results in *S. litura* population in field conditions. Liquid formulations of *M. anisopliae* were stable and effective against diamond black moth (*Plutella xylostella*).

The use of NPV against teak leaf defoliator (*Hyblae puera*), groundnut red hairy caterpillar (*Amsacta albistriga*), southern armyworm (*Spodoptera litura*), cotton boll worm (*Helicoverpa armigera*) and caterpillars of *Spilosoma obliqua* was highlighted. While the protozoan *Vairimorpha* sp. was found to be effective against *S. litura*, it was not effective against *Bombyx mori* and *Apis cerana indica*. Local isolates of *Bt* available in the Indian soil proved to be toxic to *S. litura*.

The much studied and discussed fungi *Beauveria bassiana* was found to be effective against *H. armigera, S. litura* and stored product pest *Sitophilus oryzae*; also the fungus *Nomuraea rileyi* was found to be effective against *H. armigera* and *S. litura*.

The symposium admitted the necessity to isolate more geographical isolates of NPV, *Bt*, and promising fungi for insect pest control and highlighted the need for genetic improvement of microbials. Issues related to the formulations, mass production possibilities, culturing of host insects, environmental factors, timing of application, inoculum potential, inoculum load, virulence, safety and quality control were also discussed.

Improvement of inoculum load in the formulations, safety to non-target organisms and beneficial insects, genetic changes in the hosts, standard bioassay procedures, combating spurious cultures, adverse effects to humans during production and use, were discussed.

The symposium concluded with the panel discussion that highlighted the need for the following:

(1) Technology for large-scale production of microbials; (2) Identification of nodal centres of excellence for technology transfer like, KVK, SAUs, ICAR, and institutions like ERI; (3) Developing a protocol for an effective implementation of programmes in vast and diverse areas; (4) Detachment of scientists from commercialization and involvement of commercial organizations for bioefficacy testing; (5) Development of good R&D based programmes in microbials by research institutes at least for another 10 years till effective and quality commercialization takes root; (6) Training of manpower for microbial production and entrepreneurship; (7) Anticipatory research in the management of insect resistance; (8) Further work on insect fungal pathogens and establishment of identification services; (9) Identification of important crops for use of microbials and economic threshold level; (10) Encouragement of combinational studies such as botanicals, microbials, etc.

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# Genetically modified foods: Report on a workshop

Gene Campaign, a 'specialist' science-based NGO working on bioresources, related-IPR, food security, farmers rights, etc. organized a day-long workshop on 'Genetically Modified Foods: Pros and Cons for Developing Countries', in Delhi on 25 April 2000. This workshop was the first in a series of several such meetings planned to debate the pros and cons in India of genetically modified (GM) crops.

This interactive workshop, aimed at starting an informed debate on this contemporary and controversial subject of far-reaching importance for India, was attended by a large number of people from relevant government departments and ministries, consumer organizations, science and research institutions, students, research scholars of various universities, policy-makers, trade unions, politicians, diplomats, lawyers, media and the NGO community. Speakers at the workshop highlighted various aspects of GM technology and its relevance to countries such as India, as also the areas of concern with respect to GM foods.

Deepak Pental of the University of Delhi highlighted the importance GM technology to Indian agriculture. He noted that in future GM varieties would help achieve durable disease resistance and increase the nutritional value of crops. To achieve this, a careful identification of goals, collaborative research, proper safety tests and evaluation of yield potential and ecological impact were necessary. Pental stressed that transgenic technologies should be explored as an adjunct to conventional methodologies. To exploit this, India will have to put in place a durable infrastructure and nurture its vast human resources potential.

Malathi Laxmikumaran from TERI, explained the methods by which genetic engineering is done in the lab, and how genes are cut out from bacteria and put into plants to make GM varieties. She explained how GM technology can be used to add value to crops, giving the example of the research on 'golden rice' supported by the Rockfeller Foundation. This research has added vitamin A and iron to rice which is otherwise a nutritionally poor cereal. Researchers in the Jawaharlal Nehru University, Delhi are trying to put protein genes from Amaranth (Chaulai) into potato to increase its nutritional value.

Suman Sahai of Gene Campaign spoke about the areas of concern associated with the new GM technology. Whereas GM foods had undoubted potential to help produce more and better food, this was not being done. GM technology was controlled by six multinational corporations who were directing the research to commercial agriculture and maximizing corporate profits, not to the needs of small farmers or to alleviating hunger. The attempt of the MNCs to establish their monopoly over the GM sector by IPR laws must be countered.

GM technology in India should not follow the research goals in the West; it should be applied to our problem areas where conventional breeding has not succeeded, like in producing improved varieties of pulses and oilseeds.

GM foods is a new and emerging science-based technology. Further studies are needed to understand its impact on human health and the environment, specially in Indian conditions. Serious efforts will have to be made so that this

technology can be harnessed without exacerbating genetic erosion and further marginalizing small farmers. To enable the latter, the notion of equity will have to be included in the planning, use and practice of GM technology. Benefits must be shared with farming communities who have provided the base material for GM varieties. There will have to be much greater transparency in 'the system'. Data on GM research and GM products must be publicly available and debates on risks and benefits should be conducted in public.

*Suggested reading*

1. 'So far so good', *New Sci.*, 25 March 2000.
2. First editorial, *Nature*, 16 March 2000.

# Rao named new Head of Third World Academy of Sciences

C. N. R. Rao, Honorary President of the Jawaharlal Nehru Centre for Advanced Scientific Research in Bangalore, India, has been named the new president of the Third World Academy of Sciences (TWAS). Rao succeeds José I. Vargas, who stepped down from the post after being appointed the Brazilian Ambassador to the United Nations Educational Scientific and Cultural Organization (UNESCO). Vargas has served as TWAS president since 1996.

TWAS membership currently consists of more than 500 distinguished scientists from 77 countries, mostly in the developing world. The Academy was founded in 1983 by the late Nobel Laureate Abdus Salam and 40 distinguished scientists from the developing world. Its headquarters is in Trieste, Italy.

In a 7 May 2000 letter addressed to the TWAS Council, Vargas thanked the members for the 'high and unforgettable privilege' of serving the Academy over the past five years and anticipated that the goals of TWAS would continue to be advanced at a rapid pace 'under the competent and farsighted leadership of our most distinguished President-elect, scientist and world science statesman, C. N. R. Rao'.

TWAS Council members offered their sincere thanks for the contributions that Vargas has made to the Academy. They noted that his tireless efforts on behalf of the Academy have increased the strength and visibility of TWAS among both scientists and scientific policy makers across the globe. Council members agreed that Vargas's legacy would continue to shape the Academy's agenda in the years ahead and they wished him well in meeting his new challenges in Paris.

Rao will preside over the next General Meeting of TWAS to be held in Tehran, Iran, 21–26 October 2000.

## RESEARCH NEWS

# What's up with chelates

*Rashmi Sanghi*

The word chelation is derived from the Greek word 'chele' that means claw (like that of a scorpion or crab). The concept of chelation is based on the observation that when a certain amino acid complex like ethylene diamine tetra acetic acid (EDTA) comes in contact with certain positively charged metals and other substances such as lead, iron, copper, magnesium, zinc, platinum and manganese, it grabs them (hence the chele or claw), and removes them. Thus, chelation therapy is the process of removing from the body the undesirable ionic material by the infusion, or taking orally, of an organic compound which has suitable chelating properties.

Some of the problems of metal toxicity may be overcome by use of chelation therapy where chelating agents are used to remove toxic metals like lead and mercury or to reduce metals such as iron or copper to normal concentrations. Ideally, chelation therapy results in the removal, in the form of a metal chelate, of much of the toxic metal present in the blood stream. The subsequent removal from other parts of the body will depend primarily on the rate at which the metal becomes redistributed within the tissues. For use in chelation therapy, a chelating agent should be of low toxicity, not easily metabolized and capable of penetrating to metal storage sites. It should also be capable of coordinating with a metal ion to form several chelate rings, that is, to give a highly stable complex and to be fairly selective in chelation.

Chelation is very basic to all life. Chlorophyll which converts energy from the sun into everything we eat, is the chelation of magnesium by four molecules of porphyrin. Our human digestive process is a very good example of how chelation takes place. Digestion and assimilation of food involves the chelation of protein substances (amino acids) with minerals for transportation to their destinations, or in which blood cells latch on to, and thus acquire, iron. Haemoglobin is chelate of iron (as is the enzyme catalase, that is