

## Science communication in multicultural societies\*

Scientific information was debated recently by the public in fields like climate change and *Bt* brinjal. It seems relevant to transfer scientific information to the public because the scientific approach or information could be used by them to make better informed decisions. This is where science communication and communicators play a key role. But why do we talk about 'science' communication? Is science important enough to be communicated? What is the challenge in science communication and how do we counter it?

Both India and the United States are multicultural societies and the question of culture in science communication is also common to both. So, it would be best if ways of overcoming cultural barriers in communication are discussed on a bilateral platform. Indo-US Science and Technology Forum (IUSSTF) helped bring science communicators from both these countries together for a workshop on science communication, where the aforementioned questions were discussed.

Science communication is not a linear process where scientists discover and information passes out. Science communication is much more complex. As Bruce Lewenstein (Cornell University, New York) rightly pointed out, 'Culture affects the process of producing knowledge and differs among scientific communities; how earth scientists communicate is different from how agricultural scientists communicate'. Cultures also differ within research institutions, government agencies and science museums. Though science culture differs, science is perceived as universal. Hence the conflict.

Bad science communication includes good science going unused or being forced upon people. Andrew Pleasant (Canyon Ranch Institute, Tucson) presented how public communication of sci-

ence stands distinct from a research paper. The style in which journalists most often convey science is like an inverted pyramid in which the most important information is conveyed first, unlike the 'pyramid' format followed by scientists in research papers where the conclusion appears at the end.

Have you ever wondered why some scientists do not communicate well? To be able to talk or write well, it is essential that scientists read widely and indiscriminately, according to Raghavendra Gadagkar (Indian Institute of Science (IISc), Bangalore). If communication becomes part of the scientific culture, it would help move towards, if not achieve, an ideal situation where there would be no distinction between 'information producers' and 'communicators', he said. Gadagkar also added that the current trend in the scientific community is to respect peer-reviewed papers, but not newspaper articles. This needs to be balanced out.

What are some of the tactics to attract the audience to your writings? What is common to best science writings? Yateendra Joshi (World Institute of Sustainable Energy, Pune) presented his observations on the characteristics of good communicators and noted some tactics for attracting readers, such as giving

examples, developing analogies, avoiding jargons and abbreviations, limiting the length of chapters, explicitly posing questions and then answering them, and explaining pronunciations and derivations of terms used. Agreeing with Gadagkar, Joshi also stressed the usefulness of reading for improving writing skills. For every hour one spends on learning to write, Joshi advised that 10 hours be spent on reading.

Gauhar Raza (National Institute of Science Communication and Information Resources, New Delhi) emphasized that without a proper understanding of what is to be communicated and how that is to be communicated, efforts and money that are put in communication programmes do not reap many benefits. The role of Information and Communications Technology (ICT) such as Facebook, Twitter, and science blogs in communicating science was evaluated by John Bosco Lourdasamy (Indian Institute of Technology (IIT) Madras, Chennai). ICTs, on the one hand, help in involving the audience (or readers) in communication (two-way interaction) while on the other hand, tend to limit access to only those who are well-versed in English. The potential of blogs still remains to be exploited by the scientists for networking and improving the understanding of science through



Clockwise: Andrew Pleasant (top left), Deepak Kumar, N. S. Anuradha, Yateendra Joshi, Suchitra Mathur, Raghavendra Gadagkar and Bruce Lewenstein (bottom left). (Photo credit: IISc; Collage: author.)

\*A report on the IUSSTF Workshop on 'Social Identity and Science Communication in Multicultural Societies, a platform to evolve shared understandings and distinct perspectives of what is science communication', held at the Centre for Contemporary Studies, Indian Institute of Science, Bangalore during 13-15 December 2010. It was organised by the institute in collaboration with Cornell University.

comments and feedback. This was evident in a recent discovery of arsenic-utilizing bacteria, published in *Science*.

Richa Malhotra (S. Ramaseshan Fellow, *Current Science*) spoke on the issues of science journalism in the print medium and possible ways to overcome them. These were based on her interactions with well-known science journalists from India. To overcome the issue of credibility of science in newspapers, Malhotra suggested that agencies could employ a 'fact-checker' (a science graduate) to check if all the stories on science are factually correct. Suchitra Mathur (IIT-Kanpur) traced how science fiction could be used as a medium to communicate science and explored a host of issues related to the teaching of science in India. She expressed concern over the fact that the Indian system of education does not expose science students to science as a discourse – that history of science is never told.

Sarah Davidson (Cornell University), and H. N. Chanakya (IISc), presented case studies of interacting with villagers, the involvement of farmers and local knowledge. Davidson focused on how

genetically modified papaya got into debate in Thailand. Deepak Kumar (Jawaharlal Nehru University, New Delhi), in his keynote, presented a historical perspective of science, where he anecdotally described how science changed from pre-colonial to colonial science. S. Ranganathan (National Institute of Advanced Studies, Bangalore) being a scientist mentioned his role as a communicator in disguise.

Best discussions usually happen over a cup of coffee. This was noticeable in the World Café at the workshop conducted by N. S. Anuradha (IISc). Participants shared and discussed ideas to enhance science communication and learn about science in multicultural societies, and ways to embrace multiple perspectives. The discussion brought to light that there are clear divides relating to rural–urban, gender, language and access to technology when it comes to communication. Thus, remote areas should be studied for what they need in terms of information from science and then communicated with, rather than communicating and later learning what was needed. Use of technologies such as mobile phones and

video conferencing needs to be further exploited. To make the interaction two-way, one strategy could be forming a group of semi-experts that could act as mediators between scientists and laymen.

The IUSSTF was established in 2000 with an aim to promote, catalyse and seed 'bilateral collaboration in science, technology, engineering and biomedical research through substantive interaction amongst government, academia and industry' (<http://www.indousstf.org/>). The activities of the forum include fostering exchange programmes, visiting professorships, travel grants, research fellowship awards, training schools, workshops, conferences, symposia, etc. Some of its popular programmes are Stanford–India Biodesign Fellowships, Khorana Program for scholars, visiting fellowships in nanotechnology and innovation growth program. Another internship opportunity recently instituted is the Viterbi–India Program.

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## MEETING REPORT

### Molecular interactions\*

Although a bond between two atoms in a molecule is fairly well-understood, intermolecular interactions remain at the heart of chemistry and biology. Hydrogen bonding is the most important of intermolecular interactions, as it controls the properties of the molecules of life, water and DNA. While the importance of these strong O–H...O and N–H...N hydrogen bonds in life has been well-recognized for long, some recent studies reveal that weak hydrogen bonds may play a crucial role in anesthesia. Advances in various experimental and theoretical techniques are contributing to shaping and enhancing our understanding of all these molecular interactions. A

discussion meeting on 'molecular interactions' was organized with the support of the Indian Academy of Sciences, Bangalore. The meeting attracted scientists working in diverse fields.

The meeting started with a brief introduction by E. Arunan (Indian Institute of Science (IISc), Bangalore), convener of the meeting. He pointed out that there have been several key advances over the last decade that challenged the conventional wisdom about hydrogen bonding. The stunning difference between the crystal structure close to the freezing point at ambient conditions, for ice (H<sub>2</sub>O) at 0°C and H<sub>2</sub>S at –60°C has led to the common perception of 'hydrogen bonding' and 'van der Waals interaction' as two distinguishable physical forces among chemists. The advent of molecular beam spectroscopy and scattering studies have showed that (H<sub>2</sub>O)<sub>2</sub> and (H<sub>2</sub>S)<sub>2</sub> have

similar structures. Moreover, molecular beam electric resonance spectroscopy showed that the complex formed between HF and ClF had a structure HF...ClF, rather than the expected hydrogen bonded ClF...HF. Though it was originally called 'anti-hydrogen bond', it is now well-recognized as a halogen-bonded complex. The International Union of Pure and Applied Chemistry (IUPAC) recognized the importance of these phenomena and formed task groups to summarize our understanding of these phenomena and define hydrogen bonding and halogen bonding.

The meeting had 16 invited lectures and there were discussions during and after the talks. The topics ranged from the interaction between two rare gas atoms such as argon and neon to the interaction between the domains in multi-domain and multifunctional proteins. The first

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\*A report on the Discussion Meeting on Molecular Interactions held at Orange County, Coorg, during 28 November–1 December 2010.