sons for both the industry and the common man. Sixty-three per cent of all patents on neem were related to pesticidal use and several other uses covered included veterinary care, health care, cosmetics and industrial applications. USA dominated the neem patent scene with over 50 patents. Discussing the issue of patenting natural products such as neem, Gopinathan commented that neem was the ultimate winner since both the IP rights of the patent seekers and also the native knowledge are being recognized. However, the need for proper documentation of local traditional uses of neem and such plants is a vital step towards which the government and non-governmental organizations need to take more intensive steps. Some interesting statistics provided by him amply suggested the operation of natural selection among the poor-quality products that would in any case be eliminated in due course of time.

Procedures involved in the development and registration of pesticides and the performance of neem, were presented by H. Kleeberg (Trifolio-M GmbH, Germany). Specific exemptions available in different countries for registering neem and neem products compared to synthetic pesticides were also discussed. S. A. van der Esch (ENEA Neem Task Force, Rome) presented the Italian experience in neem research. Italian work in the recent past amply demonstrated the possible utility of neem in managing pigeons through fertility control, mosquito control, management of several agricultural and veterinary pests and in human health. He also suggested the need for better understanding of the mode of action of neem against insects.

Development of neem-coated urea and its manifold benefits were discussed by B. N. Vyas (Godrej Agrovet Limited, Mumbai). Urea is the most important and intensively used nitrogen fertilizer in India. After its application to soil, nitrogen is lost quickly due to leaching and volatilization, resulting in less than 30% of the applied nitrogen in the form of urea to be really useful for the plant. Neem-coated urea, however, has been shown to greatly enhance the utility of N applied as urea. He called for farmer education in this direction, to enhance efficiency of both N and P fertilizers.

During the course of the conference, several important issues came to the fore. One of the most important aspects of neem that needs immediate attention is a dedicated database that would document burgeoning information being generated on neem. While this would take care of the needs of researchers, the utility of neem, proper methods of use and the need for its conservation and propagation by local communities call for launching a massive educational programme. The benefits of such a programme would not only lead to farmer empowerment, but also reap rewards for the industry.

As already stated, an estimated 664,000 MT of neem seed is being produced in the country according to S. R. Singh. At a liberal rate of 5% of home-made neem seed kernel extract with five applications per crop using a high volume sprayer, this quantity, if harvested, even at the present rate of 50%, would be sufficient to treat over 1 m ha of agricultural crops for pest management. This would be an estimated saving of nearly 800,000 kg insecticidal compounds (not formulations), at an average expected rate of consumption of 0.75 kg active ingredients per hectare per season. From the industry point of view, this amounts to an estimated over 1600 MT of azadirachtin per annum. That is an enormous amount of raw material for the pesticide industry. Unfortunately, neem is not really cared for either as a home-made insecticide or as an invaluable raw material for the industry. India, therefore, should now take right steps in promoting neem, both for the benefit of the farming community and the country at large, by providing good quality and sufficient raw material for the industry. With these ideas, to watch what is happening in Africa, the next neem conference to be held in 2005, is Africa-bound.

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MEETING REPORT

IOGOOS-I Mauritius 2002: Establishment of a regional alliance*

The Indian Ocean is the third largest ocean in the world with an average water depth of 3840 m and area of 74 million km^2. The continental shelf and slope together in the Indian Ocean admeasure to 6.73 million km^2 (one-third of Atlantic and one-fourth of Pacific oceans). Moreover, the Indian Ocean is unique, as unlike the Atlantic and Pacific oceans, it is blocked by landmass on the northern side and disconnected from the Arctic polar environment.

These physical characteristics give this ocean unique dynamical qualities resulting from vigorous air–sea–land interaction. This is the only ocean where annual reversal of the wind regime occurs. The climate is dominated by the northeast (NE) monsoon (December–April) and the southwest (SW) monsoon (June–October). Tropical cyclones occur during May/June and October/November in the northern Indian Ocean and during November and April in the southern Indian Ocean. The ocean response to the monsoon regime is also unique. The ocean surface is dominated by a counter-clockwise gyre in the southern Indian Ocean, while a reversal of surface currents in the northern Indian Ocean is generated by the monsoon. While the decadal variation of the Indian Ocean circulation is associated with rain anomalies in many countries in the region, the Antarctic circumpolar wave affects the climate of southern Africa and Australia. All these greatly impact the socio-economic development of the Indian Ocean countries.

Yet the Indian Ocean is the least explored ocean in spite of much effort

*A report on the first IOGOOS meeting held at Mauritius from 4 to 9 November 2002 at the International Conference Centre, Grand Baie, hosted by the Mauritius Oceanography Institute under the aegis of the Intergovernmental Oceanographic Commission (IOC) of UNESCO' Regional Office, Perth and supported by several sponsors.

deployed recently, in the light of recognition of its crucial role on global ocean circulation and regional climate. This ocean, in one way or another, influences the livelihood of about 1500 million people. It is, nevertheless characterized by a fragile environment that is susceptible to changes in climate, natural calamities and anthropogenic activities.

Ocean circulation, climatic impacts and marine pollution do not recognize any geopolitical boundary. Hence regional cooperation among Indian Ocean Rim countries to develop and co-sponsor necessary infrastructure, capacity building and product delivery in the region in an efficient and cost-effective manner, deserves close attention. These aspects were discussed thoroughly in November 2001 at a high level meeting of Indian Ocean Principals in New Delhi, which called for the establishment of an Indian Ocean Observing network within the framework of the Global Ocean Observing System (GOOS). It may be recalled that GOOS was developed under Agenda 21 of the United Nations Conference on Environment and Development (UNCED, Rio, 1992).

As a follow-up to the New Delhi meeting, the first Conference of the Indian Ocean Global Ocean Observing System (IOGOOS) was held in Mauritius. The main aim was to establish an IOGOOS regional alliance to foster cooperation towards the development and strengthening of operational oceanography in the Indian Ocean. It is noted that similar bodies have already been established in other regions. About 160 leading scientists from countries bordering the Indian Ocean as well as countries outside the region having interest in the Indian Ocean took part in the conference.

The six-day conference broadly delved into four main topics – Ocean and Climate, Coastal Observing, Data Management and Satellite Applications. Under the Ocean and Climate session, discussions and presentations centred around the Indian Ocean Dipole, the Madden-Julian Oscillation, importance of the Indonesian throughflow in the modulation of the Sea Surface Temperature (SST) in the Indian Ocean, and predictive modelling. It was stressed that the nature and intensity of circulation, advection and input of freshwater that plays significant role in SST variations were poorly understood, as insufficient information south of the equator is available. There was a consensus that region-specific problems should be given emphasis. Loss in biodiversity, coastal erosion, tropical cyclones and threat to fisheries resources could constitute the problems of Indian Ocean islands. For the African region, droughts, floods and ocean circulation such as the Agulhas current were identified as important while for the rest of the region, the Indian Ocean Dipole and the monsoon were major concerns on which deliberations were centred.

The Coastal Observing session identified ocean processes of regional interest and set priority areas that could be translated into pilot projects. Three themes were short-listed to receive further attention: (a) multiscale monitoring and mapping of keystone coastal ecosystems through remote sensing, GIS and community participation, (b) establishing a regional network to understand, quantify and predict shoreline changes, and (c) networking the coastal laboratories and institutions involved or mandated to be involved in these types of activities.

Under the Satellite Application session, there were a number of interesting presentations and briefing by scientists from Australia, India, Mauritius and South Africa. The main issues identified during the follow-up deliberation were to (a) compile a resources directory on satellites and their products, (b) prepare an inventory of research and capacity building facilities and (c) identify additional needs for capacity building programmes.

The deliberations in the Data Management session, as expected, had been most controversial, yet lively. The activities of various NODCs (National Ocean Data Centres) and RNODCs (responsible data centres of the several regions) were presented. An urgent need was felt to rationalize and coordinate the efforts of these centres to avoid duplication and maximize available resources.

To commemorate this regional cooperation, the Department of Ocean Development, Government of India arranged two legs of a dedicated cruise of the Indian Research Vessel *ORV Sagar Kanya* from India to Mauritius and back. Scientists from six Indian Ocean Rim Countries (India, Kenya, Mauritius, Seychelles, South Africa and Sri Lanka) took part in the cruise. The major objectives of the cruise were to (a) bring together marine scientists of the Indian Ocean region on a common platform to exchange expertise and jointly participate in the operation of a variety of instruments, data collection and data analysis pertaining to various meteorological and oceanographic parameters, including satellite oceanography and (b) train participants on deployment of ARGO deep-water floats and surface-drifting buoys.

One of the highlights of the conference was the formal establishment of IOGOOS to provide an organizational framework for planning, coordinating and effective implementation of appropriate regional and sub-regional ocean and coastal observing systems to develop operational oceanography and services. Nineteen organizations from ten countries bordering the Indian Ocean signed a Memorandum of Understanding on 5 November 2002, thus creating a regional alliance. Many other countries/institutions have signified their intention to join the IOGOOS soon. By signing the MoU, the members of IOGOOS agreed to collaborate and work together for developing programmes for the benefit and well-being of the population in the region.

At the end of the six-day conference, a Meeting Statement was issued. It particularly emphasized that due to climate change, natural disaster and human impact, the Indian Ocean countries have decided to mobilize their resources to safeguard and manage their oceans and coastal waters through a permanent ocean-observing system. The imperative need to make progress through partnership by contributing collectively to the progress of ocean observations, ocean science and operational oceanography was further highlighted. This association is expected to contribute and make available necessary data and information to stakeholders in order to protect living habitats and resources in the Indian Ocean region.

This ocean may be viewed as keeping countries apart, but IOGOOS may be viewed as bringing them together. It is intended to elevate the Indian Ocean from one of the least studied to one of the most studied of the world's major oceans, with a real emphasis on the link between societal and scientific issues. IOGOOS will minimize the gap between procedures and requirements in the observation of the Indian Ocean, and enable the community to derive benefits from baseline data, timely maps of ocean properties, and useful forecasts on all relevant timescales. This will enable the detection of climate change in the marine environment, with the least possible lag between changes and their detection.

For Mauritius it was special, as this momentous coming together of IOR nations and the signing of the MoU happened quite appropriately at the centre of the Indian Ocean triangle. And by hosting this conference, this strategically located country in the Indian Ocean has shown to the world community the importance Mauritius attaches to ocean issues and also demonstrated her readiness to play a significant and central role in the development of operational oceanography in the Indian Ocean. For the first term (2002–2004), K. Radhakrishnan (India) was elected as Chairman of IOGOOS. The other IOGOOS officers are J. Kasungu (Kenya) representing Eastern African region, H. Ganoo (Mauritius) representing the Island states, A. Forbes (South Africa) representing the Southern African region, N. Smith (Australia) representing Eastern Indian Ocean Region, while the Indian National Centre for Ocean Information Services (INCOIS), Hyderabad would host the Secretariat.

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Pollin Prize for Mahalanabis

Dilip Mahalanabis recently received the first Pollin Prize (2002) in Pediatric research. Mahalanabis is cited for his seminal contributions to the discovery and implementation of the oral rehydration therapy (ORT) for infectious paediatric diarrhoea, in place of the usual intravenous fluid replacement. Three Americans (Norbert Hirschhorn, David R. Nalin and Nathaniel F. Pierce) shared the Prize along with him.

The Pollin Prize, an international award created by Irene and Abe Pollin and their family from Maryland (USA), recognizes outstanding research achievements in areas relating to children's health. The inaugural prize has been awarded in New York on 15 November 2002. The award consists of a cash prize of US $ 100,000 in addition to a US $ 100,000 fellowship grant for another staff position.

Mahalanabis holds a medical degree from the Calcutta University, and postgraduate diploma and certificate in paediatrics from London and Edinburgh (UK). Before taking up his current position as the Honorary Director of a non-governmental research organization, Society for Applied Studies, Kolkata, he has served in various capacities in Kolkata and also for the World Health Organization. He is a member of the Royal Swedish Academy of Sciences.

RESEARCH NEWS

Sensitive flow sensors with carbon nanotubes

Nirupa Sen

Sensors are basically devices which work on the ability to convert one form of energy which is not directly measurable, to another which can be measured. For example, our eyes are light sensors – converting light energy to electrical pulses that are recorded by the brain. Sensors are so much a part of our lives that we are quite oblivious about them. They are in our cars, watches, heating ovens, computer printers . . ., the list is endless.

A flow sensor is a device which can record fluid flow. What is so special about a flow sensor with nanotubes? It is part of an ongoing effort worldwide to have a representative in the microscopic nano-world of all the sensing elements in our present macroscopic world (world with large objects). As part of this ongoing quest Shankar Ghosh, Ajay Sood and N. Kumar have recently discovered a new phenomenon that takes place when a liquid flows on carbon nanotubes, and provided a theoretical explanation for the same[1]. This will allow application of this phenomenon for measuring fluid flows and at the same time make it amenable to fine tuning, to enhance efficiency.

Carbon nanotube structures are fullerene-related consisting of graphene cylinders closed at either end with caps containing pentagonal rings (Figure 1). Discovered in 1991 by the Japanese electron microscopist Sumio Iijima while studying the material deposited on the cathode during the arc-evaporation synthesis of fullerenes[2]. The central core of the cathodic deposit found by him contained a variety of closed graphitic structures including nanoparticles and nanotubes. It was the first time a material with such a revolutionary structure was seen. A short time later, Thomas Ebbesen and Pulickel Ajayan, from Iijima's lab, showed how nanotubes could be produced in bulk quantities by varying the arc-evaporation conditions[3]. This simple method of preparation of these materials has paved the way to a multitude of research efforts looking into the physical and chemical properties of carbon nanotubes in laboratories worldwide. Single wall carbon nanotube bundles, with an average tube diameter of 1.5 nm used in the experiment of Sood *et al.*, were prepared by the electric-arc method in C. N. R. Rao's laboratory[4].

What Sood and coworkers have actually found is the development of current/voltage in a bundle of single-walled carbon nanotubes when the bundle is kept in contact with flowing liquid. Development of such current/voltage was predicted by P. Král and Moshe Shapiro in 2001 who theoretically investigated the behaviour of nanotubes in a flowing liquid[5]. Generally an electric current in a material is produced when flow of free charge carri-