Vijnana jijnase: Ideas of science for non-scientists*

Ninasam, a cultural organization in the village of Heggodu, Shimoga district, was the venue of *Vijnana jijnase*, where a dozen scientists presented a panorama of modern scientific ideas to a diverse audience composed of writers, theatre artists, journalists, cultural and literacy critics, architects, and others with similar pursuits not closely related to science. The intention of the workshop was to initiate a substantive dialogue between practitioners of science and their peers in disciplines outside the sciences, and to introspect on the need for promoting literature in Indian languages, communicating the ideas and the spirit of scientific investigation.

The idea of having a workshop of this nature grew out of discussions among some participants in Ninasam's activities, which included some scientists. It was clear from these discussions that science looms large in the preoccupations of intellectuals outside the scientific community. This preoccupation stems from a perception of science as a dominating ingredient in shaping modern society and polity. As such, the perspective on science is largely focused on the role of science as the progenitor of technology, and on its relation to the state. Although there is a great deal of curiosity about the paradigms of scientific knowledge, an appreciation of the methods of science is overwhelmed by concerns regarding its instrumental role in society. There was a feeling that a forum for a regular engagement focusing on the nature of the scientific enterprise, its methods and ideas, as well as its role in society, among scientists and non-scientists would be highly desirable. This workshop was a forerunner of such discussions.

The meeting opened with remarks by K. V. Akshara of Ninasam, who quoted Kannada writer and cultural critic Kirtinatha Kurthukoti about translation being the 'episteme' of modern culture. He also referred to the famous Kannada writer Pu. Ti Narasimhachar's essay on 'The Laboratory and the Theatre' as an illustration of an engagement in the past between creative writing and art in Kannada and scientific activity, and expressed the hope that such a tradition could be revived, among the large number of active scientists and the artists in Karnataka.

Appropriately for the designation of 2005 as the year of physics, in cognisance of Einstein's miracle year 1905, the workshop began with a lecture by C. V. Vishveswara, Jawaharlal Nehru Planetarium, Bangalore, on 'Space, time and gravitation'. Vishveswara explained the concepts of space and time as in the special theory of relativity, the notions of general relativity and its implications to our understanding of gravitation and cosmology.

The lecture by N. D. Hari Dass, Institute of Mathematical Sciences, Chennai, entitled 'Quantum reality and the classical mask', provided an exposition of the quantum mechanical description of the world, and its relation to notions of reality stemming from classical physics. Hari Dass used the hypothetical example of a 'rose atom' to illustrate the nature of quantum mechanical consequences of measurement of non-compatible observables, the origin of the uncertainty principle and the emergence of a classical picture when a large number of measurements are made.

Amitabh Joshi, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, gave an account of 'The idea of evolution'. He outlined the task faced by evolutionary theory as providing an explanation of the diversity, relatedness and adapatedness of species, and explained how evolution provides an explanation for the generation of new species and adaptation in a given environment.

Raghavendra Gadagkar, Indian Institute of Science, Bangalore, spoke on 'War and peace: Conflict and cooperation in animal societies'. Taking examples from his research on bees, wasps and ant colonies he provided an account of the forms and complexity of social organization, communication, including the possibility of the use of language, and the birth within the same colony of different types of insects designated for different tasks. He provided instances of altruism in these insect colonies.

The evening programme of the first day comprised of a play enacted by graduates of Ninasam theatre institute, Kaaladivya and directed by Manipuri director Kanhilal. The play was preceded by a book release of *Vijnana Samskruthi*, translations by K. V. Akshara of Roddam Narasimha's essays concerning mathematical and scientific traditions in India and their relation to modern science. The book was released by U. R. Ananthamurthy, who expressed the hope that gatherings such as these would lead to more books of the kind being released to be published in Kannada. He emphasized the importance of scientists communicating their ideas to a large audience.

The second day's programme began with a talk by B. Ananthanarayan, Indian Institute of Science, Bangalore on 'Fundamental particles and their interactions'. He outlined the development of our understanding of the sub-atomic composition of matter and fundamental forces, starting with the discovery of the electron and ending with the description of quarks as the building blocks of protons and neutrons.

Vishnu Kamath, Bangalore University described composition of matter at the molecular level, the domain of chemistry. He illustrated his talk by taking the example of sugar as a substance, the properties of which may be traced ultimately to sugar molecules. He also spoke about reactivity as an essential concept, and the relationship between molecular structure and properties of materials.

Vidyanand Nanjundiah, Indian Institute of Science, Bangalore, spoke on 'Life, genes and DNA'. He began with a discussion of the differences in the composition of living and inorganic matter, which lead to the expectation that gigantic molecules such as DNA and proteins present in living organisms are fundamental to life. He described the role of DNA as carriers of hereditary information and the relationship between proteins and DNA. He also described information, organization and evolution by natural selection as notions that are key to the understanding of life.

Shobini Rao, NIMHANS, Bangalore, spoke on 'Windows to the mind: Scientific methods and insights from cognitive neuroscience', wherein she discussed the distinction between the mind and the brain, gave a description of the structure of the brain, and the methods by which a func-

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tional map of the brain has been developed. She explained the programme of cognitive neuroscience, based on these ideas, in analysing the components of the psyche and cognition.

The evening programme of the second day comprised film screenings. The first event was showing of two short films by, and a discussion with, Kabir Mohanty, a film maker and video artist from Mumbai dwelling on the craft of the film maker and perception. The second event was the screening of the documentary 'The pleasure of finding things out' featuring the physicist Richard P. Feynman.

On the third day, Vijay Chandru, Indian Institute of Science and Strand Genomics, spoke on 'Algorithm is the idea that has made the modern world possible'. In his lecture, he outlined the development of the notion of algorithms starting from the contributions of Leibniz, Boole, Frege, Hilbert and Goedel, culminating in the work of Turing and Church. He described the Turing machine, and the conceptual structure of the computer, and illustrated a typical algorithm that may be implemented. He spoke of the contribution of Manindra Agarwal and co-workers concerning prime numbers and of Narendra Karmarkar on linear programming as examples of Indian contributions to computer science.

Roddam Narasimha, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, gave a lecture entitled 'Does God play dice?' in which he dwelt on unpredictability, arising from chaotic dynamics, and its implications. He mentioned Einstein's famous statement of belief that God does not play dice, and discussed it, not in the original context of quantum mechanics, but in view of unpredictability inherent in classical nonlinear dynamics. He also narrated the instance of weather prediction to illustrate these ideas.

The last lecture of the programme was given by Sanjay Jain, Delhi University, on 'Complexity: An integrative theme in the sciences'. Mentioning living organisms, brain, ecosystems, human societies, and the biosphere as some examples of complex systems, he highlighted the agglomeration of non-identical parts, complex organizational structure, evolvability, a network of interactions, and role playing as some significant aspects of complex systems that set them apart from most other studied systems.

The lectures were accompanied by an equal amount of time set aside for discussion, and time for each discussion session was used to the fullest. The questions from the non-scientist audience were thought-provoking and insightful dwelling on seeking analogies between science and notions in other realms, judging scientific ideas based on other value systems and vice versa, and comparing various notions of reality.

The final session of the meeting was devoted to two responses and feedback from a number of participants of the workshop. Sundar Sarukkai, National Institute of Advanced Studies, Bangalore, posed the question of what makes science the source of such rich narratives about the world. He discounted the notion that science was more logical than other human activities. He identified language as the key issue, and in particular discussed the role of mathematics as the language of science. He described scientific discourse as multi-semiotic, and attributed to this nature of scientific discourse some of the richness of scientific narratives.

U. R. Ananthamurthy invoked the essay on the two cultures by C. P. Snow and the response to this essay by F. R. Leavis. He felt that the success of modern science needs to be yoked to a philosophical perspective on the part of the scientists. He criticized the trend of seeking justification of other thought systems through modern science. He expressed the desire for preserving and nurturing traditionally acquired knowledge even as modern scientific methods are deployed in activities such as agriculture and medicine. He felt that science needs to be supported strongly by the state so that it can continue to inquire into issues not forced upon it by the market, but the resulting constraints to free scientific inquiry should be pondered upon.

There was a desire expressed for the converse dialogue. The importance of communicating science in Kannada and other Indian languages was reiterated by many. A discussion of emerging directions in science along with their social and ethical components was thought to be a fit theme for future meetings. An aspect of the discussion of science that is fascinating to many non-scientists is the philosophical implications of science, and it was felt that future meetings may engage this aspect more fully. The overall message from the perspective of the scientists present at this interaction was that while there is a great deal of interest in science among the non-scientists such interest is yoked to a broad range of intellectual positions, ethical preoccupations, etc., which scientists need to be willing to address, in order to engage in a substantive dialogue.

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