodologies for synthesizing fluoro organics, on which more than twenty thousand patents were filed during the last decade and the utilization of phase-transfer catalysis in industrial chemistry. Specific topics such as Suzuki coupling in drug synthesis, utilization of alkyl lithium in process development and chirality in industrial chemistry were covered in great depth. Detailed case histories of the synthesis of some specific drugs provided insight into how the laboratory process from the medicinal chemists has been upgraded, refined, optimized and updated to suit industrial manufacture, keeping in view the raw material cost and process adaptability to large-scale manufacture in a cost-effective and safe manner.

The deliberations at the concluding session reaffirmed the pivotal role of organic synthesis in drug discovery and development and the key role that the synthetic organic chemists would be playing in shaping the new molecules.

*A report on the two-day workshop on 'Synthetic organic chemistry in drug discovery and development' held at the B.V. Patel PERD Centre, Ahmedabad, during 18–19 November 2000.

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