burden of disease?' and 'what strains contribute to this burden?', she designed a number of studies to address other critical questions required to inform public policy and to design interventions: What are the economic costs associated with disease? What is known about the transmission of these viruses and their presence in the environment? Can household and community-level interventions (such as solar disinfection, filtration and point of use chlorination) be effective in reducing disease burden?

Matching the spectrum of her scientific work, Kang has worked with a wide range of individuals starting from investigators in leading public health and research laboratories worldwide to a strong and committed army of grassroot-level workers; she engages with local community health leaders to heads of Government and non-governmental public health agencies, and has employed a wide variety of techniques ranging from simple laboratory assays to state-of-the-art molecular methods and the use of geographic information systems to map diseases. Her work extends from providing evidence for the need for specific strategies for prevention and control of diseases, to the effect (or lack of effect) of interventions.

Kang's expertise in public health is recognized globally. She serves as a member of the National Technical Advisory Group on Immunization and WHO's Global Advisory Committee on Vaccine Safety, Immunization and Vaccine Implementation Research Advisory Committee, among others. She is Chair of WHO's Southeast Asian Region's Immunization Technical Advisory Group. She is an Independent Director of the Biotechnology Industry Research Assistance Council established by the Government of India and Hilleman Laboratories, a partnership established to make affordable vaccines by Merck and the Wellcome Trust. She has published over 250 papers in national and international journals, and has received numerous recognitions and awards: She is an elected Fellow of all the three Indian science academies, a Fellow of the Royal College of Pathologists in the UK and the American Academy of Microbiology, where she is the only Indian woman elected to the fellowship. She is also the first woman and the first person from a low or middle-income country to edit the prestigious *Manson's Textbook of Tropical Medicine*, the holy book of Tropical Medicine. She is a recipient of the National Award for Woman Bio-scientist from the Government of India and is a role model for young investigators, particularly women.

From the beginning of her scientific career, Kang retained a keen interest in honing the next generation of scientists and enabling them to be successful in their research careers. She has been the Program Director of a Global Infectious Disease Research (GIDR) Training Grant from the NIH Fogarty International Center, USA for over a decade and is building enteric infectious disease research capacity in India through strong collaborations and high-quality training. With GIDR support and through other grants, every graduate student and postdoctoral trainee from Kang's group has participated in multiple national and international meetings. Many have trained in laboratories outside their institution, which allows them to gain a wider exposure to research. Several trainees from Kang's group are recipients of the DBT–Wellcome Trust India Alliance Early Career Fellowships that will allow them to make an early start in establishing independent research careers. Kang has worked with fellows and trainees both within India and outside, and is widely respected for her teaching and mentoring.

The hallmark of Kang's work is interdisciplinarity and collaboration, with a committed, systematic and rational approach to addressing problems. She is known for her effective communication and presentation skills. As many of Kang's trainees, mentees and collaborators affirm, she leads by example. The impact of Kang's work is perhaps best summarized in the message from Inder Verma, head of the jury for the Infosys Prize: 'Prof. Kang's tremendous achievements in translational and clinical science reflect her scientific breadth and depth, her willingness to tackle hard problems pertaining to human health in India, her ability to forge national and international collaborations to take critically-needed comprehensive approaches, and her inspiring leadership and mentorship.' Her laboratory in Vellore is now a reference centre for rotaviruses and other tropical infectious diseases, and is ably managed by young investigators who trained with Kang. In her current position at THSTI, Kang aims to build effective programmes that use mechanistic insights to develop new products and strategies for prevention and control of infectious and metabolic diseases in India and enable the next generation of scientists and public health leaders to address still larger problems in health in India and globally.

Sasirekha Ramani, Department of Molecular Virology and Microbiology, Baylor College of Medicine, 1 Baylor Plaza, Houston, TX 77054, USA.
e-mail: ramani@bcm.edu

2017 King Faisal International Prize for Science and Medicine

The King Faisal Foundation in Riyadh, Saudi Arabia has awarded the 2017 King Faisal International Prize (KFIP) for Medicine (topic: Biologic Therapeutics in Autoimmune Diseases) to Tadamitsu Kishimoto of Japan in recognition of his prominent role in developing a novel biologic therapy for autoimmune diseases. The Prize for Science in the field of physics has been awarded to Daniel Loss of Switzerland and Laurens W. Molenkamp of the Netherlands. Loss is a pioneer in the theory of spin dynamics and spin coherence in quantum dots showing promise for practical applications in spin quantum computers. Molenkamp has contributed significantly to the experimental field of spintronics.

The Prize consists of a certificate, hand-written in Diwani calligraphy, summarizing the work of the laureate; a

commemorative 24 carat, 200 g gold medal, uniquely cast for each Prize and a cash endowment of Saudi Riyal 750,000 (about US$ 200,000). The winners will receive their awards in a ceremony in Riyadh under the auspices of the King of Saudi Arabia.

Tadamitsu Kishimoto was born in Osaka in 1939. He graduated from the Department of Medicine at Osaka University Medical School in 1964. Kishimoto studied for four years (1970–1974) at the Johns Hopkins University, Baltimore, USA, under Kimishige Ishizaka (the discoverer of immunoglobulin E). After returning to Japan, he became an assistant at Osaka University, Faculty of Medicine. In 1975, he spent three months with Robert Good, at the Memorial Sloan-Kettering Cancer Center, New York, USA.

To understand the central theme of Kishimoto's contributions, we note the following background. The mechanism of immunity detects external invasions of bacteria and viruses, and tries to eliminate them. Immunity is a complex system consisting of a variety of cells, including lymphocytes (T-cells, B-cells) and macrophages. The chemical substance which plays a pivotal role in transmitting information between cells is called interleukin. During his stint at Sloan-Kettering Cancer Center, Kishimoto discovered a new interleukin and purified it. This was later named as interleukin 6 (IL-6)[1]. He demonstrated the involvement of IL-6 in the pathogenesis of cardiac myxomas, multiple myeloma, Castleman's disease, rheumatoid arthritis, Crohn's disease and juvenile idiopathic arthritis. Significantly, Kishimoto prepared a monoclonal anti-IL-6 receptor antibody that was subsequently humanized and shown to be of great therapeutic value in a series of autoinflammatory diseases, including Castleman's disease, rheumatoid arthritis and juvenile idiopathic arthritis[2,3]. Kishimoto has jointly developed with a pharmaceutical company, an antibody drug Tocilizumab which inhibits IL-6 action. The drug was approved in Japan in 2008 and has now been approved in over 70 countries, including USA and the European Union. He is ranked as the world's eight most cited researchers between 1983 and 2002, and is among the top ten with respect to *h*-index among the living biologists. He has won the Imperial Prize of the Japan Academy (1992); Asahi Prize (1988); Sandoz Prize for Immunology from the International Union of Immunological Society (1992); Crafoord Award from the Royal Swedish Academy of Sciences (2009), and the Robert Koch Gold Medal (2003).

So far, a total of 66 scholars from 13 countries have been awarded the King Faisal International Prize for Medicine.

Daniel Loss was born in 1958 in Winterthur, Switzerland. He received Ph D in theoretical physics at the University of Zurich in 1985. During 1989–1991, he worked as a postdoctoral researcher for Anthony James Leggett (the 2003 Physics Nobel laureate). In 1996, Loss returned to Switzerland as Professor of Theoretical Physics at the University of Basel. He is the Director of the Basel Center for Quantum Computing and Quantum Coherence. His research interests include many aspects of the theory of condensed matter systems, with particular focus on spin-dependent and phase-coherent phenomena (mesoscopics) in semiconducting nanostructures and molecular magnets. A major portion of his current research involves the theory of spin dynamics, spin coherence, spintronics in two-dimensional electron gases, and spin-related phenomena in semiconducting quantum dots[4]. Loss is a pioneer in the theory of spin dynamics and spin coherence in quantum dots showing promise for practical applications in spin quantum computers. The idea is to use spin rather than charge of the electrons trapped in quantum dots as quantum bits. His work has inspired many important experimental programmes. Loss' contributions open the door to powerful spintronic quantum computers with exceptional speed and storage capacity[5,6]. He has received several prizes, including the Humboldt Research Prize (2005); Marcel Benoist Prize (2010) and Blaise Pascal Medal in Physics (2014).

Laurens W. Molenkamp was born in Garrelsweer, the Netherlands in 1956. He received an undergraduate degree in physical chemistry from the University of Groningen, the Netherlands in 1980 and obtained a Ph D from the same university in 1985 for his thesis on ultrafast coherent spectroscopy. He then joined Philips Research Laboratories in Eindhoven, the Netherlands, working on semiconductor lasers and subsequently on mesoscopic transport in semiconductors. In 1994, he was appointed as Professor of Experimental Physics at the RWTH in Aachen, Germany. Since 1999, he is the Chairperson of Experimental Physics at the University of Würzburg, Germany. His research currently revolves around quantum transport and semiconductor spintronics, combining nanolithography and low-temperature transport experiments with the specialized semiconductor epitaxy available at Würzburg[7].

Molenkamp has contributed significantly to the experimental field of spintronics. In 2007, he achieved the first experimental verification of the quantum spin Hall effect[8]. Until then, it was only a theoretical prediction related to the quantum Hall effect (a major discovery in solid-state physics from the 1980s). Unlike the latter effect, the quantum spin Hall effect occurs without an external magnetic field. Instead it uses a strong spin-orbit coupling. This fundamental difference has a potential for many applications. This has led to groundbreaking methods for creating and manipulating spin-polarized charge-carrier states in semiconductors, with the potential to develop magnetic storage devices[9]. The discovery of the quantum spin Hall effect has provided a significant impetus to both basic and applied research. Topological insulators (a novel form of quantum matter) is one of the most active areas of global research in solid-state physics. It is to be noted that the 2016 Nobel Prize in Physics was awarded to David Thouless, Duncan Haldane and Michael Kosterlitz for topological insulators[10]. He has received numerous prizes, including the Oliver Buckley Prize of the American Physical Society (2012); Physics Frontiers Prize (2013) and Gottfried Wilhelm Leibniz Prize (2014).

The prizes are named after the third king of Saudi Arabia, to recognize dedicated men and women whose contributions make a positive difference, not only to scientists and scholars, but whose research results in significant advances in specific areas that benefit humanity. Each year the King Faisal Foundation awards International Prizes (KFIP) for Service to Islam, Islamic Studies, Arabic Literature, Medicine, and Science. The Prize for Science rotates in the fields of physics, mathematics, chemistry and biology[11]. Within three decades, KFIP is ranked among the most prestigious awards. To date there are 18 KFIP laureates, who also have received Nobel

Prizes (mostly after the KFIP). A total of 56 scholars from 13 countries have been awarded the King Faisal International Prize for Science. Mudumbai Seshachalu Narasimhan is the only Indian to have won the KFIP in the science category (for mathematics in 2006)[12]. Vamsi Krishna Mootha of Indian origin, now based in USA received the Science Prize in the category of biology in 2016 (ref. 13). The other major science prizes instituted by the Middle Eastern region are the UNESCO Sultan Qaboos Prize for Environmental Preservation[14] and the recently launched Mustafa Prize for Science by Iran[15].

The Science Prize for the year 2018 will be awarded in the field of mathematics. The topic for the Medicine Prize is 'Immunotherapy for Cancer'. The deadline for all nominations is Saturday, 1 May 2017 and details are at http://www.kff.com/ and http://www.kfip.org/.

1. Kishimoto, T., *Blood*, 1989, **74**(1), 1–10; http://www.bloodjournal.org/content/bloodjournal/74/1/1.full.pdf
2. Nishimoto, N. and Kishimoto, T., *Nature Rev. Rheumatol.*, 2006, **2**, 619–626; doi:10.1038/ncprheum0338.
3. Yokota, S. *et al.*, *Lancet*, 2008, **371**(9617), 998–1006; doi:10.1016/S0140-6736(08)60454-7.
4. Duckheim, M. and Loss, D., *Nature Phys.*, 2008, **4**, 836–837; doi:10.1038/nphys1121.
5. Loss, D. and Di Vincenzo, D. P., *Phys. Rev. A*, 1998, **57**(1), 120–126; doi:10.1103/PhysRevA.57.120.
6. Burkard, G. and Loss, D., *Europhys. News*, 2002, **33**(5), 166–170; doi:10.1051/epn:2002503.
7. Schmidt, G., Ferrand, D., Molenkamp, L. W., Filip, A. T. and van Wees, B. J., *Phys. Rev. B*, 2000, **62**, R4790; doi:10.1103/PhysRevB.62.R4790.
8. König, M. *et al.*, *Science*, 2007, **318**(5851), 766–770; doi:10.1126/science.1148047; https://arxiv.org/abs/0710.0582.
9. Hart, S. *et al.*, *Nature Phys.*, 2014, **10**, 638–643; doi:10.1038/nphys3036.
10. Ramakrishnan, T. V., *Curr. Sci.*, 2016, **111**(8), 1293–1294.
11. Khan, S. A., *Curr. Sci.*, 2013, **104**(5), 575; 2014, **106**(4), 500; 2015, **108**(7), 1202–1203.
12. Malhotra, R., *Curr. Sci.*, 2010, **99**(3), 323–331.
13. Khan, S. A., *Curr. Sci.*, 2016, **110**(7), 1140–1141.
14. Khan, S. A., *Curr. Sci.*, 2016, **110**(1), 15.
15. Khan, S. A., *Curr. Sci.*, 2016, **110**(6), 961.

Sameen Ahmed Khan, Department of Mathematics and Sciences, College of Arts and Applied Sciences, Dhofar University, Salalah, Sultanate of Oman.
e-mail: rohelakhan@yahoo.com

MEETING REPORT

Teacher training workshops in India*

The International GeoScience Education Organisation, Bengaluru organized three teacher training workshops in Goa, Mangaluru and Bengaluru. These workshops were organized as a pilot project to test the impact of such an approach in an Indian setting.

One of the main challenges to humankind in the 21st century is maintaining the balance between human activities and nature. Unfortunately, human activity can cause imbalances in the natural earth system that put at risk the ability of many species, including *Homo sapiens*, to survive on earth. Earth science connects together all aspects of earth processes and the resources that are needed for our existence (freshwater, air, energy, soil, ocean and earth materials) with the study of natural and human-induced hazards. It focuses on understanding the manner in which this complicated earth system works. Therefore, earth sciences is vital to humans in general and especially to those in India, the second most populated and a rapidly growing country in the world.

Unfortunately, without an understanding of the role of humans within the earth system (environmental insight), people of India and the entire world may face future global crises. Therefore, it is essential that every child in India becomes aware of these aspects and is enabled to grow up to be an environmentally literate and responsible world citizen. Emphasis should be laid on the earth system science approach early in the educational scheme as several issues of concern to humans are either related to or emanate from interactions of the different subsystems of the earth system, such as aspects of the Indian monsoon, ocean productivity, cyclones, tsunamis and sea-level rise. Earth science is a truly multi-disciplinary and integrated science of the 21st century and links economic and environmental aspects with human well-being.

Earth science, unfortunately, is neither a separate subject of study nor is it comprehensively represented in the school curriculum in India. Teachers not from the science stream, but the arts stream, teach earth science topics in schools. Teaching is mainly in the form of lectures without many hands-on and mind-on activities. Inquiry-based learning and teaching skills are inadequate; as a result, students memorize facts and figures and do not observe, analyse and hypothesize. Hence they are unable to relate what is taught in the classroom to what they see in their surroundings. That school teachers are not formally trained in the teaching of earth science, which is a glaring omission, covering both the aspects of content knowledge and interactive teaching skills, using the laboratory, outdoors and computer-learning environments that form the heart of earth science education.

In light of the above, the way earth science is taught in Indian schools needs a radical shift from classroom lectures to field work and hands-on activities, observations and deduction. This challenge can only be met by a systematic professional development of teachers, based on teaching materials especially tailored for the Indian curriculum and circumstances.

*A report on Teacher Training Workshops in Goa, Mangaluru and Bengaluru organized by The International GeoScience Education Organisation, Bengaluru during 2–5, 7–10 and 12–15 July 2015 respectively, jointly with the National Centre for Antarctic and Ocean Research, St Aloysius College (Autonomous) and the Karnataka State Council for Science and Technology.