

the maximal extent from opportunities the new technologies offer. Treating genomics as a branch of molecular genetics instead of a methodology that, in conjunction with other entirely non-molecular techniques, can address fundamental biological questions would, in my opinion, be a tragedy for Indian science.

Some of the other issues, of somewhat narrower interest, that were discussed at the meeting included the relationships between within- and among-species variation, and whether or not the same loci and alleles are primarily involved in shaping these two levels of variation. A related issue is that of rates of evolution and whether

these differ for different kinds of traits (developmentally versus ecologically important) and different kinds of loci (regulatory versus structural). A relatively neglected but also important issue is the extent to which transposable element-mediated events play a role in shaping genetic variation at various hierarchical levels from individuals to species (P. Cappy, [cappy@pge.cnrs-gif.fr](mailto:cappy@pge.cnrs-gif.fr)). To sum, the two broad questions raised at the meeting were: (a) Can genomics help address some of the 'classic' questions in evolution? (b) Can evolutionary genetics help in the integration of information generated by genomics into real biological knowledge? The consensus appeared to be

that the answer to both questions is a resounding YES!

**ACKNOWLEDGEMENTS.** It is a pleasure to thank the Wissenschaftskolleg zu Berlin for academic support while this report was being written, and Dr Anne Postel-Vinay and the staff of the Domain des Treilles for their magnificent hospitality during the conference. I also thank Prof. Jean R. David and an anonymous reviewer for helpful comments on the manuscript.

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## Indian Academy of Sciences' refresher course in experimental physics\*

The broad aim of the Refresher Course in Experimental Physics organized by the Indian Academy of Sciences was to help motivated teachers improve their background knowledge and teaching skills. This course was planned with the purpose of exposing teachers to some aspects of experimental physics, mainly centred around experiments on solid state physics. In addition, the teachers had to build a few general-purpose instruments in a 'project' mode, for carrying out measurements of various material properties.

Twenty-four teacher participants were selected from various Indian universities and colleges. The criterion for selection was based on academic qualifications and their involvement in post-graduate teaching. In all, 18 teachers attended this two-week course.

In his inaugural address, B. S. Sonde (Vice-Chancellor, Goa University) referred to several aspects of underlying

physics in various day-to-day human activities, from food preservation to transport, communication, entertainment, etc. He emphasized the role of refresher courses in anti-obsolence and upgradation of teaching faculties. His address was preceded by welcome remarks by P. R. Sarode (Goa University) and Satish Shetye (National Institute of Oceanography, Goa). Shetye referred to various activities related to the Science Education Panel of the Indian Academy of Sciences. K. R. Rao (Course-Coordinator) gave details of the scope and course content.

The scientific programme started with talks on background physics with the slated experiments. Beginning with the third day, the participants were divided into two batches. While one batch carried out the experiments, the other batch worked on the projects. In addition, there were seminars on related and useful topics in the evening. The experiments were carefully selected so as to cover most of the areas in solid state physics and a few aspects of optics and electronics. A manual for all the experiments was made available to the participants. Project handouts were also given to them before starting the project work. Each experiment or project was

carried out individually by each participant.

The selected experiments were the following: Resistivity of metal and semiconductor by the four probe method; Measurement of Hall coefficient and mobility of a semiconductor; Paramagnetic susceptibility of a solid by Gouy's method and verification of Curie law; B-H loop and Curie temperature of ferrite; Electron spin resonance: Determination of 'g' value; Composite piezoelectric oscillator: Determination of elastic constant; Measurement of dielectric constant of a ferroelectric material; Thermoluminescence: Study of defects/colour centres in alkali halides; X-ray diffraction (Debye-Scherrer method): Determination of lattice constant of a material; X-ray spectroscopy: Emission spectrum of tungsten; Analysis of sodium spectrum; Simulation of electronic circuits using SPICE.

In addition, a few more experiments were also set-up for interested participants: Lattice dynamics kit for the study of vibrational modes in monatomic and diatomic lattices; Geiger-Muller counting system; Zeeman effect.

The projects carried out by the participants included building of a constant current source (0.1–10 mA), a furnace

\*A report on the 'Refresher Course in Experimental Physics' organized by the Indian Academy of Sciences, Bangalore in collaboration with the Department of Physics, Goa University, Goa for university and college postgraduate teachers from all over India during 29 October to 12 November 2001.

(RT–300°C), a variable power supply for the furnace, and a temperature controller with Pt-100 as sensor.

The projects gave good hands-on experience to the teachers, starting from soldering, to assembly and testing the instruments.

The experiments and projects were introduced to the participants by speakers who were either Fellows of the Academy or faculty members of Physics Department, Goa University. R. Srinivasan (Raman Research Institute, Bangalore) gave a series of lectures on resistivity, Hall effect and dielectrics and piezoelectrics. R. B. Prabhu (Physics Department, Goa University) explained the basics of magnetism to cover Gouy's method and B–H loop experiments. He also spoke on analysis of sodium spectrum. K. R. Rao delivered a lecture on X-ray diffraction and X-ray spectroscopy. A. B. Bhattacharyya (Physics Department, Goa University) introduced simulation-based electronic experiments using SPICE software tools. Some participants took active interest in this novel way of learning and teaching electronics design and circuits. On their request, all of them were given a copy of p-SPICE software on CD-roms. P. R. Sarode dealt with the aspects of electron spin resonance. Thermoluminescence was covered by Uma Subramanian (Physics Department, Goa University).

Explanation of project circuits involved in the manufacture of printed circuits boards was given by M. Dehdia. He was assisted by R. K. Kamat and Efreem D'sa (Goa University). The designing part of the circuits was undertaken by R. B. Tangsali and R. K. Kamat (Goa University) a few

months before starting the course, based on conceptual inputs from R. Srinivasan.

The laboratory and project sessions were conducted by K. R. Priolkar and R. K. Kamat (Goa University) with active assistance from R. V. Pai, Efreem D'sa, V. G. Kulkarni, T. Nagvekar and Preeti Bhobe (Goa University).

The evening seminars were delivered by R. Srinivasan on IUC-DAEF activities; K. R. Rao on neutron scattering activities at Dhruva reactor BARC, Mumbai; and J. A. E. Desa (Goa University) on analysis of errors of observation and their application in experiments. A. B. Bhattacharyya spoke on the status of VLSI design technology in India. S. N. Tandon (IUCAA, Pune) talked about the electronic detectors of light starting from the detection by photographic technique. A. K. Rastogi (Jawaharlal Nehru University, New Delhi) gave two seminars on design of vibrating sample magnetometer and some novel low-cost experiments on diffusivity and thermal conductivity. B. N. Chandrika (VVS First Grade College, Bangalore) talked about the Physics Olympiad and Indian participation. P. R. Sarode delivered a talk on extended X-ray absorption fine structure (EXAFS) and its application for structure determination in materials.

On 2 November, the participants visited the National Institute of Oceanography (NIO), Goa. Introductory talks by Satish Shetye and his colleagues covered various activities of NIO. Thereafter, the participants visited various laboratories in the institute and interacted with the scientists.

The participants showed a lot of enthusiasm in completing the projects and

experiments. Each of them carried out at least 10 experiments and all the projects were complete in all respects. The instruments and furnace fabricated by the participants themselves under the projects were donated to their respective teaching departments by the Academy for continued use.

It is to be noted that some of the participants had experience in performing experiments and making electronic circuits; they helped others who had difficulties. All of them, without exception, had taken to the laboratory and project work with great enthusiasm.

In the afternoon during the last day of the course, a feedback session was conducted. The general opinion expressed by most of the participants was that the refresher course was quite successful in emphasizing the continued need for hands-on training in the laboratory and importance of constructing low-cost instruments for laboratory use. In addition, useful suggestions regarding introduction of experimental data analysis sessions and other comments were also made. Participants expressed a desire that such refresher courses should also be organized frequently, in other branches of physics.

On the whole, the refresher course was a success. It may be mentioned that the course was nicely organized and the participants were highly impressed by the local hospitality.

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