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**FOCUS ON INDIA**

# Secure electricity for rural India

## Indian company teams up with researchers in Surrey, BC, Canada

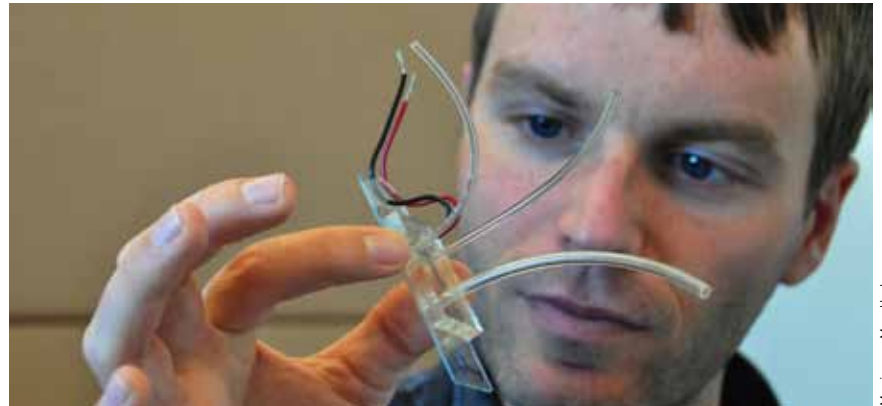
**W**hat really motivates Erik Kjeang is making a difference in the world. “Obviously, there are a lot of poor people in India. We can improve life and even save lives by providing a low cost power solution for the masses in rural areas where grid power is unreliable and frequently unavailable. And if it can be done in India, it can be done anywhere,” says Kjeang.

The SFU assistant professor of Engineering Science invented a microfluidic fuel cell that cuts energy costs. He patented it in 2007 while working on a Ph.D. at the University of Victoria. Now his technology is at the core of an agreement signed this February between SFU, the City of Surrey and Luminous Power Technologies, a leading power solutions provider in India (recently acquired by the multinational company Schneider Electric).

To succeed in the Indian market, products must be much lower cost than they are in Western countries. “Fundamentally, in my opinion this technology is as cheap as it can get because our single cell architecture is nothing but carbon and plastics,” says Kjeang. The device does have another ingredient: vanadium.

The technology is not new. Vanadium-based energy storage systems originated in Australia in the 1980s, but they rely on relatively expensive proton exchange membranes to separate differently charged vanadium ions on the positive and negative sides of the cell. Kjeang’s technology eliminates the membrane by taking advantage of smooth non-turbulent fluid flow that arises in microscopically small channels. His energy cells generate electricity with two streams of water flowing in parallel, one con-

taining the fuel and the other containing the oxidant, but they don’t mix due to the laminar flow conditions at such tiny dimensions. When scaled up in systems that contain thousands of tiny energy cells, enough power can be stored or discharged to power a home. Vanadium power cells have many advantages. They can be charged and discharged tens of thousands of times, they are safe, and they last for decades.



Marianne Meadhal

Kjeang was born in Sweden. On the wall above his desk is the Viking Code: be brave and aggressive. Be prepared. Be a good merchant. Keep the camp in good order. “What really hits you when you come to India is the Indian mentality to make things work without spending any money,” says Kjeang. “The Tata Nano car for example. It’s got a lot of engineering ingenuity that lets them build a car for a few thousand dollars.” Kjeang is doing the same thing for electric energy storage.

SFU is also building clean energy initiatives with other Indian partners such as Sutlej Motors (clean energy systems), Mahindra (alternative fuel, automotive technology), IIT Ropar (clean energy, mechatronics) and IIT Bombay (energy systems engineering). ■

Engineering science professor Erik Kjeang holds a clean energy microfluidic fuel cell based on vanadium ions.

## Message from the Vice-President, Research Canada/India brain exchange



Greg Ehlers, SFU

Dr. B. Mario Pinto V.-P., Research, with his wife Linda Pinto at Simon Fraser University's Diwali celebration, 2011

SFU is ideally positioned to contribute to the movement of research and development and educational services through Vancouver Canada's Asia Pacific Gateway. It already has a number of productive partnerships with several leading Indian academic institutions and companies, and a demonstrated track record in growing new connections with India.

SFU has taken a slow and steady approach to forging research alliances with

its Indian partners. Relationships must not be rushed. They are the foundation upon which future ventures are built. SFU's strategy is to seed select long-term projects and to crystallize initiatives around these seeds over time.

SFU was one of the first Canadian universities to launch an India Strategy, in 2006. A large amount of time and resources have been invested into building solid relationships with India because of a high regard and respect for its potential and intellectual horsepower. We are nurturing mutually beneficial partnerships in key areas of complementary strength: bioinformatics and genomics for public health, clean energy technologies, new media, and information and communication technologies. The recent MOU with India's Luminous Power Technologies, for example, is expected to provide clean energy to Indian households while simultaneously supporting sustainability initiatives in the city of Surrey, BC.

SFU is also building enduring relationships with the local Indo-Canadian community,

facilitated through its India Advisory Council (see p. 4).

With more than 50% of its population under 25 years of age and a target to increase its university enrolment ratio from ~14% to 30% by 2020, India is facing a growing demand for higher education. Meanwhile, Canada requires highly skilled professionals to supplement its aging workforce. In 2010, Canada and India signed a MOU to strengthen cooperation in higher education. Canada has committed \$10 million to develop an international education strategy, and \$12 million to establish a Canada-India Research Centre of Excellence. Coupled with improved visa services, these initiatives should facilitate the smooth flow of human capital between the two countries.

According to a recent report by Frost & Sullivan, returning Indians, as well as Americans and Europeans, will fill India's vast vacancies for senior level positions. Another mega trend will be a generational political shift in India, as "young leaders who are educated abroad ... resolve to revitalize policies and electoral make-up" at home.

Brain exchange holds many benefits beyond the economic. Visiting students enhance the in-class experience for everyone. These students also learn the practices and values of the host country and establish a network of contacts for future collaboration. Humanitarian benefits can arise from exposure to global problems. A great example of this are the SFU international students who are working on some of the technologies featured in this issue. Universal researchers move between disciplinary and country boundaries with ease, serving as catalysts for international projects of global relevance. Faculty members who develop relationships with international colleagues can participate in research projects, co-publish with international scholars, supervise international students and host visiting faculty. Research is also an ideal vehicle to jump-start diaspora initiatives for international development. ■

# Fighting infectious disease

## Conquering disease with genomic knowledge

**L**ow-cost whole-genome sequencing coupled with new genomic knowledge is speeding the development of many new, more effective antimicrobial drugs, vaccines and diagnostic tools.

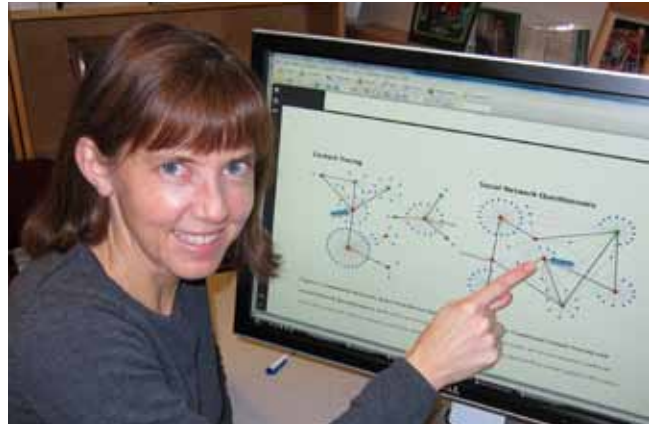
The SFU Bioinformatics for Combating Infectious Diseases research group led by molecular biologist Fiona Brinkman and computer scientist Cenk Sahinalp, has had excellent success with drug target discovery and validation in a model *Pseudomonas* bacteria system. They are now applying the same approach to tuberculosis and have already identified an anti-infective function for an existing drug that is now being patented.

The SFU group takes a computational approach, analyzing the single nucleotide changes in the genome of *M. tuberculosis* for use in epidemiological studies. They can follow a tuberculosis outbreak in a community by identifying subtle genomic differences in bacteria isolates from each infected person. A landmark pa-

per recently published in the *New England Journal of Medicine* shows how their new technique reveals risks for TB transmission not previously appreciated.

The SFU researchers are currently working with the following organizations:

- Department of Biotechnology of the Ministry of Science (DBT)
- International Science and Technology Partnerships (ISTP) Canada
- Vallabhbhai Patel Chest Institute, University of Delhi
- International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi
- Computational Biology and Bioinformatics Centre, Jawaharlal Nehru University, Delhi ■



Fiona Brinkman shows how social network analysis combined with genomics can track the spread of an infectious disease.

# Live-in for literacy

## SFU students raise money to build school libraries in India

**T**heir goal: to raise \$27,000 to build six school libraries in India. The challenge: two students had to eat, sleep and live in a designated area of their university library for seven consecutive days. Their experience was recorded live on webcam for a global audience.

“The rules are that two people have to be in the library always,” explains Timofey Nosov, an engineering science student. “If someone leaves for classes, then someone else has to substitute for that person.”

Participants were allowed to bank five minutes for every hour they spent in the library, and use that time to run to the gym for a shower, or to the cafeteria for hot food. No cooking or bathing is allowed in the library.

Scott Mackenzie, head of SFU Library’s Access Services, endorsed the project because it was community oriented and organized by



students. “It fits with the library’s aims to provide a comfortable space for students, to foster community outreach and to support third-world countries,” he said. The tents were located on the library’s busy main floor, just east of the entrance. The students met their goal. ■

From left: Ada Li, Timofey Nosov and Kymberly McGarvie.

# Community Outreach



Public Affairs and Media Relations, SFU

Every November, SFU's Surrey campus celebrates Diwali. Dancers are from SFU's bhangra dance course in the School for Contemporary Arts—the first full credit course of its kind in Canada. The event brings over 300 community and business leaders together and raises money to send SFU students to study in India.

India's growing economic, political and socio-cultural presence on an international scale inspired the creation of SFU's India Initiative in 2006, a strategic framework to guide academic programming, support relevant research, and deepen community engagement. SFU's Surrey campus executive director, Joanne Curry, says, "Our India strategy supports both the connection with the local South Asian community as well as building ties to India for education and research." Through these relationships, SFU has been able to launch new projects and new student experiences.

SFU's India strategy is under the oversight of SFU's India Advisory Council, a group of leading community, business and government leaders. The Council helps identify opportunities for SFU to raise funds for new projects, and provides contacts and advice on the placement of students in India.

## Student and Faculty Exchange

Over its five-year history, the most valuable

outcome of the India Strategy is the often life-changing experiences of SFU students who have worked in leading Indian companies such as Tata Consultancy Services, as well as in India's villages. SFU also offers financial support for scholars and executives from India to visit and conduct teaching, research or knowledge-sharing activities at the University.

A new \$302,525 federal government investment will support SFU's BC-India Innovation, Exchange and Mobility Initiative to place SFU students with Indian organizations, bring Indian professionals to SFU, and host sector-focused workshops. The clean energy, health and life sciences, and new media/film sectors will be targeted.

## Cultural Events

Situated in Metro Vancouver's vibrant multicultural milieu, SFU's campuses are a popular venue for community events that promote cultural awareness. Joanne Curry says, "This year at our fourth annual [Diwali Gala] event we had record attendance. Almost \$30,000 was raised in funding for grants to support SFU student travel to India." The inaugural Indian Summer Festival at the SFU Goldcorp Centre for the Arts in Vancouver showcased diverse Indian talent to thousands of people, and raised \$5,000 for India's Room to Read program.

## Community Engagement

SFU runs a Punjabi Language and Culture summer camp for children to learn more about their language, heritage, and culture. SFU also offers a program for immigrant teachers to become certified to work in the BC education system. SFU students and researchers helped produce public-service videos to raise awareness of pesticides among local Punjabi farm workers. The SFU Library is leading the Komagata Maru project to create a comprehensive digital resource of the infamous 1914 incident. In India, SFU's involvement in the India Village Life Improvement Foundation project has led to sanitation improvements in rural villages. For more information on SFU's India Initiative, visit [www.sfu.ca/india](http://www.sfu.ca/india). ■

Indian summer festival at SFU Vancouver.



Aziz Dhamani

# Lab on a chip

## Infant mortality in rural India can be reduced with new device

**W**hen a young child in a rural area develops diarrhea as a result of bacterial infection, a delay in treatment could be life-threatening. Rural health workers try to help by prescribing antibiotics, but SFU engineering science professor Ash Parameswaran explains, “It normally takes up to seven days for test results to come back identifying what antibiotic works. During that time the baby can dehydrate and die, so an antibiotic cocktail is typically given, with the hope of a cure.”

Unfortunately, this shotgun approach leads to the creation of multi-drug resistant bacteria, an even greater problem. “The actual test only takes two hours,” says Parameswaran. His research team created a tiny, low-cost plastic testing device that works anywhere. “If they could dispatch a team with our chip solution, then they can do the test and determine which specific antibiotic can be given to kill the bacteria,” says Parameswaran.

The device, which is based on a technique called an antibiogram, works in the laboratory and it will soon be tested in the field.

Originally from Coimbatore, Parameswaran was educated at PSG college of Technology before coming to Canada to earn a doctorate from the University of Alberta.



Andrea Sunderland

While the technology works, certain political and regulatory issues had to be overcome. Working with Dr. V. Lakshminarayanan at Bangalore’s Raman Research Institute and Dr. K. Sankaran at the Centre for Biotechnology at Anna University in Chennai, tests will soon begin in a controlled hospital setting. Funding for such an international cross-cultural and high-tech product is difficult to come by and hence the progress in this project is slow and steady. The ultimate result will be a lower rate of infant mortality in rural India and other potential diagnostic tools that will emerge from this applied research. ■

Engineering science professor Ash Parameswaran with graduate research students (from left) Carlyn Loncaric, Sumanpreet Chhina, and Mona Rahbar showing their device. Sumanpreet emigrated to Canada from Punjab. The students are dedicated to combining technology with humanitarianism to help the less fortunate in rural India.

## Medical tourism

**A**t one hospital in Chennai, a team of SFU researchers was surprised to learn that about a dozen people from the small community of Golden, BC had been there for orthopaedic surgery. Driven by the demand for faster, less costly, and innovative procedures, India’s medical tourism industry is growing rapidly, surpassing other Southeast Asian countries and contributing significantly to the country’s economy. Analysts predict tremendous growth in this sector, from \$150M/year in 2010 to \$2B/year in 2015.

“As we walked from the immaculate and modern hospital building to the fine hotel-like quarters for international patients, we found

ourselves under a hot noon-day sun crossing a stagnant canal of raw sewage flowing from nearby homes in a poverty stricken neighbourhood,” says Valorie Crooks, SFU geography professor. Her group, which includes SFU graduate student Rory Johnston and SFU health sciences professor Jeremy Snyder, combines bioethics and health geography to understand such dichotomies of the medical tourism industry in India and other countries.

The team has identified a number of areas



Source unknown

Rory Johnston, Valorie Crooks, and Jeremy Snyder stand in front of a CyberKnife machine at the Apollo hospital in Chennai, India.

Continued on p. 8

## Early detection of Oral Cancer

### Canadian technology could save lives in India

**F**or over a decade, SFU Biomedical Physiology and Kinesiology professor Miriam Rosin has been championing the early detection and diagnosis of oral cancers. She and her research team employ new optical devices and computer imaging tools to identify precancerous mouth lesions before they become malignant.

Mouth cancers in India often result from oral chewing products, including betel nut and smokeless tobacco called betel quid. “Tissue changes are different when oral cancer begins from betel quid, instead of cigarette smoking, which causes most oral cancers in North America,” says Rosin.

Several years ago, on a trip to the Manipal

College of Dental Sciences in Mangalore, Rosin met professor Ajit Auluck who ultimately came to study with her in Canada. He is now completing a Ph.D. in dentistry at UBC, focusing on the prevalence of betel quid induced oral cancers in South Asian Canadians.

Rosin is working internationally on a global framework with the WHO to ensure the backing of senior level policy makers from many countries for early detection of oral cancers. “We want to make sure that it’s not just a flash in the pan, so we have to align the major institutions. India needs this and we are now working to establish partnerships and funding in India to support a parallel program there,” says Rosin. ■



Source unknown

Dentists in Canada now use non-invasive VELscope technology to detect early signs of mouth cancer.



Public Affairs and Media Relations, SFU

Rekha Krishnan, assistant professor of International Business.

## The dark side of trust

### School of business researcher studies database of Indian companies

**R**ekha Krishnan grew up in Ooty, a hill station in India and went to Cochin U. After a Ph.D. at Tilburg U. in Holland, she came to SFU’s Beedie School of Business in 2005. “People talk about trust as a magic ingredient in business—that it’s always good, but there are times when it can be bad, and it’s not because one party is cheating but because it introduces cognitive limitations,” says Krishnan.

Her well cited award-winning research has implications for India, where many corporations are partnering with multinationals. The trusting Indian partner might be blind to mistakes the multinational makes in the global marketplace. “You follow what your partner says, and don’t use your own judgment,” says Krishnan, who supplements her survey data of international alliances in India with the Prowess Database, covering over 25,000 Indian firms. ■

## Beyond print literacy

### SFU researchers study multicultural education in Dharamsala

**I**n the modern world, print literacy is not enough. People need to be literate in countless ways. Today, video making is one of the most important. SFU’s Faculty of Education offers a Professional Development Program experience in Dharamsala, Northern India. As part of their practicum, students work with teachers in schools serving Tibetan children and adults. They meet with NGOs and community members to explore the cultural, historical and socio-economic factors influencing the local education system for the largely Tibetan refugee population. How does it compare to Canadian systems which also must accommodate multiple cultures?

In one research project conducted by SFU education professors Kelleen Toohey and Diane Dagenais, children are stimulated by giving them video cameras and asking them to show children in two other countries what their lives are like. Meanwhile their counterparts in a Canadian Punjabi community and a Mexican community are doing the same thing.

“The videomaking project recognizes that many children are multilingual and it encourages them to share their personal multicultural knowledge. It also provides SFU Education students a world of experience and techniques far beyond the typical print-based classroom,” says Dagenais. ■



Stills from a video made by students in Petoen Model School, Dharamsala, India.



# Visiting scholars & outstanding students



• Dr. K. S. Rajan, SASTRA University. Rajan is an expert in nanomaterials and nanoimaging. He taught a course in SFU's school of Interactive Arts and Technology called *Creative Nanotechnology* exploring nanotechnology in the context of contemporary art, design and the emergent field of advanced technological art.

• Dr. Priscilla Ngaihte, Indian Institute of Public Health. Ngaihte has been working with John O'Neil in the Faculty of Health Sciences. Her specialty is health promotion and communication. She is developing HIV/AIDS related projects with the Bill and Melinda Gates Foundation.



• Dr. Neelu Kang, Punjab University. Kang studies the women's movement in India. She teaches *Introduction to Women's Issues in Canada* in SFU's Department of Gender, Sexuality and Women's Studies. She also taught a course called *Dynamics of Indian Family* at SFU in 2008, when she was a visiting scholar in the Department of Sociology and Anthropology. She is married to Herb Dhaliwal.



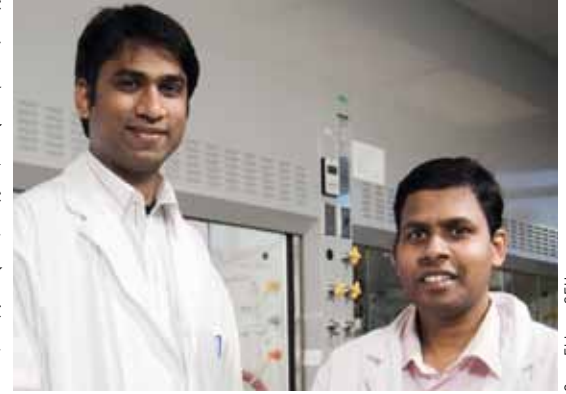
• Dr. Rathish Kumar, Indian Institute of Technology, Kanpur. Kumar works on applied mathematics in biological systems with John Stockie in SFU's Department of Mathematics.



• Dr. Daya Gaur, IIT Ropar. An SFU alumnus, Gaur heads the Computer Science and Engineering department at IIT Ropar. He studies bioinformatics and information technology in health care. He's visiting BC health agencies and companies, and also looking to start a joint graduate program in computing science with SFU. ■



Two former classmates from the same small town in southern India's Tamil Nadu state were serendipitously reunited in an SFU Chemistry lab, where they worked to synthesize the active principles in *Salacia reticulata*, a shrub used since ancient times as a treatment for diabetes in Sri Lanka and India. The naturally occurring glucosidase inhibitors that they derived from the plant have been used to characterize the four enzymes in the intestinal lining that convert starch into glucose. One day, these inhibitors could be sprinkled onto food to control diet-induced degenerative disorders. Sankar Mohan has now returned to India with a doctorate and newfound expertise, while postdoctoral fellow Jayakanthan Kumarasamy has chosen to stay in Canada.



Greg Ehlers, SFU

Sankar Mohan (left) and Jayakanthan Kumarasamy

Aurosish Mishra studied at SFU Burnaby last summer. He worked on a complex computer-science problem whose solutions had to satisfy numerous limitations and conditions, like a Sudoku puzzle. He and Deepak Krishnamurthy were among 105 of India's top undergraduate students on three-month computer science, engineering and mathematics internships with top researchers at 14 Canadian universities—including 13 interns at SFU. They were here as part of MITACS Globalink, a provincially and federally supported internship program to attract international undergraduate students to Canada for their graduate studies and strengthen Canada's research links with India. Krishnamurthy worked with Erik Kjeang on sustainable energy technology in which Luminous Power Technologies has interests. ■



Aurosish Mishra



Deepak Krishnamurthy

# Artistic collaborations

## Film, dance and theatre with Indian partners



Source unknown

Contemporary Arts Field School students taking part in a kathak dance class in Varanasi, 2009. Patricia Gruben is third from the right.

**N**ext year, a visual projection of a 3D elephant will appear in a Vancouver theatre workshop, part of a project involving SFU contemporary arts professors Patricia Gruben and Martin Gotfrit. “It’s based on the life of Helena Blavatsky, a charismatic and controversial spiritual leader who lived in India in the 1880’s,” says Gruben, who wrote the script. With the help of a three-year SSHRC Research Creation grant, she will be returning to India to shoot background footage for the production. “It’s part of my ongoing fascination with India,” she says. “People keep talking about India as a potential source of students and economic partner, but for me, India is a mirror—a very deep one, with many layers. Over the centuries Indian artists have absorbed many new cultures, including Hollywood—and turned them into something unmistakably Indian.

“We can’t say that modernity only comes from the West.”

Bollywood films, for example, are traditional and contemporary at the same time. We can’t say that modernity only comes from the West.”

Gruben received a partnership development seed grant from the Shastri Foundation to collaborate with Indian institutions. She has run screenwriting workshops in Kolkata, Kerala, and Mumbai. She brought a producer from Canada’s National Film Board to teach an animation course at Xavier Institute of Communications in Mumbai.

Gruben also runs the SFU Field School in Contemporary Art & Culture of India, with classes at Jawaharlal Nehru University in New Delhi and Whistling Woods Film Institute in Mumbai.

Participants get a deeper view of India than tourists on a guided tour, with dance classes and lectures from top professors and famous filmmakers such as Sooni Taraporevala, the screenwriter for several of Mira Nair’s films.

At a film conference in Mumbai in 2009, Gruben met a producer and now they are working together to adapt Bapsi Sidhwa’s novel, *The Bride*, for film. One of Sidhwa’s other novels, *Cracking India*, was made into Deepa Mehta’s 1998 film, *Earth*. “We’re in the midst of financing the film and we hope to shoot it next summer,” says Gruben. ■

## RESEARCH MATTERS

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## Medical Tourism continued from p. 5

of concern. Patients may travel alone to save money, but surgeries can be traumatic, requiring companionship and family support. Flights are typically 15 - 20 hours long, and if a person is recovering from knee or hip surgery, they may suffer travel-related complications. Then there are socioeconomic factors. “You’re putting resources in for creating state-of-the-art medical care while there’s a huge disparity within the communities where these facilities are located,” says Crooks. She wants to find out what ethical, equity, and safety implications result from medical tourist dollars. “We learned that more Canadians are going abroad for medical care

than we were aware of,” says Crooks about her visit to Chennai. Her research is funded by the Canadian Institutes of Health Research.

The group is developing ethical buying guidelines for Canadian medical tourism—a first in the industry—while also identifying knowledge gaps that can inform their improvement.

Crooks and Snyder are co-editing a special issue on medical tourism for the journal *Developing World Bioethics* to be released in early 2012. Upon publication, abstracts from the articles translated into Hindi will be available at the group’s web site: [www.sfu.ca/medicaltourism](http://www.sfu.ca/medicaltourism). ■