

the phasing-out of animal experiments in cosmetics within 10 years, the legislation for chemicals (REACH) is only emerging since it anticipates data requirements for more than 30,000 substances produced at levels above 1 ton/yr. Horst Spielmann (ZEBET, Berlin) detailed the 'Mission and accomplishments of ZEBET', which is the German centre for documentation and evaluation of alternative methods. Spielmann's presentation included an overview of various measures and institutions established globally on alternative methods. For instance, following the European Directive 86/609/EEC, the European Centre for the Validation of Alternative Methods was established in Italy in 1993. ZEBET, the German centre for documentation and evaluation of alternative methods, was established at the Federal Health Institute, Berlin in 1989. FRAME, the centre in the UK and the National Centre for Alternatives in the Netherlands were established during the same period. The Interagency Coordinating Committee on the Validation of Alternative Methods was established in 1997. In 2004, the UK National Centre for the three Rs (NC3Rs) was established to focus on refinement and reduction protocols. Outside Europe, in USA, several institutions to promote alternatives to the use of animals have been established. For instance, the Johns Hopkins University Centre (CAAT) established in 1981. More recently, Japan established the Japanese Centre for the Validation of Alternatives in 2005. The mandate of the validation centres includes establishment of a database and information service on

alternatives at the national and international level; to develop alternatives in accordance with the concept of the three Rs; to fund research on alternatives, to coordinate validation studies; to cooperate with national and international funding agencies and other validation centres, and to provide a forum for sharing data and information on alternatives to animal testing.

Coenraad F. M. Hendriksen (the Netherlands Vaccine Institute (NVI), Bilthoven) spoke on the application of the three Rs concept in quality control of vaccines, in which he highlighted the ongoing work at NVI on the possibilities of using the three Rs to minimize the use of laboratory animals in vaccine quality control. Traditionally, vaccine quality control requires a large number of animals with higher levels of pain and suffering compared to other uses of laboratory animals such as toxicity testing or cancer research. The new strategy in vaccine control that lead to an almost total phasing-out of animal use is 'consistency approach'. This approach relies on non-animal test models and could include both physico-chemical methods such as HPLC, as well as immunochemical methods such as biosensor analysis or epitope mapping using monoclonal antibodies.

Joseph Bressler (Johns Hopkins University) presented the challenges in developing *in vitro* models for studying the blood-brain barrier (BBB). This is a physical barrier that prevents polar chemicals and large molecules from entering the brain; and the basis of the physical barrier is tight junctions ex-

pressed by endothelial cells lining the capillaries. Because high amounts of glucose and other requisite chemicals required by the brain would be impeded by BBB, the brain capillary endothelial cells express a broad range of transporters for different nutrients. The BBB is also a metabolic barrier, and the major role here is to prevent the entry of amphipathic molecules. Despite tremendous efforts in establishing models for determining the permeability of the BBB, *in vivo* models suffer from several problems such as cost and availability of reagents. The challenge therefore is to attain an impermeable cell monolayer that mimics brain capillary endothelial cells *in vivo*.

Presentations on education, awareness and capacity building included talks by Maria Eugenia Webb (University of Lisbon) on tapping emotional literacy as a means to teach alternative methods in life sciences; Massimo Tettamanti (Atra, Lugano) on an interactive database of alternative methods in education, and U. S. Gadgil (Johnson and Johnson Medical, India) on the role of simulators in surgical education. The proceedings of the Congress culminated with a panel discussion on 'Taking forward the science of alternatives in India', resulting in a set of recommendations which the organizers propose to share with the apex educational and research bodies of the country to take forward the initiative.

Jayshree Vencatesan (*S. Ramaseshan Fellow*), Care Earth, No. 5, 21st Street, Thillaianga Nagar, Chennai 600 061, India. e-mail: jvencatesan@careearth.org

MEETING REPORT

Biocontrol and biotechnology*

In the Fourth International Symposium on 'Biocontrol and Biotechnology' (Biocontrol in the Genomics Era) held recently, there were about 190 delegates from across the country and 10 delegates from China, Thailand, Germany, Japan, South Africa and the Philippines. The pro-

gramme committee considered 185 abstracts, of which 20 were scheduled for plenary talks in five sessions, 77 for oral presentations in eight parallel sessions and 88 poster presentations. The symposium began with the Presidential address by G. Thygarajan (Former Director, CLRI, Chennai). He appealed to the scientific community to shoulder the responsibility of convincing the endusers (farmers) by making them aware of the advantages of GMOs (genetically modified organisms), transgenic crops and animals. This was fol-

lowed by a plenary lecture by K. Dharmalingam (Madurai Kamaraj University, Madurai) entitled 'Biotechnology entrepreneurship in India'. He pointed out the critical issues, the required infrastructure and the role of entrepreneurs. He also emphasized that universities and other research institutions with their own policies and guidelines should strive to encourage entrepreneur-partnership with scientists.

Joseph Thomas (Former Adviser, Indian Institute Technology, Madras) spoke on 'India as an emerging superpower and

*A report on the International Symposium on 'Biocontrol and Biotechnology' organized by the PG and Research Department of Zoology and Biotechnology, Lady Doak College, Madurai from 27 to 29 November 2006.

the potential for biotechnology'. He highlighted the role of Indian biotech companies in vaccine production and the role of biotech industries in the economic growth of India. Thomas also discussed the myriad applications of enzymes in food, feed, brewing, baking and alcohol industries, which are green microbial technologies ensuring environment-friendly advances in meeting human needs. Yang Qian (Harbin Institute of Technology, China) gave a talk on Bio-control-related genes from the expressed sequence tags (ESTs) of *Trichoderma* sp. and *Chaetium* sp. The focus was on biocontrol genes in the development of biofungicide in future. Anandavalli Mahadevan (Madurai Kamaraj University) delivered a lecture on 'Biotechnology 2025'. Her lecture was focused on how innovations in science and technology have changed people's lives, behaviour and attitude. She also stated that information technology, materials technology, biotechnology and energy technology would be the drivers of change and shape the world of 2025. Ananda Kumar (IARI, New Delhi) gave a lecture on 'Bt-based transgenic crops in insect control', where he stated that future agricultural methods have to be designed to avoid adverse effects of pest resistance to Bt crops and how Bt transgenic crop cultivation should be integrated with practices that nurture diverse crops, crop rotation, soil fertility and wildlife biodiversity.

Hideo Ishii's (National Institute for Agro-Environmental Sciences, Japan) address on 'Can natural systems provide effective disease-control?' highlighted the importance of searching for unknown bioreactive compounds from natural resources in order to combat the existing resistance problem in plants. Dusanee Thanaboripat (King Mongkut's Institute of Technology, Thailand) spoke on the 'Effect of ammonium salts on the growth and aflatoxin production of *Aspergillus flavus* in corn. She described the ability of ammonium carbonate in inhibiting the growth of aflatoxin-producing fungus and aflatoxin formation. She also emphasized the use of this ammonium carbonate as an antimycotic agent in corn and other agricultural commodities during storage.

T. J. Pandian (Madurai Kamaraj University) gave a lecture on 'Sperm preservation and genome restoration in fishes'. He described a simple, practical method of obtaining live, fertile sperm cells of Indian catfish (*Heteropneustes fossilis*)

from specimens that were post-mortem preserved at -20°C for 240 days. He also described how the restoration of genome can be attained for endangered/extinct fish species through the use of live/cadaveric sperm of the desired species and enucleated/genome inactivated (by UV irradiation) eggs of often alien but compatible surrogate species. Indrani Karunasagar and Iddya Karunasagar (College of Fisheries, Mangalore) spoke on 'Bacteriophages for biocontrol of pathogens in aquaculture' and 'Recombinant protein and DNA vaccines in aquaculture', respectively. They highlighted the way in which bacteriophages can reduce bacterial numbers in biofilms on the surfaces, thus playing an important role in the management of bacterial disease in aquaculture. They explained how the outer membrane protein, ompTS of *Aeromonas hydrophila* cloned and expressed in pQE30 expression vector and over-expressed in *Escherichia coli*, was found to be immunogenic. P. Gunasekaran (Madurai Kamaraj University) presented his work on 'Plant growth promoting rhizobacteria (PGPR) as biocontrol agents'. He emphasized the importance of application of PGPR for the control of fungal pathogens in greenhouse systems. Radha D. Kale (University of Agricultural Sciences, Bangalore) spoke on 'Progress of research on vermicomposting in India'. She discussed the importance and progress of vermicomposting in India through the years.

S. Krishnaswamy (Madurai Kamaraj University) delivered a lecture on 'Structure-based approach to anti-viral drug design'. He described the nature of assembly and disassembly of viral capsids and the significance of this mechanism in the design of drugs against viruses. He also described several aspects of the application of crystallographic and molecular dynamics simulations in designing broad-spectrum anti-viral drugs. R. Usha (Madurai Kamaraj University) spoke about 'Biotechnological approaches for developing virus-resistant plants. She focused on strategies based on the concept that the introduction and expression in plants of viral sequences, could interfere with the viral life cycle. Kailash Paliwal (Madurai Kamaraj University) gave a lecture on 'Effect of biodiversity on ecosystem stability and function – An Indian perspective of environmental disturbances'. He spoke about various changes in biodiversity that alter the eco-

system processes and change the resilience of ecosystems to environmental changes and also on how these influences of mankind on the biosphere are manifested in different processes. Vai. Ramanathan (Metahelix Life Sciences, Bangalore) gave a talk on 'Transgenic approaches for insect pest control'. He described various transgenic strategies that have been applied in insect pest control such as Bt sprays, and the use of several other genes like chitinases, lectins, protease inhibitors, pheromone biosynthetic genes and terpenoid biosynthetic genes. He also spoke on RNAi, an emerging technology that finds applications in developing crops that are protected from insect pests. B. K. Tyagi (Indian Council of Medical Research, Madurai) spoke on 'Climate change and dengue emergence in Kerala'. He dealt with the fast-emerging mosquito-borne infection, Dengue, and its intensity of occurrence. His study provided proof that *Aedes albopictus* is responsible for dengue transmission in Kerala, southern India and that the drastic climatic and environmental vicissitudes, mostly manmade, have been responsible for the disease to a great extent.

There were several oral presentations on biotechnological approach to biocontrol, biodiversity as a source of biocontrol agents, vaccines for developing countries, animal and plant-derived therapeutic agents, *in silico* design of drugs, environment biotechnology, biotechnology entrepreneurship and education and biotechnology policies for the future.

The symposium concluded with a valedictory address delivered by Viloo Morawala Patell (Director, Avesthagen). She reminisced about her journey which began as a young passionate scientist at Bangalore and also emphasized the need to bridge the gap between laboratory and field through scientists becoming entrepreneurs. She translated her words into action by announcing a Chair in Systems Biology at the Lady Doak College, Madurai.

The symposium ended with the declaration that the Fifth International Symposium on Biocontrol and Biotechnology will be held in Thailand in October 2007.

Nirmala Jeyaraj and R. Shenbagarathai*, Department of Biotechnology, Lady Doak College, Madurai 625 002, India.

*e-mail: shenbagarathai@gmail.com