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Indian Journal of Science Communication

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To Our Readers

Indian Journal of Science Communication invites readers' views and critical comments on any of the aspects of the journal. Suggestions for further improvement in presentation of the journal and its contents are also welcome. Selected letters would be considered for publication under the column *'Letters to the the Editor'*.

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Editorial

An organic approach to science communication yields results!

Looking at the population, size and make up, variety of languages, urban-rural, digital divides, prevalent disparities, poverty, illiteracy, inadequate opportunities, facilities, services, reach of mass media, and so on, India is poised with many challenges, that offer opportunities and possibilities in science and technology communication as well. In developed nations, "the science museums, planetariums, exhibitions, lectures, audio-video media and high-end technological application" approach dominates the 'state-of-the-art' in this field of human endeavour, which is capital intensive and urban oriented. In India, same or better results are achieved through "folk forms, Vigyan Jatha, print and visual media, road-shows, and people's involvement" approach, which is cost effective and fits into our social milieu. However, India is not legging behind in modern approach and has been able to make world records, especially in case of "Science Express" - science exhibition on wheels and "Vigyan Jatha" – an assemblage of activists carrying messages of science from village to village. More recently, India has won the bids against many developed and developing nations and organized international forums – the 6th International Conference on Hands-on Science (HSCI-2009), and 11th International Conference on Public Communication of Science & Technology (PCST-2010) attracting over 1,000 scholars from across the world.

Many developing countries are more or less following western approach but it is refreshing to note that after organization of these forums in India, not only developing but several developed nations are willing to try Indian model for science communication. Moreover, it emerged if scientific literacy implies disseminating knowledge of science, its wonders, its scope, its application, etc., then perhaps in Indian context scientific and technological temper has more meaning and relevance. What we would like to see is that our population at large, particularly the illiterate and backward rural community, develops a scientific outlook rather than being told about facets of science alone that allows informed and logical application of S&T and elimination of superstitions and ignorance. In India, therefore, a more organic approach has taken shape and making inroads. Use of local languages, dealing with everyday S&T problems, using surroundings and environs at home, in field and outdoors, learning by doing, are some of the elements of this parallel but fast emerging approach. In terms of international comparison, no country claims to have achieved 100% scientific literacy. However, USA scores top with its 12% (1995) basic scientific literacy, European Union 5% (1991); Canada 4% (1989), Japan 3% (1991), and China 1.4% (2001) according to a survey conducted by the National Institute for Educational Policy Research in 1991. During a dialogue with the Indian Journal of Science Communication (IJSC), John Maddox, Former Chief Editor, Nature pointed out, "science coverage in media in UK has decreased, as compared to 1970s when it peaked after the Apollo's moon expedition in July 1969".

According to a recent survey in China, science literacy has seen uplift to 3.27% and rising. In Malaysia, a series of studies on science awareness had shown improvement. In India, science coverage in mass media has increased from 3% (1990) to 5% (2010), though it is still abysmal and needs to reach 10-15%. Prof. Bruce Lewenstein, Director, Science & Technology Studies, Cornell University, USA, in an interview with IJSC revealed, "most of the western countries were following 'deficit or linear' model of science communication, assuming that the public has a deficit of scientific knowledge, which must be covered; though public understanding is much more complex and context dependent". It is heartening to realize that Indian initiatives, like Vigyan Jatha, Children's Science Congress, Scientific Explaining of So-called Miracles, Indian Science Communication Congress, Vigyan Mail, and Indian Journal of Science Communication, etc., are widely acclaimed and are unique in nature. Many other countries have followed with some similar activities lately. However, surprisingly Indian magazines- Science Today, Bulletin of Sciences and Invention Intelligence were closed and Indian editions of Scientific American and Popular Science have stepped in.

Several countries have their well-drawn science communication programmes suitable to their needs. In China, science popularization programme is run by China Research Institute for Science Popularization (CRISP), China Association of Science & Technology (CAST) through its countrywide network of science clubs. In South Africa, South African Association of Science & Technology Advancement (SAASTA), the official agency responsible for science communication, works deeper into society with voluntary agencies. What is happening in India is pioneering, new and innovative, and organically indigenous. No other country has a programme, as well coordinated, as comprehensive and with as much on the ground as we do. What we have been able to build up and put together may not yet be adequate but certainly is not insignificant. There now is enough in our possession in terms of ideas, experiences, human assets and enthusiasm to make transition from the tiny, little and isolated experiments and demonstrations to big, bold and large operations in this field. Yet, there is a wide scope of S&T communication activities in future to serve the mankind better and Indian organic approach could perform a lead role.

- Manoj Patairiya

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Science for masses: Thoughts and activities of Tagore

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Abstract

The first Nobel Laureate of India and Asia Rabindra Nath Tagore was a versatile genius. Apart from his creative literature, paintings, philosophical writings and thoughts on education, he had a keen interest in popularization of science and promotion of scientific outlook in the society. In the last phase of his life he had written a book in his mother tongue Bengali entitled 'Biswa Parichya' (An introduction to Universe). The main objective of writing this book was not to discuss development of scientific research but to foster scientific knowledge among the common public through their mother tongue. In fact, dedicating the book to Satyendra Nath Bose, the famous physicist, he expressed his desire that every common man should have right to enter the corridors of science, if not in the inner house. Inspired by Tagore many noted scientists like J.C. Bose, S.N. Bose, M.N. Saha, P.C. Roy, etc., had written a good number of books and articles in their native language for common masses.

Throughout his life, Tagore had experienced that science establishes affinity between human life and natural universe. He nurtured this philosophy in many of his writings and fostered this idea through introduction of various festivals at Santiniketan, an institution that he had created. Agriculture, environmental protection, medicinal value of plants, eradication of superstitions and social dogma, campaign of scientific humanism by glorying human over the Divine and encouraging the power of reasoning over blind beliefs- all these important areas of science and scientific temper have been prominently reflected in his thoughts and practices. The present paper aims to revisit all these aspects with critical analysis of his works and useful references to present Tagorian philosophy of Science for All.

Keywords: Dissemination of science, Scientific temper, Common mass, Works of Tagore

Introduction

Rabindra Nath Tagore (1861-1941) was a creative genius of all times– a poet, a philosopher, an artist, an educationist and a great humanist. Numerous books and research papers are written on Tagore's life and works in above mentioned areas. But Tagore as a popular science writer and a pioneering promoter of scientific attitude in the society are comparatively less emphasized.

The paper proposes to discuss Tagore's contributions on dissemination of science among masses through his writings and his role as a promoter of scientific awareness in the society through his activities. It deals with his science writings and sees him as a lexicographer for creating science glossary. The paper narrates his reflections on environmental awareness in his literary compositions and his experiences in practical fields. It also discusses his sense of scientific temper and presents Tagorian aesthetics in science.

Science Writing

It is now almost accepted that Tagore's first published prose writing was an article on science entitled 'Planets: the abode of living beings (Grahagana jiber abas bhumi)'. In the year 1874, when he was a boy of twelve years, this article was published in *Tatwabodhini*, a journal brought out from his family. The existence of extra-terrestrial intelligence or ETI on other planets of solar system was his concern in this article. Indian Association for the Cultivation of Science was established in the year 1876 in Calcutta. Subsequently it grew into an excellent research institution. Sir C.V. Raman got Nobel Prize in physics in the year 1930 for his research done here. Till the beginning of twentieth century it was primarily the place of lecture and discourse. Tagore wrote an essay on the development of this science association named 'Bigyan Sabha' compiled in Siksha (Rabindra Rachanabali 12th Volume, Visva Bharati p-518).

Despite institutional science education, there was a trial of spreading rational thinking and scientific temper in the society prior to Tagore's birth. In fact Raja Rammohan Ray was the pathfinder in that trial. Scientific attitude was a major issue in modernity ideology of 19th century Bengal renaissance. The sense of modernity was reflected in various ways through social reformation. At that time a bill was passed on abolition of traditional practice of 'Sati' and introduction of widow remarriage. Perhaps this was the first triumph of scientific outlook over superstitions and dogma in Indian society. Later on it emerged as Nehruvian scientific temper.

Tagore however did not complete any formal education and had left his school. He protested against the teacher-centered traditional methods of school education and preferred to be a self learned scholar. In his 'Memoirs of Life (Jiban Smriti)' he narrated his home study of childhood days in the heading 'Learning Many Subjects' (Nana Bidyar Ayojan). Home tutors used to teach him science subjects, like physics, geometry, mathematics, etc., regularly with demonstrating experiments. A student of medical college used to teach him anatomy. For this a human skeleton was kept in his study room. One of his significant short stories "Kankal" reminds this experience. Thus his hands-on science learning which was initiated in his childhood days had life long impression in his mind.

At the age of 76, he wrote his only science book 'Biswa Parichaya (An Introduction to Universe) in mass education book series (Loko sikshya granthamala). This book was dedicated to noted physicist Satyendra Nath Bose with a heart touching note of dedication. In this note Tagore narrated how he was curious about the scientific events and eager to know the inherent wonders of science. He was moved by his science teacher Sitanath Dutta who explained simple science laws through experiments. He was interested in astronomy from his childhood days inspired by his father Maharhi Devendra Nath Tagore who taught him about solar system through sky watching. Subsequently he took interest in reading books on astronomy and biology. In his words, "I got immense pleasure from the big book of Robert Ball (The book 'the story of heavens by Robert Ball was kept in personal collection of Tagore in Rabindra Bhavan library in Santiniketan). Then I read a set of essays on biology by Huxley" (This Huxley was grand father of famous writer Aldus Huxley and biologist Julian Huxley.) In the way he was well acquainted with 'universe of discourse' in the field of life science. 'Through continuous study a scientific temperament grew in my mind which created disliking towards superstition and protected my mind from emotions, but never affected my poetic imagination.'

He urged "The man (scientist) has made far to near, invisible to visible. He has been trying to explore the mystery of the universe hidden in the invisible world by diving in to the deep of the visible world. Very few people are capable of doing and knowing this mystery of science. Those who are deprived of this knowledge they are detached from the main stream despite being in this modern age. This is our primary duty to familiarize them with preliminary knowledge of science through literature." With this specific objective he wrote Biswa Parichaya in his mother tongue Bengali using very simple and lucid language. This is a wonderful book ever written in an Indian language to popularize science. The book contains four chapters namely atomic world (Paramanuloka), the star world (Nakshytraloka), solar system (Saurajagata), planet world (Grahaloka) and earth world (Bhuloka). Now the book has been translates in many languages for wider reach and dissemination.

All the accumulated knowledge till that time (1930) of different disciplines of science like physics, chemistry, astronomy, biology and geology are disseminated in a simple way for popularization. He has explained the nature of colourfulness and colourlessness of objects in a very attractive way- the colour of sunlight is white then why we see different colours of different objects. The cause is that all objects do not absorb all colours they give away some. Our

eyes see that colour. Ruby stone accepts all waves of Sun's radiations except the red. The glow of ruby is due to this sacrifice. Like this many facts, theories of science are explained in a very simple and picturesque way. In biology chapter he has narrated amoeba as nebula of life. He has observed the human evolution in a larger background of space and time with his wide scale of imagination. Like Einstein's statement, 'The eternal mystery of the world is its comprehensibility', Tagore also said 'Man knows everything in this world in spite of all his limitations is a mystery'.

Thus by writing the book Biswa Parichaya in his native language Bengali, Tagore encouraged many scientists to follow his path to acquaint the masses with the wonders of science. A list of his science writings published is given in appendics-1.

A lexicographer: Creating science glossary

One may ask what the relation of science glossary with a poet is. This question can be answered in two different ways. One on the general principle and the other on the specific works of Tagore. From antiquity poets were regarded as skilled users of language. Matter and objects in our language are defined as 'padartha- the meaning of terms or words'. Words are signified as primary identity of every entity and poets as the seers are creators and nurturers of the words. The language of science also has been enriched under the guidance of the poets through the ages. In this context it may be worth mentioning that on the eve of inauguration of Royal Society of England in the year 1667, an advisory committee was formed to teach scientists how to write science topics in normal English language.[1] The poet Jon Dryden was one of the members of this committee. Thus the responsibility was given to a famous poet and language creator to think how ordinary language can be made appropriate for science writing.

On behalf of Calcutta University, Syamaprasad Mukharjee invited Tagore to be associated with the work of compiling the science glossary in the year 1932. This project continued with direct guidance of Tagore and later by Rajsekhar Basu. Tagore was interested in philology primarily on the spelling errors in Bengali. He used to give stress in choosing words from colloquial spoken language for science glossary. A lot of words designed by him are still used in writing popular science in Indian languages. A selected list of his science glossary is given in appendics-2.

Environmental thoughts and practices

Today environmental education is an integral part of every curriculum. But hundred years ago it was appropriately thought by Tagore. In Santiniketan Ashram school nature study (Prakriti Siksha) has been a component of course from its inception. 'Brikshya Ropana' (the tree plantation) and 'Halakarshan' (tilling of land) festivals are examples of the expositions of Tagore's imaginative and at times maverick world-view, nonetheless unique. It has a pioneering place in the history of modern environmental awareness in its originality and vivacity.

Many voices in chorus sing a paean to the Earth, to the triumph of vegetation over desert in the beginning of 'Brikshya Ropan' festival. It was observed for the first time in his Ashram Santiniketan on July 14, 1928. In this ceremony five young men carrying a sapling together enter the festival ground. They are an allegory. They stand for the elements, 'Kshiti (Earth)', 'Ap (water)', 'Tej (fire), 'Marut (air) and 'Byom (sky)' in classical philosophy of our country these embody the building blocks of the cosmos. Each of their attires carries a sign of the element they represent. They recite verses from his 'Bana Bani (the message of forest)'. 'Halakarshan' festival is observed at Sriniketan, an adjacent place to Santiniketan. In this festival a bull plough the designated strip. We may mention here that Tagore had sent his son Rathindranath to study agriculture technology at the University of Illinois, USA which was later applied with much impact at Sriniketan. Similarly the rainy season and spring are welcomed with festivals like 'Barsa Mangal'and 'Basanta Utsab' in Santiniketan. The message that runs deep within all the colours, lyrics and pageantry is the recognition of the bounty the Earth bestows on us and awakening to a covenant to honour and to preserve environment. These festivals are perhaps the first sentient move in the world to build up mass environmental awareness.

In many of his writings Tagore has narrated how tree and forest are important for human civilization. In one of his short stories 'Balai' he described tree as a dumb mother of world life who from time immemorial gathers nectar from the atmosphere and saves it for human being. Nature runs as a consistent motif in whole of Tagore's oeuvre. He sought harmony between the progress and preservation.

The relationship of eating and being eaten up at different level in an ecosystem is represented in the form of a food chain. And a network of species relationship formed by interconnected food chains is a food web. Energy flows from Sun, the source through producer, and the trees to primary and secondary

consumer. This is very cleverly narrated by Tagore in his play 'Bisarjan (immersion) through a dialogue with a priest of a temple who was in favour of animal sacrifice.

The beauty of Tagore's conception was that he sought to inculcate this rubric not through slogan and pamphlets but over a cultural framework.

Scientific temper

Modernity, rationalism, free thinking and quest for truth are different aspects of scientific temper and scientific humanism. Communalism, racialism, untouchability, orthodoxy, etc., had been major evils of our society. Tagore had seen these crises in his lifetime and raised voice against them through his speech, pen, and active campaign. In one of his speeches he lamented that man loves man- this simple statement has to be explained to our countrymen through gospel sayings. Tagore always told to think and act freely against dogmatism and orthodoxy. To him truth is embodiment of progress and freedom. In conversation with Albert Einstein, Tagore told that if there be some truth which has no sensuous or rational relation to human mind, it will ever remain as nothing so long as we remain human beings. He has told, "My religion is in the reconciliation of the universal human spirit in my own individual being".[3]

Conclusion: Aesthetics in science

Tagore lived for eighty years splitting two halves between 19th and 20th centuries and dabbled in music, literature, painting, education, occasional politics, social reforms and science communication. He was a renaissance personality, a complete man and one of the makers of modern Indian ideology and civilization. His creative world is unique in vigour, volume and variety. He was awarded the Nobel Prize for literature in 1913, the first Nobel Laureate from Asia. From his self exposition we know him as a poet. But he had tried his hands in every branch of human learning and successfully contributed something to be remembered for ever. Curiosity about science began in his mind during his boyhood days; it remained till the end of his life. He pondered over the illusion and reality of nature and life to discover mystery of science. Not merely information, it became the knowledge and at last the wisdom of prudence. To his knowledge and belief science is law or philosophy of nature which rules over universe. He defined it in aesthetics, the beauty of nature and epitomized this belief in abundance. His 'Hands-on and Mind-on Science' became aesthetic experience and attractions for others. He was an 'Angel of Surpluses' and 'science popularization' is no exception!

References

1. J.D. Bernal, 'Science in History' (Watts, London), 1957, p321
2. Rabindranath Tagore, 'Bangla Sabdatawta' (Visva Bharati), p184
3. Rabindranath Tagore, 'Sadhana', English writings of Rabindra Nath Tagore, (ed. S. K Das), Vol.2 (Sahitya Akademi, New Delhi, 1966), p283

Appendics-1. Science writings published in magazines

1. Grahagana Jiber Abasbhumi (Planets - abode of living beings), *Tatwabodhini Patrika*
2. Samudrik jiba (Ocean creatures), *Bharati*
3. Sangiter utpatti O upjogita (Creation and use of music), *Bharati*
4. Bangla ucharan (Bengali pronunciation), *Balak*
5. Baigyanika sambad (Science news), *Balak*
6. Ekti prasna(One question), *Balak*
7. Baigyanika sambad (Science news), *Sadhana*
   a) gatinirnyer indriya (Sense organ of finding motion)
   b) ichhamrityu (Willing death)
   c) makarsha samaje stri jatir gourab (The importance of female in spider world)
   d) rogosatru O deharakhak sainya (Disease enemy and body protecting soldiers)
8. Baigyanika sambad (Science news), *Sadhana*
   a) jibaner sakti (Force of life)
   b) bhuter galper pramanikata (Proof of ghost stories)
   c) manaba sarira (Human body)
9. Udayaste Chandra surya (Rising and setting Sun and Moon), *Sadhana*

[List taken from the Bengali book 'Rabindranath O Bigyan by Dipankar Chattopadhaya, Ananda Publisher, Kolkata]

Appendics-2. Selected glossary

English	Bengali
Adaptable	abhiyojya
Adaptation	abhiyojan
Amorphous	abyabhin
Animal husbandry	goshthabidya
Asteroids	grhaika
Automobile	swata schalita
Caloric food	tapajanak khadya
Centrifugal	kendratiga
Centripetal	kendranuga
Degenerate	apajata
Expanding	sphaita
Heredity	bansanugati
Neutral	samyadharmi, etc.

[Collected from the books- Bangla Sabdatatwa and Biswaparichaya] ■

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Urgency of communicating climate change

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Abstract

Climate change is one of the most important global environmental challenges, with implications for food production, water supply, health, energy, etc. Addressing climate change requires a good scientific understanding as well as coordinated action at national and global level. This paper addresses these challenges. There are many temperature dependant phenomenons that also indicate the earth is warming. Scientists suggest that the cause for increase in atmospheric carbon dioxide (CO_2) and ultimately for planetary warming are anthropogenic activities. It has been twenty three years since 'the summer of 1988' and the establishment of the Intergovernmental Panel on Climate Change. Since that time, global climate change has emerged as the most intensely researched and discussed environmental issue ever, with many millions of dollars being spent on efforts to understand causes, anticipate future climatic conditions and their associated impacts, and consider appropriate responses. Despite the abundance of expert knowledge on these topics, and the many communication efforts, greenhouse gas emissions continue to increase in most jurisdictions and societal vulnerability to climate variability and change remains high. This raises questions about the effectiveness of past and present efforts to communicate relevant information to the various publics and policymakers. It also raises questions about the role of information in moving forward on the climate change agenda. Communication involves imparting knowledge with the intent of raising awareness and promoting understanding. In many contexts, such as environmental education and emergency planning, communication is thought to be effective only when these changes in awareness and understanding result in attitudinal adjustments and/or improve the basis upon which decisions are made.

Keywords: Global warming, Climate change, Mitigation, Communication, Barriers to communication

Introduction

An Indian metropolitan city Mumbai was besieged with heaviest downpour in July 2005, killing nearly 600 people. According to the India Meteorological Department, it was the heaviest ever rainfall received in a single day, anywhere in India recording 94.4 cm in the last 100 years. It broke the record of previous highest rainfall at one place in India at Cherrapunjee in Meghalaya of 83.82 cm recorded on July 12, 1910[1]. Cherrapunjee in the North Eastern state of Meghalaya is well known for being the wettest place in the world, was going through a rare rain crisis and was experiencing dry spells. On one hand Mumbai was being flooded, Cherrapunjee received less than average rain fall in June and July with distressing situation

subsequently. In the same year, there was another record broken in Eastern Indian state of Orissa, for unusual mercurial rise in summer, June 2005 recorded the highest temperature of 46.3 degree Celsius in Bhubaneswar of the last 33 years which is 10 degrees above normal[1], leading to a heat wave. The 1998 heat wave in Orissa was recorded as one of the worst, claiming more than 2000 lives[2]. 1998 was the warmest year globally[3]. Floods are an annual feature in Bihar, but the 2004 floods were unique for its severity. Andhra Pradesh reeled under heat wave in 2003 killing 1,421 people, which is an all-time high in the history of Andhra Pradesh[4]. Orissa is no stranger to cyclones but the 1999 cyclone was unprecedented for the sheer severity with wind speed reaching over 300 km per hour leaving nearly 10000 dead and has gone down in history as the super cyclone[5].

Extreme weather could be a manifestation of global climate change and global warming. The record-breaking Mumbai rain or heat waves in Orissa may not have a direct causal association with global warming/ global climate change but at the same time, it cannot be ignored as "simple local aberrations". Extreme weather events such as severe storms, floods and drought have claimed thousands of lives during last few years and have adversely affected the lives of millions and cost significantly in terms of economic losses and damage to property. In addition to changing weather patterns, climatic conditions affect diseases transmitted through water and via vectors such as mosquitoes. Climate-sensitive diseases are among the largest global killers. Diarrhea, malaria and protein-energy malnutrition alone caused more than 3.3 million deaths globally in 2002, with 29% of these deaths occurring in the Region of Africa[3]. The major brunt of global climate change in terms of adverse health impact will be mostly borne by poor and developing countries, even though rich and industrialized countries account for maximum green house gas emission[3,6]. Over the last 100 years India has contributed only 2% of the total carbon emissions from fossil fuel burning[7]. Any region under stress, such as the Indian sub-continent, is likely to experience greater effects from these 'extreme weather' events, because of obvious reasons of poverty, malnutrition, poor public health infrastructure. In its Third Assessment Report (2001), the United Nation's Intergovernmental Panel on Climate Change (IPCC) stated: "There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities" and concluded that overall, climate change is projected to increase threats to human health, particularly in lower income populations, predominantly within tropical/ subtropical countries.

India is a large developing country with nearly two-thirds of the population depending directly on the climate sensitive sectors such as agriculture, fisheries and forests. The projected climate change under various scenarios is likely to have implications on food production, water supply, biodiversity and livelihoods. Thus, India has a significant stake in scientific advancement as well as an international understanding to promote mitigation and adaptation. This requires improved scientific understanding, capacity building, networking and broad consultation processes.

What is climate change?

About two third of solar energy reaching Earth is absorbed by, and heats, the Earth's surface. The heat radiates back to the atmosphere, where some of it is trapped by greenhouse gases, such as carbon dioxide. Without this 'greenhouse effect' the average surface temperature would make the planet uninhabitable for human populations. The atmosphere maintains life-sustaining conditions on Earth. However, ever since the Industrial Revolution began about 150 years ago, man-made activities have added significant quantities of green house gases (GHGs) to the atmosphere. Human activities, particularly burning of fossil fuels, have released over the last 50 years, sufficient quantities of carbon dioxide and other greenhouse gases to affect the global climate. The atmospheric concentration of carbon dioxide has increased by more than 30% since pre-industrial times, trapping more heat in the lower atmosphere. The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have grown by about 31%, 151% and 17%, respectively, between the years 1750 and 2000[8] . *Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or due to persistent anthropogenic activities that brings change in the composition of the atmosphere.*

Precisely at a time when India is confronted with development imperatives[9], we will also be severely impacted by climate change. With close economic ties to natural resources and climate-sensitive sectors such as agriculture, water and forestry, India may face a major threat[10], and require serious adaptive capacity to combat climate change. As a developing country, India can little afford the risks and economic backlashes

that industrialized nations can. With 27.5% of the population still below the poverty line, reducing vulnerability to the impacts of climate change is essential[10].

The future impacts of climate change, identified by the Government of India's National Communications (NATCOM) in 2004 include [9]:

- Decreased snow cover, affecting snow-fed and glacial systems such as the Ganges and Bramhaputra. 70% of the summer flow of the Ganges comes from meltwater
- Erratic monsoon with serious effects on rain-fed agriculture, peninsular rivers, water and power supply
- Drop in wheat production by 4-5 million tones, with even a 1ºC rise in temperature
- Rising sea levels causing displacement along one of the most densely populated coastlines in the world, threatened freshwater sources and mangrove ecosystems
- Increased frequency and intensity of floods. Increased vulnerability of people in coastal, arid and semi-arid zones of the country
- Studies indicate that over 50% of India's forests are likely to experience shift in forest types, adversely impacting associated biodiversity, regional climate dynamics as well as livelihoods based on forest products.

Communication as a medium for change

With an increasing sense of urgency, policymakers, the public, opinion researchers, communicators, and the news media are confronting climate change. Many are aware that decisions made in the very near term will determine the long-term severity of climate change impacts upon the environment, public health, the global economy, global security, and civil society. They have realized that climate change is inevitable and indeed is already occurring but the worst effects can still be mitigated with appropriate public policies and widespread adoption of personal and commercial actions that reduce greenhouse gas emissions. Global climate change is an important challenge that we must embrace and, that communication is an essential element in the response to this challenge. One of the most effective ways of getting the message across to the largest possible audience in a country as vast and diverse as India is through the mass media, including television and the English and vernacular press. Both these media have the potential of being extremely effective tools for environmental communication, but have not been sufficiently exploited for this purpose so far. The television revolution that has recently hit India provides an excellent opportunity to reach out to the literate as well as the illiterate population of the country. Since the advent of satellite television, TV today attracts audiences ranging from the educated elite to poor villagers in all parts of the country. Recognizing the rapidly deteriorating environmental scenario, the Supreme Court of India in several directives has emphasized the need to use the mass media, especially TV, for promoting environmental awareness. Responding to this, the Government is now increasingly interested in allocating prime time TV slots to environmental programmes.

Before considering what needs to be communicated, it's essential to recall that people have their own reasons for using any informational content. To successfully convey information to audiences, one must understand their motivations and satisfy their perceived information needs. People typically acquire scientific information for its social uses in conversation, to satisfy social norms that people should be informed on public issues, or because the information is personally useful for some reason. Because climate change involves particularly complex information, the "entry costs" are very high, i.e, it requires a lot of effort to become expert on the issue, and this inhibits people from actively seeking and carefully attending to information on the topic.

Studies of public health campaigns have long demonstrated that personal behavior changes and significant public policy changes rarely involve a simple one-step process, effective communication is important because it is a tool that can be used to identify problems, encourage participation, invite innovation in problem solving, and promote adaptation and mitigation. Communicating the climate change issue requires the imparting of information to fulfill three expectations: 1) To raise awareness; 2) To confer understanding; and 3) To motivate action.

Awareness

Change is typically gradual and entails a number of small steps. As a nation we are addicted to lifestyles that are not sustainable, and while the need for change is urgent, we should recognize that people are at many different stages in the change process. Some are already

highly motivated to adopt a green lifestyle, others unconvinced that climate change is occurring or that any type of change is needed. A communication strategy must ensure access to information, presentation of information in a usable form, and guidance on how to use the information. Risk communication is a complex, multidisciplinary, and evolving process. Often information has to be tailored to the specific needs of specific geographic areas and demographic groups. This requires close interaction between information providers and those who need the information to make decisions. Studies show that messages that increase people's perceptions of their risk are the place to start with groups that do not yet recognize the problem. For those who already recognize the risk, however, messages explaining what to change and how to do it, and messages that support the individual's belief that these changes will effectively avert the worst consequences of climate change, will be more effective.

A number of behaviour change theories stress the importance of subjecting habits to scrutiny as a first step towards changing them, by raising them out of the unconscious mind. Communications designed to influence habitual behaviors must therefore look at which strategies will be most effective in turning a habit into a conscious behaviour. Ambient media used at the point where the behaviour actually takes place is an example of communications seeking to do this and can be very effective for example, posters and stickers near washbasins reminding people to wash their hands, as used in the swine flu campaign.

Understanding

Understanding the issue and perceived behavioural change all describe 'an individual's sense that they can carry out a particular action successfully and that action will bring about the expected outcome'[11]. What is important is the belief, not whether or not the individual is actually capable of achieving a particular goal. This will determine the effort a person is prepared to put into changing their behaviour and even whether they will attempt it at all. People's sense of awareness can be driven by many things, including past experiences and personal beliefs (for example, some people are naturally more pessimistic than others). Lack of awareness can be a strong barrier to behavioural change. Public responses to climate change are commonly characterized by a lack of awareness, for instance, the sense that the problem is too large for individuals to make a difference[11]. Communication can help increase individuals sense of awareness, for instance by providing clear instructions that make a particular behaviour seem more achievable, by using testimonials to show how other people have made the change or by helping to teach relevant skills.

Adaptation and mitigation

Adaptation requires responses at multiple scales. Building local resiliency in designated sectors and with acceptable socio-economic constraints on possible options offers many opportunities for stakeholder involvement and other community benefits. But the rapid onset of climate change effects may forestall the gradual adaptation recommended [12]. While many decision-makers think of terms of mitigation and adaptation as two independent paths in responding to climate change, recent work shows that adaptation and mitigation are closely linked. For example, on one hand reforestation can be an effective net sink of carbon and therefore qualify as a mitigation measure. On the other hand, forests are also under threat from changing climate, and must therefore also adapt to climate change.

Barriers to communication

The same characteristics that make the media more powerful in communicating the importance of climate change to the public simultaneously make it less likely that the mass media will cover the issue on a steady, continuing basis. News media tend to focus on dramatic, discrete, and local events. Dramatic or unusual weather triggers coverage, as do political events relating to the issue, but slow cumulative changes in temperature and rainfall do not make for exciting reading and hence receive little attention. However, in spite of its capacity to fulfill these roles and the importance of climate change, the topic of climate change communication has received relatively little research attention. Climate change is a complex issue that presents its own challenges for effective communication. First, the issue still lacks immediacy. Uncertainties on the response of the climate system, the environmental and socio-economic impacts, greenhouse gas emission reduction targets, and the reliability of climate model output further cloud the discussion rather than the certainties of this environmental issue. The nature and language of scientific climate impact assessments also make it difficult for the general public, policy makers and even decision makers to respond.

Informing the public about the urgency of the issue, and educating them about the policy options and personal and commercial means for responding is a challenging task for communicators because of the following barriers:

- Climate change is abstract, too broad a topic, and not connected with day-to-day reality.
- Public understanding of the causes and consequences of climate change is low, as awareness of the methods that can mitigate its effects.
- Journalists ignore climate change as part of news coverage as they do not understand the technicalities involved[13].
- Action has been hampered by political partisanship and industry disinformation campaigns.
- The issue remains a low policy priority, and is likely to remain so until the perception of controversy is overcome and people clearly understand both the dangers we face and the actions we must take to avert the dangers.

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Article

Communications: From smoke signals and drumbeats to cybernetics and beyond

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Preamble

From the past to present, it has been a long journey for communications. Many innovations, new ideas and alternative technologies have richly contributed to the growth of communications. As early as in 3000 BC, the use of smoke and drumbeat for signaling was recorded with innovations like encoding information by varying size, hue, and position of the smoke puff and by varying sound beat pattern of drums. One of the present day applications of communications is in telemetry and tele-transfer of data. The traditional fields like agriculture, crop production, farm irrigation, besides many other fields, are deriving benefits out out modern communication techniques. It is a long way ahead to see many more technologies that will be newer and more innovative to appear and to enrich the communications systems. This paper attempts to highlight some of the above mentioned aspects and recognizes the efforts of scientists, mathematicians, engineers, technologists, organizations and their R&D groups who have immensely contributed to growth of communication.

The urge and the necessity to communicate gave birth to personal communication, telecommunication, and mass communication. Techniques to transmit a message from one point to other cover all forms of distance communication, including visual and audible signaling, semaphore, telegraphy, telephony, radio and television, data communication, computer networking, Internet, telemetry and tele-transfer (communication of scientific data), etc. The variations and different aspects of communications can be point-to-point, point-to-multipoint (conferencing), broadcasting that is point-to-multipoint from a transmitter to several receivers, telemetry and tele-transfer of data from field sites to a central station.

Application of communication technologies in agriculture

Agriculture represents the largest sector in the economy of many countries. More than 60% of the population lives in rural areas. Some of the villages have no access to reliable information and fast communication. The farmers sell their produce to intermediaries who buy them at very low price, then resell in cities and make huge profits. Can the communication technology combined with information technology (ICT) contribute towards enhancing the living standards of the population in rural areas; can it assist them in establishing direct relationships with clients and break the intermediaries? These challenges are needed to be met for uplift of the condition of the farmers. Medium to large scale commercially operated farms, scientific methods of crop production, and extensive application of ICT appear to be a viable solution. Telemetry and tele-transfer of data for monitoring and managing the field operations, as well as fast movement of information from one point to another (like: availability of input resources and bank credits therefore, best prices for the produce), have a great potential.

Telemetry and tele-transfer provide an affordable means of status monitoring, measurement and control of various parameters responsible for optimum crop performance, and the timely management of field

operations. Such systems eliminate the need of personnel to make time-consuming visits to remote sites. They allow to send commands to/ from these sites any time in day or night and to carry out status interrogation of equipment or environments. The purpose is not to eliminate human interventions, but to provide a better overall management and scientific farming through efficient and timely communications.

In telemetry, automated sensors collect data from a single or multi-sites and transmit the results to a central monitoring point. The parameters are sensed continuously or at regular intervals. A typical example is: data collected from an agricultural field and transferred to a central station, such as: soil moisture, solar radiation and microclimatic parameters in the crop canopy, crop health (disease infestation, nutrient stress), and crop maturity. From the central station, operations like 'when and how much to irrigate' (scheduling irrigation), 'nutrient applications (proper mix of nutrient and micronutrient components), 'pesticide spray – quantity and spray duration' can be regulated. The entire working is a form of efficient communication for handling scientific data and information, instead of conventional applications of telecommunication like audio, video and text communications as in telephony, TV- broadcast, Internet, etc.

The raw output of the sensors, mounted in the field site(s), is a voltage or current that varies with time. Such output signals are converted to digital form by analog-to-digital conversion or sampling. In sampling, the signal is examined at evenly-spaced time intervals and a binary number assigned to its magnitude. The telemetry device organizes the bit-stream produced by sampling into standard-length frames containing information specifying data type, time of acquisition, etc. If the transmission channel is noisy, the signal is subjected to error-correction coding to allow recovery of data from errors. The signal can also be encrypted before transmission if secrecy is desired. The final and processed signal is sent from the data-collection site(s) using a coaxial cable, or a RF link, or an IR link to a receiving station, where it is recorded and monitored by computers or human operators.

A typical telemetry system (GME telemetry system www.gme.net.au) operates in the 450-520 MHz UHF band. Line of sight coverage is of around 100 km. Repeaters, if needed, are used for larger distances. Typically, a 5-watt output power of the trans-receiver will maintain a reliable link and data transfer. The system is built around a UHF telemetry trans-receiver, control interface unit(s), a supervising software program, and a PC. A number of remote sites are monitored and controlled by a central station. The control interface unit(s) provides connection between trans-receiver and the sensors. The systems are solar powered and software controlled and functions semi-automatically or fully automatically.

Transmitted signals contain the remote sites ID's, as well as the command messages being sent or received. The remote site repeats the message back to the central station to confirm it has correctly received. The central station is pre-programmed to retransmit the message a given number of times until the outstation confirmations reply is received. If no reply or an invalid response received, a warning message is displayed.

Growing crops on commercial scale in medium and large-sized farms and under controlled environment (glasshouses) has become a high-tech business. Most activities related to healthy crops, good yields and high productivity depend on the timely availability of weather, soil, and crop-growth related data. Wireless weather stations mounted in the field play a major role in optimizing the crop performance and its production. These stations transmit back to a central station the major parameters needed for good decisions. Solar power makes the station independent from local infrastructure.

The parameters needed are air temperature, relative humidity, precipitation, soil moisture (crucial for proper irrigation decisions in order to understand the progress of water into the soil and towards the roots), solar radiation, vapour-transpiration (crop to atmosphere moisture exchange by monitoring wind speed and other microclimate parameters), and disease infestation prediction (by leaf-wetness measurements). Such data needs to come from right within the micro-climate of the crop, since the micro-climate in the field varies significantly from the data collected at conventional weather stations. The farmers, therefore, are recommended to put agri-met stations right into their crops.

The way ahead: A vision

Enormous possibilities exist to reap the benefits of communication technologies. The roadmap ahead should be: (1) the furtherance of the existing technologies (Bluetooth, higher compression of data, narrowing the channels without loss of intelligence and information content, systems consuming extremely low power, power needs to be met by body heat or ambient – no need of external power sources), (2) giving trials and experimenting the innovative ideas - biochips,

DNA chips, molecular computing, information coding similar to genetic coding, (3) easy and cost-effective encryption/ decryption techniques for all communications (audio, video, data transfers, etc.), (4) newer, environment sustainable materials for devices and systems, (5) updated production technologies, and (6) overall cost reduction.

Radiation

Electromagnetic radiations, such as radio frequency, VHF, UHF, microwave and optical radiation, are the carrier of the communication and information contents. Altogether newer type of radiations – based on quantum phenomenon, cosmic and other forms of radiation from human body (e.g. brain waves - telepathy) need to be thought of and experimented to find out, if these can reduce the present imperfections in communication channels - shot noise, thermal noise, latency, non-linear channel transfer function, sudden signal drops, bandwidth limitations, signal reflections, etc.

New materials and production technologies

Other than the presently used materials in manufacturing of devices for telecommunications, several newer materials – composites, polymer based materials, semiconductor multi-band materials, special compositions based on nano-tube architectures – should be tried. Can they provide more efficient working, miniaturization, better heat-dissipation properties, lower cost, easier workability and mass production, and environment protection?

New approach to communication

As it happened with wireless telegraphy and telephony, Internet, etc., the newer approaches like telepathy, human to human communication (may be based on some kind of cosmic radiation, body-to-body new form of radiation) need to be explored. The pathway is challenging and needs innovative interventions so that the communication channels continue to serve the mankind.

Some milestones and significant contributions

- **3000 BC**: Smoke was generated; size, shape, colour and timing of smoke puff were used to code more messages than to announce only a presence/ absence of an event. Drumbeats of varying notes were used to convey specific messages.
- **2400 BC**: Couriers (birds), pigeons and hawks, were employed to carry messages, by using tags tied to their neck.
- **490 BC**: Heliograph
- **50 BC**: First newspaper was *Acta Diurna*, ordered by Julius Caesar
- **100 AD**: Paper making art was initiated
- **1000 AD**: Pen, first Chinese printing press (Pi Sheng)
- **1400 AD**: First European printing press (Gutenberg)
- **1500 AD**: Pencils were devised
- **16th century**: Ship flags were used on ship decks for signaling. This was a kind of visual communication
- **1790 AD**: Semaphore is an apparatus for conveying information by means of visual signals, from towers with pivoting blades or shutters, or hand-held flags, etc. Information is encoded by the position of the mechanical elements. Other forms of optical telegraphy include ship flags, lamps and heliographs. Semaphore is a form of optical telegraphy. A British scientist R. Hooke gave a comprehensive outline of visual telegraphy to the Royal Society in 1684, but his system was not put into practice. C. Chappe, 1792/ 94, built the first visual telegraphy (between Lille and Paris); A. Edelcrantz (Sweden), 1794, built a different system (somewhat faster).
- 1**800**s: Typewriter
- **1838 AD**: J. Lindsay gave classroom demonstration of wireless telegraphy in 1832, and later in 1854 demonstrated a transmission over two miles (Dundee to Woodhaven) using water as transmission medium; in 1837/ 38 S. Morse and A. Vail developed and demonstrated electrical telegraph; the first commercial electrical telegraph based on galvanometer needle deflection by C. Wheatstone and W.F. Cooke in 1839; telegraph lines spanned in USA in 1851; first trans-Atlantic cable in 1866 (earlier cables in 1857/ 58 failed); in 1893 N. Tesla explained and demonstrated wireless telegraphy.
- **1848 AD**: Conventional telephone invented by A. Bell in 1876; earlier in 1849 a crude version by A.

Meucci; the first commercial telephone service in 1878/ 79 between London and New Haven; by mid-1888s telephone exchanges in USA; radio-linked trans-Atlantic voice communication in 1927 and cable connection providing multi-telephone connections in 1956.

- **1896 AD**: R. Fessenden in 1900 wirelessly transmitted voice; G. Marconi established in 1901 wireless communication between Britain and USA; Nobel Prize in Physics awarded to G. Marconi (Radio) and K. Braun (work on CRT) in 1909. Sir Jagdish Chandra Basu also worked successfully on wireless radio communications during almost same period.

- **1897 AD**: Abacus (150-100 BC) is one of the earliest computing devices/ machines (still in use); European engineer W. Schickard in 1623 built a mechanical calculator. J. M. Jacquard in 1801 used punched paper tape in the textile loom to programme woven patterns - this could be viewed as an early form of programming. In 1837 C. Babbage was the first to conceptualize and design a fully programmable mechanical computer – "the Analytical Engine". US Census in 1890 used punched cards in the tabulating machines designed by H. Hollerith and manufactured by Computing Tabulating Recording Corporation (later became the IBM). During 1900s by mid of 20th century many technologies and machines started appearing, the notable achievements include: digital computers Zuse Z3 (1941), A-Berry (1941), Colossus (1943/44), Harvard - I/IBM ASCC (1944), ENIAC (1944/48). Use of digital electronics, mainly developed by C. Shannon in 1937 based on information theory, many other ideas and innovations - floating point arithmetic, stored programme architecture (John von Neumann, 1945), vacuum tubes with improved oxide-coated emitter, transistors, VLSI and ICs, microprocessors and memory devices, compact circuit assemblies, main frames replacing PCs, software(s) – window based operating systems, application software, anti-virus and fireballs, etc., gave impetus to the growth of computer systeme.

- **1927 AD**: J.L. Baird in 1925 demonstrated transmission of a picture; improved transmission in 1926; BBC started experimental broadcast in 1929: K. Braun invented the cathode ray tube (CRT) and the first version of television using CRT in 1927 by P. Farnsworth (concurrent work by K. Tihanyi and V. Zworykin); Zworykin's camera later known as the iconoscope (supported by RCA); K. Braun co-shared Nobel Prize in 1909 for his invention on CRT. J.L. Baird switched from mechanical (Nipkow disc) TV to B&W / colour TV using CRT.

- **1969 AD**: George Stibitz in 1940 used a teletype machine to send instructions from New Hampshire to New York and received back the results. In 1962 J.C.R. Licklider developed the "Integrated Network", a precursor to the ARPANet (Advanced Research Projects Agency's Net). In 1964 Dartmouth time sharing system and the same year MIT (supported by GE, Bell Labs, using DEC's PDP-8) routed and managed telephone connections. During 1960s, L. Kleinrock, P. Baran and D. Davies independently conceptualized packt-swiched networks. Bell Labs scientist Claude Shannon, in 1948, published "A Mathematical Theory of Communication" (The Information Theory), the landmark [Shannon, C.E. (1948). A mathematical theory of communication. Bell System Technical Journal, vol. 27, pp. 379-423 & 623-656, July & October 1948]. His theory enabled to evaluate the capacity of a communication channel according to its bandwidth and signal-to-noise ratio. The landmark work lead to IC designs using digital signal processing (DSP). His papers lead to switching circuits using boolean algebra, theory of secrecy – cryptography, engineering limits to communication rates, etc. In 1969 the University of California and the University of Utah were connected as the ARPANet network using 50 KB circuits. Broadly, there are two types of networks in existence: Local Area Network (LAN) and Wide Area Network (WAN). The computer networks are the core of modern communication. The scope of communication has increased significantly and this boom would not have been possible without the progress in the computer networking. The possible imperfections in a communication channel are: shot noise, thermal noise, latency, non-linear channel transfer function, sudden signal drops, bandwidth limitations, signal reflections, etc. These are taken care of to varying extents by several innovative techniques developed from time to time.

- **1983 AD**: J.C.R. Licklider, in 1960. articulated the idea of 'man-computer-symbiosis', and said "a network of computers, connected to one another by wide-band communication lines, which

provided the functions of present-day libraries together with anticipated advances in information storage and retrieval and other symbiotic functions". Man-computer-symbiosis, a sub-class of man-machine systems, conceptualizes that mutually-interdependent human brains and computing machines would prove to complement each other's strengths to a high degree. This made marking the genesis of ideas about computer networks which later resulted into the Internet. The ARPANET became the core of what would become the Internet. Its development was centered on the 'request for comments' (RFC) process for proposing and distributing Internet protocols (in internet-working and computer network engineering, RFC documents are the memoranda encompassing new research, innovations, and methodologies applicable to Internet technologies). S. Crocker wrote the host software and published it in 1969.

Radio Development Timeline

1864: James Clerk Maxwell mathematically predicts the existence of radio waves.

1872: Mahlon Loomis and W. H. Ward (USA) file for U.S. Patents for a "wireless telegraph".

1885/86: Heinrich Hertz proves the existence of radio waves using a primitive transmitter and receiver. As a professor of physics at Karlsruhe Polytechnic, he produces electromagnetic waves in the laboratory and measures their wavelength and velocity. He shows that the nature of their reflection and refraction was the same as those of light, confirming that light waves are electromagnetic radiation obeying the Maxwell equations.

1887: Hertz publishes his research in the journal Annalen der Physik.

1890: Edouard Branly invents the coherer.

1891: Nikola Tesla is granted U.S. Patent No. 454,622 "System of Electric Lighting," first revealing the basic techniques for greatly improving radio transmitter performance.

1892: Hertz publishes "Investigations on the Propagation of Electrical Energy", in German ("Untersuchungen Ueber Die Ausbreitung Der Elektrischen Kraft").

1893: Tesla demonstrates "wireless telegraphy" at the Franklin Institute in Philadelphia and the National Electric Light Association, demonstrating the practical application eight years after Hertz experiments.

1894: The book "Inventions, Researches and Writings of Nikola Tesla", edited by T.C. Martin is published.

1894: Hertz dies at age 37.

1894: Alexander Popov builds his first radio receiver in Russia. This was the first non-laboratory radio service.

1894: Oliver Lodge transmits radio signals at a meeting of the British Association for the Advancement of Science at Oxford University on August 14. One year before Marconi but one year after Tesla.

1894: Jagadish Chandra Bose uses electromagnetic waves to ignite gunpowder and ring a bell at a distance in November in Calcutta.

1895: Popov presents his radio receiver to the Russian Physical and Chemical Society on May 7. The paper on his findings was published December 15.

1895: Marconi transmits wireless signals a distance of about one mile.

1896: Tesla transmits wireless signals over distances of up to 30 miles.

1897: Tesla is granted U.S. Patents No. 645,576 and 649,621 covering the four-tuned circuit wireless system.

1897: Marconi is granted a British patent for his work, establishes the world's first radio station on the Isle of Wight, England & forms the London company later to become the Marconi Wireless Telegraph Company

1897: Bose reports on his microwave radio experiments to the Royal Institute in London & speculates on the existence of electromagnetic radiation from the sun,

1898: Popov effects ship-to-shore communication over a distance of 6 miles

1898: Tesla publicly demonstrates his remote-controlled boat containing "rotating coherers" plus circuit elements that allowed secure

communication between transmitter and receiver.

1900: Popov supervises the construction of a radio station on Hogland island providing a two-way communication by wireless telegraphy between Russian navy base and crew of the battleship General-Admiral Apraksin. Nikola Tesla was the first to hold the rights to radio.

1900: Tesla begins construction of the Wardenclyffe Tower facility for trans-Atlantic wireless telephony.

1901: Marconi receives the first trans-Atlantic radio signal on 12 December. The message received was three dots, the Morse code for the letter 'S'.

1902: Tesla gives interference testimony in the matter of his patent application for "Systems of Signaling" and that of Reginald Fessenden for "Improvement in the Transmission and Receipt of Signals," subsequently determined in Tesla's favor.

1904: Bose receives patent for the use of a semi-conducting crystal as a detector of radio waves

1904: John Ambrose Fleming develops the "oscillation valve" or "kenotron," later known as the vacuum-tube diode.

1904: Tesla advertises his services.

1906: Lee De Forest invents the Audion, now known as the vacuum-tube triode.

1906: Fessenden transmits the first audio radio broadcast on AM from Brant Rock, Massachusetts. Ships at sea heard a broadcast that included Fessenden playing the song Silent Night on the violin and reading a passage from the Bible.

1909: Marconi, co-shared with Braun, awarded the Nobel Prize in physics

1910: Lee de Forest airs radio programs from New York's Metropolitan Opera House.

1920s: Hundreds of radio stations emerge in the USA

1922: The BBC begins broadcasting from London, on November 14.

1928: Julius Edgar Lilienfeld patents the transistor principle in Germany

1933: Edwin Armstrong patents FM (frequency modulation)

1947: William Shockley, John Bardeen and Walter Brattain succeed in building the first practical point-contact transistor at Bell Labs on 22 December. This work followed from their war-time research into radar.

1956: Shockley, Bardeen and Brattain receive the Nobel Prize in Physics for invention of transistor.

(Source: Wikipedia) ■

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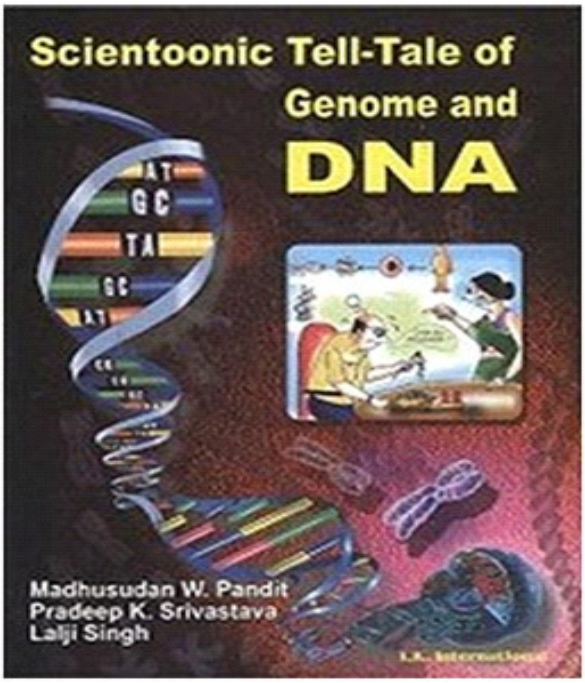
Book

Scientoonic Tell - Tale of Genome and DNA: The first Scientoon based book



Scientoonic Tell - Tale of Genome and DNA by M.W. Pandit, Pradeep K. Srivastava, and Lalji Singh Published by I.K. International, New Delhi

Scientoonics is a new discipline in science that deals with science communication by using a novel class of science cartoons called scientoons. These are essentially cartoons based on scientific concepts, discoveries, results, and their applications. The present book is an effort with entirely novel approach in communication of scientific facts in their true perspective. It will not only help the common man to acquaint himself with the scientific concepts but also make him understand how best we can make use of such facts in our day-to-day life.

Recent advances in scientific research, in fact, demand pro-active efforts from the scientists so that complex ideas reach people effectively. The present book has essentially tried, through scientoons, to depict present concerns brought forward by the recent explosion of knowledge, especially the knowledge about human genome and related areas.

This collection of scientoons has addressed areas such as DNA, DNA fingerprinting, human genome, wildlife conservation, etc. The authors have elaborated on the scientific aspect of the scientoons and have taken an opportunity to provide information that would not only help readers in appreciating the spirit and the humour in scientoons but also enrich their knowledge about scientific advances which are taking place around the world.

Each scientoon is therefore associated with a text that narrates the serious part of science or its applications in a lucid language. This book is an endeavor to reduce gap between the excitement of some of the scientific advances in science of the present time and the curious readers who want to know more about scientific discoveries. The authors deserve appreciation and encouragement of esteemed readers for furtherance of this tool for taking science to masses.

[Mr. Tariq Badar, Secretary, Indian Science Writers' Association, New Delhi] ■

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A Global Forum on Science Communication without Frontiers

The 11th International Conference on Public Communication of Science & Technology (11th PCST-2010) took off on December 6, 2010 at NASC Complex, New Delhi with an introductory session and reception held in the evening. The Central Theme of the conference was ***"Science Communication without Frontiers"***. Over 650 delegates from 51 countries and 30 Indian states participated in the main conference held in New Delhi. A number of media persons representing national and international media also gathered at the conference. The meeting of the PCST Scientific Committee took place in the afternoon. An evening talk "Disseminating science in an interesting manner through Scientoons" was given by Mr. Pradeep Srivastava, a senior scientist from Central Drug Research Institute, Lucknow. A cultural dance show was presented by Prof. Vidhi Nagar and group from Banaras Hindu University.

On December 07, 2010 the conference was formally inaugurated by His Excellency Former President of India Dr A.P.J. Abdul Kalam. The inauguration began with the invocation, felicitation of guests and lighting of ceremonial lamp. A thrilling welcome song by a group of school children created a wave of enthusiasm in one and all. Dr. Kamal Kant Dwivedi, Advisor and Head, Science Communication, Department of Science & Technology delivered the welcome address, followed by an overview of PCST by Mr. Toss Gascoigne, President, PCST Network, Australia. Dr. Manoj Patairiya introduced the PCST Scientific Committee Members and distinguished experts in science communication to the gathering. The guest of honour, Dr. Shailesh Naik, Secretary, Ministry of Earth Sciences, Govt. of India gave his felicitation address on the occasion. The PCST Proceedings and DVD were released by the chief guest Dr. A.P.J Abdul Kalam. Dr.

Dr. Manoj K. Patairiya, Director/ Scientist 'F', NCSTC; Dr. T. Ramasami, Secretary, Dept. of Science & Technology; Dr. A.P.J. Abdul Kalam, His Excellency Former President of India; Dr. Shailesh Naik, Secretary, Ministry of Earth Sciences; Dr. K.K. Dwivedi, Adviser & Head, NCSTC; Mr. Toss Gascoigne, President, PCST Network, Australia at the inaugural session

Dr. A.P.J. Abdul Kalam, His Excellency Former President of India delivering Inaugural Address

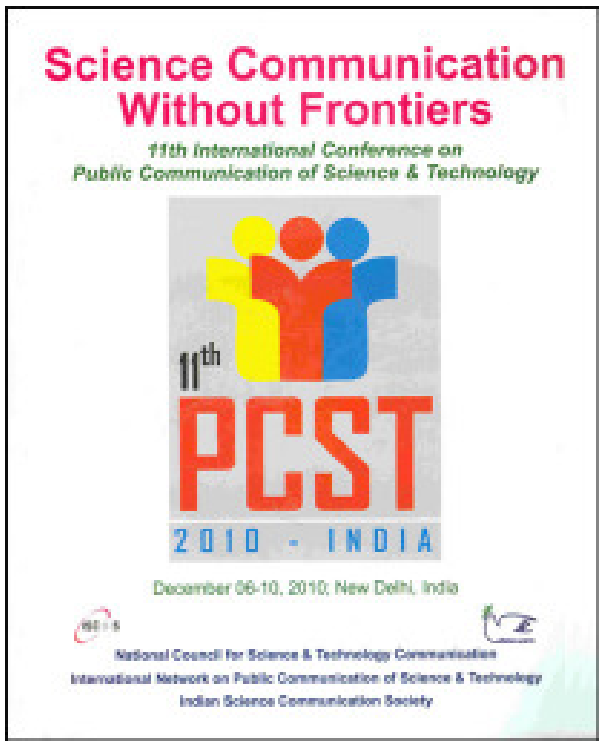
Dr. T. Ramasami, Secretary, Dept. of Science & Technology, Govt. of India delivering Presidential Address

Kalam in his inspiring address asked everyone to be cheerful and have a big smile on their face as it leads to beautiful communication which in turn leads to beautiful minds and thus makes people happy. Dr. Kalam appreciated the timely organization of such a conference attracting science communication fraternity from across the world. Dr. T. Ramasami, Secretary, Department of Science & Technology, Govt. of India in his presidential address welcomed the youth to take advantage of the schemes like INSPIR for promotion of science and emphasized the need of scientific temper and public appreciation of science, while termed the PCST conference a significant milestone in this direction. Chairman of the Organizing Committee Dr. Manoj Patairiya, Director (Scientist 'F'), National Council for Science & Technology Communication proposed a vote of thanks. Ms. Arfa Khanum, a TV anchor, conducted the programme.

After the inaugural function it was the time for knowledge sharing. The Plenary Session I: Science Communication as a Discipline was chaired by Dr. S.K. Joshi, Former Director General, CSIR; he called upon promotion of academic research in this field. The Scientific Session I presented a critical review of science communication in the World. Thematic Workshops were divided into 8 parallel sessions. Prof. Bruce Lewenstein, USA delivered an evening talk on the topic "Connecting PCST to informal science learning". After a day full of brain storming, a Fusion Musical evening was presented by SEARCH Films, Mumbai.

December 8th began with a variety of creative poster session. An exhibition of science communication software products and mobile planetarium were the added attractions to one and all, a combination of research and culture. The mobile planetarium was installed by Vagyanik Drishtikon Society, lively demonstrating space and stars and entertaining delegates. A stall of popular science periodical was organized by ISCOS. In exhibition, many scientific departments participated and displayed their achievements. The main attraction of exhibition was the stall of Department of Atomic Energy, Government of India. A stall depicting the scientific explanation of so-called miracles was a great attraction for the visitors. Posters were presented on nearly all the topics ranging from 'Role of demonstrations for effective communication of chemistry and green chemistry concepts' to 'Communication of science and technology as an instrument for social inclusion'. The scientific sessions included 'Science Communication Studies & Research', 'Role of Science Museums, Science Centres, Planetariums and Science Cities', 'Science Communication through Mass Media'. Prof. B.P. Sanjay, Vice Chancellor, Tamil Nadu Central University shared his views on motivating students for education in science communication. In the evening, Kuchipudi Indian Classical Dance was presented by Ms. Abhinaya Nagajothy and group, Tamil Sangam, New Delhi.

December 9th had a special occasion, when the



11th PCST Proceedings with DVD

Indian Science Writers' Association (ISWA) had its Silver Jubilee Seminar (1985-2010) – "***25 Years of Science Journalism & Communication: The Way Forward",*** as part of PCST conference, chaired by Prof. Jean-Marc Fleury, Chair in Science Journalism, Bell Globemedia, Université Laval (Québec), Canada (Executive Officer, World Federation of Science Journalists). Prof. Fleury said that the ISWA being a 25 years' old organization earns a global significance in shaping the science journalism and communication profession. Prof. Dheerendra Sharma and Air Vice Marshal V.M. Tiwari, the former ISWA Presidents shared their thoughts on this occasion. While remembering the role ISWA has played over the years, Prof. Sharma told that once when some newspapers were compelled to curtail jobs of their staff journalists due to financial crunch, and science journalists were on the edge, ISWA was able to convince these media houses for not doing so. ISWA President Dr. Manoj Patairiya presented his case study over 'Scientist-Journalist Conflict' and termed it as a global phenomenon that requires culture appreciation of both the professions and professionals to defusing tension and paving the way for smooth functioning in harmony

Chief Guest Dr. A.P.J. Abdul Kalam, H.E. Former President of India; Dr. Manoj K. Patairiya; Dr. Kamal Kant Dwivedi; and Dr. Shailesh Naik at the Inaugural Function

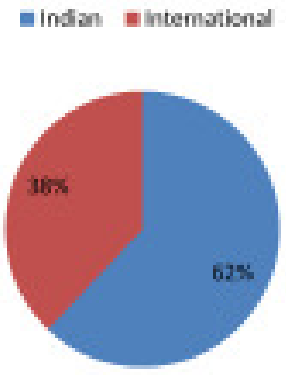
for the cause of science journalism and science communication. The talk attracted an interesting debate.

Other attractions of the day were scientific sessions'Globalizing & Localizing Science Communication' and plenary session 'Future Challenges for Science Communication'. The valedictory function was held in the afternoon, wherein Mr. Pradeep Srivastava on behalf of ISWA presented a brief report on 11th PCST-2010. Prof. Massimiano Bucchi, the host of next 12th PCST-2012, from Florence, Italy introduced the 12th PCST-2012 and previewed a film describing the venue and his plans. Dr. Manoj Patairiya, on behalf of the conference delegates, presented ***"The New Delhi Declaration on Science Communication 2010"*** at the valedictory function, which was based on the recommendations gathered in preceding sessions. A souvenir was also released by the chief guest Prof. B.K. Kuthiala, Vice Chancellor, MLC National University of Journalism & Communication. In his address, Dr. Kuthiala stressed the need for recognizing science communication as an independent discipline for its growth. Dr. Kamal Kant Dwivedi presided over the function and shared his excitement over unprecedented success of the conference with so wide and large canvas of quality presentations on the theme "Science Communication without Frontiers". Prof. M.A. Ansari on behalf of 11th PCST-2010 Secretariat tendered the vote of thanks.

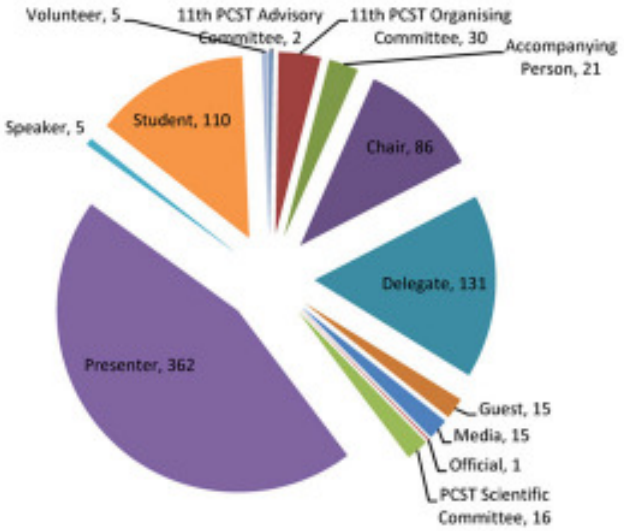
In the evening, a short film on e-learning and science produced and directed by Dr. Navneet Singhal, Italy for United Nations was previewed. Mr. S.K. Malhotra, Director, Public Affairs, Department of Atomic Energy, Govt. of India delivered the evening talk on "Public Awareness of Nuclear Energy Controversies" that triggered arguments and debate offering food for thought. Now was the time to experience the taste of Indian culture and folk dance. The Meenalaya & Deepshikha Manch presented the Folklore of Bundelkhand and the delegates could not resist themselves from joining the artistes on stage for dance and celebrate the overwhelming success of the conference.

A total of 40 technical sessions were organized on 5 different themes divided into 8 technical sessions each. In addition 3 plenary sessions and 8 thematic workshops were organized to open up new and emerging facets of science communication, i.e. risk communication, etc. A special session was also organized for the young researchers attracting a large number of youths capable of taking the messages of science across.

Country	Number of Delegates
Afghanistan	10
American Samoa	2
Argentina	1
Australia	20
Austria	2
Belgium	4
Brazil	8
Canada	9
China	62
Czech Republic	1
Denmark	8
Estonia	5
Finland	1
France	6
Germany	2
Ghana	1
Greece	1
India	496
Indonesia	1
Iran	2
Ireland	4
Italy	11
Japan	15
Korea	16
Korinthos	1
Malawi	1
Mexico	7
Nepal	3
Netherlands	7
New Zealand	1
Nigeria	5
Norway	1
Poland	1
Portugal	8
Qatar	3
Romania	1
Russian Federation	1
San Marino	1
Singapore	1
South Africa	7
Spain	12
Sweden	12
Switzerland	2
Taiwan	2
Taiwan, Province of China	1
Thailand	3
Turkey	3
United Kingdom	17
United States	9
Uzbekistan	1
Grand Total	799



PCST-2010 Participation



PCST-2010 Participation - Category Wise

Contributions were received from all corners of the globe. There were also some collaborative efforts among different nations. The experts belonging to various specialized groups – scientists, technologists, science policy makers, science administrators, science communicators, journalists, researchers, educationists, teachers and students presented over 500 research papers, review papers, case studies, survey analysis, workshops, exhibits, activity corners, posters, and talks, etc.

The research papers were of varied interest. Liu Li and Chang Jing from Beijing, China described China's science popularization policy and the national action scheme for the scientific literacy of all citizen of China.Zheng Nian tells about responsibility of science popularization in serving the society and confronting global problems. Wang Chengwei writes about lay expertise to spread knowledge on health in China. Dohee Kim urged that scientific literature should influence the people be objective, intellectually honest

Prof. S.K. Joshi, Former Director General, CSIR chaired the first plenary session; panelists Prof. Massimiano Bucchi (Italy), Toss Gascoigne (Australia), Prof. Bernard Schiele (Canada), and Prof. M.A. Ansari (India); Coordinator L.D. Kala

and morally right, without being governed or guided by emotion. Wang Dapeng discusses on science popularization by grass-root non-profit organizations. An empirical study on the database of China 2010 Civil Science Literacy Survey–Public Understanding of Science Index in China was described in details in paper given by Fujan Ren, Xuan Lin, Wei He and Lei Ren. There were some papers on science exhibition as means to disseminate science communication. Cai Wendong and Long Jinjing from China gave a study on the application of knowledge management to raise the effects of science communication – a case study of training and education in science centers and science museums. Zhang Chao, Ren Lei and Liang Qi gave an extensive coverage on model research on public channels for science and technology information in China.

Mzamose Gondwe writes about science heroes of South Africa. Nick de la Hunt and Lorenzo Raynard tells on the need for the use of Information Communication Technologies to advance science across cultures in multiple societies. Hester du Plessis spoke on social agency, justice and transformation in


Scientific Temper

Knowledge makes you great

Scientific Temper – PCST daily newsletter

the quest for a globally representative communication of science. Giuseppe Pellegrini from Italy spoke on European Project Accent – involving experts and citizens on climate change debate. Melanie Smallman,

A cultural evening

Dr. A.K. Verma, Adviser (S&T), Planning Commission, Govt. of India inaugurates Pre-conference at Khajuraho

Meeting of Minds at Khajuraho

Kirsti Thornber, Anna Jobourn, Lotten Westenberg and Philippa Lincoln from UK and Sweden elaborated on the lessons learned from dissemination of scientific issues to environment policymakers in Europe. Jorgen Burchardt from Denmark highlighted the importance of independent academic journals and expressed his concern on its survival against the competition at this time from institutional interests. He suggests the need for Government intervention for survival of these academic journals. Baudouin Jurdant and Elsa Poupardin from France talked on the Climategate dispute in France as influenced by science, politics and the media.

An analysis of two decades of European Commission's Science – Society Policy was discussed by Felt Ulrike from Austria. Valentina Bergonzi from Italy and Lukas Soukup from Czech Republic talked on the potential of low budget high impact tools of science communication in Science Cafes. Maarten C A Vander Sanden from the Netherlands and Brian Trench from Ireland reviewed 57 Ph.D. theses on science communication and discussed how research in science communication might contribute deeper theoretical development of this discipline. Christina Karmanidou et al. from Germany discussed science and technology in TV in Greece and Cyprus. Arendaarlu from the Netherlands discussed the implications of science education research on socio-scientific issues, like genetic tests for science communication.

C. Wehrmann from the Netherlands spoke on the necessity of a proper science communication curriculum. Whermann along with Bakker presented another paper describing what science communicators actually do, i.e. about their profiles. Regina Sh Chermokina from Russia wrote on efficacy of using drama techniques for science communication. Different national perspectives on technical, methodological, legal and environmental issues for the inclusion of carbon dioxide capture and storage under the clean development mechanism was discussed by Byung Jin Lee et al. from South Korea. Science communication has changed the public understanding of science and technology policy in Japan, as suggested by Masataka Watanabe.

Craig Cormick from Australia talked on how to engage non-science audiences with science communication. Kira Husher et al. presented on impact

Pre-conference seminar at Khajuraho
Meeting of Minds at Khajuraho

Dr. Manoj Patairiya speaks on "Information Deficit and Information Abundance"

Showcasing Folk Arts of Bundelkhand during cultural evening

and Prof. Hak Soo Kim, Sogong University, South Korea gives keynote address. Chasing the Tiger at Panna Tiger Reserve

evaluation of science outreach to schools. Janet Salisbury and Glenda Cloughley spoke on the art and science of climate change communication. Melanie McKenzie from Queensland, Australia presented values and evaluation – Leximancer as a tool for analyzing values in science communication transcripts. Science theatre – a novel tool for HIV interventions in South Africa was presented by Graham J Walker from Australia.

Ayelet Baram-Tsabari and Bruce Lewenstein from the USA presented a study on the impact of training and skill development of scientists for science communication. Brian Schwartz presented an update on communicating science to the public through the performing arts. Kusum Soni from the USA gave a paper entitled science center is a major player in science communication in industrialized countries rather than developing–reasons and suggestions to bridge the gap. Carlos Antonio Teixeira and Paulo Rogerio Gallo from Brazil presented a study of perception of coordinators of graduate programs in public health in public science communication. Elena Salazar and Julia Taguena from Mexico presented a proposal for an intercultural science communication model to democratize science. Patricia Rios Cabello, Aquiles Negrete Yankelevich from Mexico presented an interesting paper entitled–communicating via art installations.

Karen Bultitude and Roland Jackson from the UK, Donghong Cheng from China, Graham Smith from Australia and Manoj Patairiya from India presented a seminal paper on national strategies for science communication – comparing international approaches, Leela Dhar Kala from Indian Institute of Technology, Delhi, India presented communication hierarchy analysis and decision making in science and technology

Prof. P.C. Vyas, Chair, Post-conference, Mr. Rakesh Verma, Principal Secretary, Dept. of Science & Technology, Govt. of Rajasthan, Prof. Bruce Lewienstien, Cornel University, USA, Prof. Bernard Schiele, University of Quebec, Canada are on dais,

A traditional treat at Chokhi Dhani, an ethnic village, Jaipur, Rajasthan

communication. He analyzed how much of what is adequate for desired impact of communication. Salil Seth and Dipak Kumar form India presented a title, scienfotainment: popularizing science through entertainment. Srijothi Pichamuthu from India presented a big analytical study on health communication theories and models in communicating health messages through media strategy, with special reference to women. Turning digital divide into digital opportunity–a critical analysis was presented by Anshu Arora from Chandigarh, India.

To make the conference successful the media centre was established at the conference venue with state-of-the-art equipments and techniques to provide quick information and transfer of data. The Media Centre was coordinated by Dr. Smita Mishra and mass communication students, Delhi University. Daily press briefings and interview with prominent Indian and foreign speakers were arranged at media centre with the help of professionally qualified experts.

A daily newsletter *'Scientific Temper'* was published and distributed to the delegates, coordinated by Mr. Tarun Jain and a team of volunteers. 5 issues of the newsletters were published. A comprehensive video and news coverage was carried out by a team of *Aaj Ki Khabar*, a web based news portal. Conference website www.pcst-2010.org was widely appreciated by the delegates for regular updates and useful information and guidance to delegates. An intensive global campaign was launched over 2 years prior to conference to popularize the 11th PCST-2010. The delegates from around the world liked specially designed and packaged conference-kit with traditional painting, containing conference memento made of raw metal by tribal artisans of Chhattisgarh, handmade shawls from Kashmir, and herbal products, besides usual conference material, tourism information, and programme book, etc.

Organization of a variety of satellite events built around 11th PCST has created a vibrant and receptive atmosphere all around in India and abroad for science communication. To begin with, the first in the series was the Pre-conference Seminar "Towards a Scientifically Aware and Attitudinally Rational World" held at Khajuraho (Madhya Pradesh) during December 4-5, 2010, including a visit to Panna Tiger Reserve at Panna, in association with Madhya Pradesh Council of Science & Technology. The Pre-conference event also incorporated the 10th Indian Science Communication Congress (10th ISCC-2010).

The Post-conference Workshop "Bringing Scientists & Media Together for Better Science Communication" was organized at Jaipur (Rajasthan) during December 10-11, 2010 in association with Vaigyanik Drishtikon Society, including a visit to Taj Mahal at Agra.

On an initiative by the organizers of 11th PCST, an "Indo-US Workshop on Science Communication" was organized by Indo-US Science & Technology Forum at Indian Institute of Science, Bangalore during December 13-15, 2010, wherein a number of PCST delegates participated. Over 1,500 scholars from India and abroad attended the entire series of science communication programmes on the occasion of 11th PCST-2010 in India.

On behalf of the organizers, Dr. Manoj Patairiya prepared and presented the first bid for holding PCST Conference in India, at the PCST Scientific Committee Meeting held on the occasion of 8th PCST Conference in Barcelona, Spain in 2004. Dr. Patairiya presented the second bid at the PCST Scientific Committee Meeting during 9th PCST Conference in Seoul, South Korea in 2006, followed by presentation of a final plan at PCST Scientific Committee Meeting during 10th PCST Conference at Malmo, Sweden in 2008, and finally the PCST Scientific Committee invited Dr. Patairiya to make formal announcement for "11th PCST Conference, New Delhi, India" at the valedictory function of the 10th PCST Conference held at Malmo, Sweden and Copenhagen, Denmark in 2008.

The 11th PCST-2010 was organized with technical collaboration of National Council for Science and Technology Communication (NCSTC), Department of Science and Technology; International Network on Public Communication of Science and Technology (PCST Network), Australia; International Centre for Science Communication (ICSC); Indian Science Communication Society (ISCOS), Lucknow; and Indian Science Writers' Association (ISWA), New Delhi. The main conference held in New Delhi during December 6-9, 2010.

The 11th PCST-2010 was like any other similar event, but one thing discerning was the enthusiastic participation from the presenters and those on the chair. All the sessions were fully attended and the presenters listened to and questioned at length by the audience. The last day of the main conference in New Delhi did not seem to conclude but to begin. The participants looked unwilling to leave each other – they wanted to learn more, give and discuss more it seemed...marking the beginning of new frontiers!

[Mr. V.P. Singh, Indian Science Communication Society, Chandrika Bhavan, Near Dandahiya Masjid, Lucknow-226020, and Mr. Tarun Bannerjee, Editor, *Indian Journal of Physics & Astrophysics*, CSIR-National Institute of Science Communication and Information Resources, Dr. K.S. Krishnan Marg, New Delhi-110012]

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Science Fiction: Aligning scientific facts and futuristic imagination – A national discussion

A spectacular five days' conference 'National Discussion on 'Science Fiction: Past Present and Future', held at Varanasi during 10-14 November 2008 was first of its kind in India or probably in Asia. The National Council for Science & Technology Communication (NCSTC), New Delhi, Indian Science Fiction Writers' Association (ISFWA), Faizabad and Indian Association of Science Fiction Studies (IASFS), Vellore, Tamil Nadu joined hands together to make this unique conference see light of the day. It was a productive conference in which various experts from different parts of India participated warmly and whole heartedly. Over hundred delegates from all over the country attended the conference including scientists, SF buffs, SF writers, SF readers, academicians, administrators, media persons, puppeteers, magicians, science activists, researchers, and students, etc. The main objective of the conference was to focus on various aspects of science fiction (SF) and its role in communicating science and technology related issues to the common people and children. The five days exercise culminated in to preparing a draft for "Benaras Document on SF 2008". It also examined in depth as how science fiction input could be enhanced and successfully employed in various science communication modules currently in vogue in India. The selected papers were brought out in a book form "Science Fiction in India: Past, Present and Future"; the book also carries salient features of the "Benaras Document on SF 2008".

The programme was launched with a Press Conference on November 10th, the World Science Day. Dr. Manoj K. Patairiya, Director/ Scientist F, NCSTC, Dr. R.R. Upadhyaya, President, ISFWA and Dr. Arvind Mishra, Convener of the conference delineated the objectives of the National Discussion to the press persons. In the evening a puppet performance, befittingly based on an science fiction (SF) story by Zeashan Haider Zaidy was staged by a puppeteer from Lucknow, Arshad Umar. A short SF film 'First World' by Mark Lund was also screened. The climax of the day was celebration of the 'World Science Day' with

A view of inaugural session

an interesting presentation 'Moon: Facts and Fictions' by Dr. Nellai S. Muthu, a scientist from ISRO, Sri Harikota.

The conference was formally inaugurated on November 11th by Prof. S.N. Dubey, Vice Chancellor, JRH Chitrakoot University. Dr. Manoj K. Patairiya presided over the inaugural session. Dr. Dubey discussed the role of SF in teaching – learning, whereas Dr. Patairiya emphasized on SF as a tool and vehicle for carrying messages of science and technology to masses. Books by Harish Goyal, Dr. Ratnakar Bhelkar and Zeashan Haider Zaidy were released on the occasion. Dr. R.R. Upadhyaya, President ISFWA proposed a vote of thanks. The keynote address on this occasion was delivered by Prof. Y.H. Deshpande, a well-known Marathi SF writer. In his address he argued that SF with its futuristic vision enables man to face technological changes successfully. "Today's SF could be the science of tomorrow", says Prof. Deshpande. Justice Yatindra Singh, Hon'ble High Court, Allahabad and a SF aficionado in his paper 'Science Fiction: The Pied Piper of Science' presents a lucid account of characteristics of SF and historical background and points to the topics such as space exploration, robotics, mathematics, artificial intelligence, surrogacy, cloning and stem cell research on which modern SF are based. Mohan Sanjeevan in his paper 'Understanding SF' narrates how SF is a fine blending of science with fiction! He proves his point by giving illustrations of twelve SF stories originally written in Tamil and translated into English by him in the Tamil collection titled "Vinveli Nilayam".

The first technical session, 'Historical Perspectives of Indian SF', was chaired by Prof. Sagar Mal Gupta, and Dr. Arvind Dubey. The second technical session, 'Understanding SF: A Cognitive Approach' was chaired by Dr. Madhu Pant, former Director, Bal Bhawan, New Delhi. Dr. Thirumani. Mr. Harish Goyal, Mr. V.P. Chaturvedi, Dr. Amit Sarwal, Mr. Mehrdad Anaseri, Mr. Mohan Sanjivan, Mr. Kamalesh Shrivastava presented their papers. The third technical session 'Current Trends in SF' was chaired by Dr. Vibhawaree Deshpande. Ms. Anwesha Maity, Ms.Reema Sarwal, Dr. Zakir Ali Rajneesh, Dr. Bhelkar, Mr. Anil Kumar and Mr. Jai Prakash presented their papers. Two joint teams of Mr. M. Venkateshan and Ms. M. Srividya, and N.S. Sampath Kumar and S. Valliganthan presented papers on SF films. The fourth technical session, 'SF for Science Communication' was chaired by Mr. Unnikrishnan Nair. The fifth technical session, 'The Latest Trends in SF', was chaired by Prof. R.D. Shukla. Mr. Hemant Kumar, Dr. Zeashan Zaidi, Mr. Amit Kumar, Arshad Umar, and Dr. Taralika Trivedi presented papers. In the last session, under the chairmanship of Dr. R.R. Upadhyay, subtle qualities of SF stories were explained by Dr. Upadhyaya. Dr Arvind Dubey, Mr. Harish Goyal, Mr. Vishnu Prasad Chaturvedi, Dr. Zakir Ali 'Rajneesh', Mr. Amit Kumar also explained structure, communication and effectiveness of SF stories for various media. In all the technical sessions, questions - answers and the discussions were lively, positive and to the point.

Dr. C.M. Nautiyal in his paper 'The Dividing Lines between Science Fiction, Science Fantasy and Fantasy: Perspective from Films" credits Campbell with the origin of the term 'Science Fiction'. Comparing SF with science fiction films, he states that both media are popular with the audience. He maintains that science and technology is an integral part of SF. Further, fantasy is impossible made probable and science fiction is improbable made possible. He averts that science fiction and science fantasy are overlapping categories. Comparing fiction in general with SF in particular, Hemant Dwivedi states that mainstream fiction can learn from SF and vice versa for their betterment. S.M. Gupta comprehensively surveys the development and evolution of Indian science fiction from adventure stories to Ashok Banker and Rana Das Gupta's 'The Tokyo Cancelled'. Bengali SF writers include Sukumar Ray and Satyajit Ray.

So far as the development of SF in the world is concerned, Jules Verne is regarded as the father of SF. Among famous Science Fiction writers are H.G. Wells, Arthur C. Clarke and Isaac Asimov. Nellai S. Muthu in his informative paper "Moon: Facts and Fictions" chronologically relates facts about the Moon to the books produced as SF from 1634 onwards. Jules Verne's significant prediction in his SF 'From the Earth to the Moon' has similarity with real Apollo Programme. Jules Verne's forecast about the three men travelling in a projectile to the Moon in a weightless state proved to be correct. We find for the first time, the concept that light could work as a form of propulsion for spacecraft. He quotes extensively from H.G. Wells novels to prove that the world's first liquid propulsion engine for a rocket application was made. He refers to the lunar mission undertaken by Russia, America, Japan and China in great detail including that of India and the former President of India Dr. A.P.J. Abdul Kalam's projections in World Space Vision 2050. Jayaprakash D. in his paper "Science Fiction Films Help Make the World a Better Place" defines science films as the films that have a background of an advanced, functional technology that is normally set

in the future. Then he presents a critique of the Day After Tomorrow (2004) film which is about the effects of global warming and climate shifts.

In his paper "H.G. Wells-Shaping Science through Fiction", I. Arul Aram gives a summary of H.G. Wells' The Time Machine" in which the protagonist tells the audience about his journey in the past and into the future. Interestingly enough, the novel hints at climate change due to global warming which may result in the extinction of human race in the distant future. The researcher also discusses Wells' other novels such as 'The Island of Doctor Moreau', 'The Invisible Man', 'The War of the Worlds' and 'The First Man in the Moon'. What SF writers can learn from H.G. Wells is the harmonization of science and technology for human survival; marriage between science and social consciousness and lastly amalgamation of imagination and science for further development of science.

Ratnakar D. Bhelkar in his paper "Allien Encounter in C. Clarke's Childhood End" discusses the overlords' mission to save human race from its destructive use of science and they are victorious in creating an ideal world by the constructive use of science to restore peace and harmony as the face of the earth.

Pointing out the importance of SF drama on radio, Harish Yadav in his paper "Science Fiction for Radio" argues that it not only provides entertainment to the listener but also enhances scientific temperament and develops scientific thinking amongst masses. Afrina Rizvi's paper - 'Science Content in Science Fiction" is concerned with the evaluation of scientific content as communication material in SF by following a methodology for comparative analysis based on Common Science Referring Terms (CSRT). In his paper entitled "Science Fiction and Pragmatism" G.S. Unnikrishnan compares SF with mainstream literature and concludes that a good SF gets reclassified as mainstream fiction. There were several parallelisms between the social and political histories of Bengal and Japan in the 19th Century, affirms Anwesha Maity in her paper 'Comparing Histories of SF: Bengal and Japan'. Likewise, 'similarities and evolutionary trends are visible in the science fiction of Japanese and Bengali languages,' states the researcher and gives many examples of the books published on SF in both the languages.

A number of distinguished experts who have added colours to the conference included, amongst others, Mr. Amit Sarwal, Khalsa College, Delhi; Dr. Geetha B. BITS, Pilani; Ms. Reema Sarwal, Miranda House, Delhi University; Dr. Vibhavari Deshpande, Medical college, Aurangabad; Dr. Rajiv Ranjan Upadhyaya, President, ISFWA, Faizabad; Mr. Manglesh Dabral, noted literateure, New Delhi; Dr. Madhu Pant, Ex Director, Bal Bhawan, New Delhi; Air Vice Marshal Vishwa Mohan Tiwari, Ex President, ISWA, Noida; Prof. S.N. Dubey, Vice Chancellor, JRH University, Chitrakoot; Dr. A.C. Mishra, Registrar, JRH University, Chitrakoot; Dr. Ram Mohan Pathak, Director, MMM Patrakarita Sansthan, Varanasi; Mr. Anil Kumar Sharma, Manager, Purvanchal Audyogik Prashikshan Kendra, Varanasi; and Mr. Ayush Jain, Jaipur. The programme concluded on November 14th, the Children's Day and birthday of Pundit Jawaharlal Nehru.

The landmark achievement of the National Discussion on Science Fiction was the preparation of Banaras Document of SF 2008, which presumably will go in the annals of SF in India. Fiction writing and reading is very popular among intellectuals. Lately, India has produced Salman Rushdie, Arundhati Roy, Kiran Desai and Arvind Adiga, who have won the coveted and prestigious Booker Prize for their novels. Detective fiction by Sherlock Holmes, Raymond Chandler, Earl Stanley Gardner and a host of other writers are widely read all over the world. SF, on the other hand, (though almost 200 years old in its origin) does not enjoy that much readership.

Science Fiction is a fine fabric of a number of elements together interwoven in a manner so as to entertain the reader at one hand and to arouse one's creative imagination at the other. It can inform us with an analytical and rational approach and enable us to foresee futuristic perspectives. Several classical SF stories have prepared the ground for a number of landmark inventions. Further, it has tremendous potential to motivate, educate and entertain masses especially children. SF could be a popular means of science communication. However, it does not enjoy that popularity as compared to those of general and detective fiction. Concerted effort on the part of writers, reader's critics, syllabus framers, publishers, and media persons is required to popularize SF. Hence the 'Benaras Document' on SF 2008' was created as an outcome of the conference.

The objective of the Document amongst others is to popularize and propagate SF amongst children, students, researchers, academicians, common readers and practitioners of science in various manners in particular and to create science awareness and scientific temper in masses in general. The Document addresses the following issues, that were discussed in five subgroups formed out of the conference delegates:

1 What is science fiction?

2 Whether science fiction can be a part of science communication?

3 Should fantasy be included in SF?

4 Is speculative fiction a part of SF?

5 Should SF be anachronistic, synchronistic or futuristic or would be all the three?

6 Objectives of SF?

7 Should the history of SF be included in the Document?

8 What is the scope of SF?

9 Recommendation can be made for the promotion and propagation of SF?

10 Should SF be included in the curriculam?

11 Strategies to be adopted for teaching SF?

There was a lot of disagreement about the definition and scope of SF amongst SF writers and SF buffs. Some of them insisted on SF being futuristic genere, whereas some were happy with synchronic description of S&T in SF. Some writers were against including fantasy, whereas others felt that fantasy helped in resolving real time problems. Some insisted inclusion of human values in SF. A few discussants argued that although anachronism is a disqualification in literature but there could be a place for anachronism, synchronism and futurism in SF. A SF critiqe felt that SF is a literary art; structure is important and human sensitivity is also important, he argued. According to some writers, SF combines both literature of knowledge and literature of power. A science communicator suggests that SF is a part of science communication, whereas many vociferously refuted this suggestion and said that SF and science communication are entirely different and by excessive adherence to science, we are not popularizing SF. Arguing against the inclusion of human values, one SF writer opined that the term human values is a relative term and is governed by time and place, whereas SF is neutral to such human values. Finally, all the delegates came to define SF in the following words.

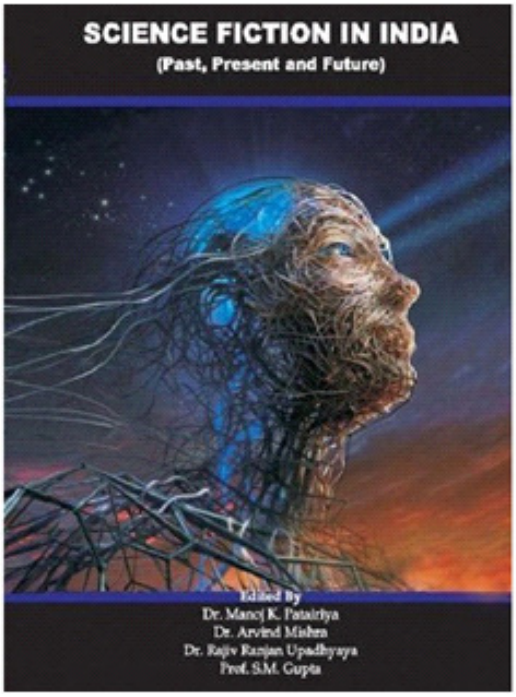
"SF deals with the impact of actual or imagined science upon society or individuals; it often involves speculation based on current or future science or/ and technology. SF combines science elements with fictional elements in such a way that the form and content are fully merged. Fantasy cannot be ruled out from SF because any sufficiently advanced technology is indistinguishable from magic. Like a literary fiction, SF has a plot, characters, and a point of view. The plot of SF is scientific in that it is based on current or future laws of science. It can make predictions about future science but need not adopt necessarily the role of a future teller. The plot of SF should follow Aristotle's dictum to the effect that there can be probable impossibilities in SF but not improbable possibilities".

The scope of SF is extending. SF started as adventure stories (Vide Jules Verne's From Earth to Moon (1865) and 'Around the Moon' (1870); 'Aashcharya Vrittant' ('A Strange Tale (1884) by Ambika Dutt and Chandra Lok Ki Yatra, 'Journey to the Moon' by Kesav Prasad Singh (1900) in Hindi. in Japanese, Ukeshiro Monogartan and Yano Ruykeis included lunar journey, space exploration, robotics, mathematics, artificial intelligence, nanotechnology, surrogacy, genetic engineering, cloning and stem cells in its fold. The current SF includes cyberpunk, space opera, alternate history fiction, science satire, motion pictures and television series in its fold. In contemporary SF, there is a combination of myth with modern technology. Ashok Kumar Banker reminisces Ramayan in an SF context. This treatment of the Ramayan is parallel to CS Levi's treatment of the New Testament in 'The Chronicles of Narnia. Such examples very well outline the scope of SF in the contemporary world and refer to its unlimited possibilities.

A special and an important session was held to discuss various issues necessary for promoting the growth of SF in India. In this session AVM Vishwa Mohan Tiwari was the Chair and five experts from different fields were on the dais Viz., Dr. Vibhawaree Deshpande, Dr. Madhu Pant, Prof. R.D. Shukla, Prof. S.M. Gupta, and Mr. Unnikrishnan Nair. Dr. Manoj K. Patairiya outlined the expectations and methodology of the session and AVM Tiwari explained the aim of the session.

The aim of 'Benaras Document on SF 2008' was to put together the essence of discussions of five groups on subjects that were given to them in various sessions. The subjects were so chosen as to provide sufficient coverage necessary to develop a strategy for growth and popularization of SF in India. SF is an important and futuristic genre of literature. The purpose of discussions was to obtain a roadmap for the promotion of growth and popularization of SF in all forms in India. However, a broad outline of entire proceedings of the conference is also given, in brief, because that activity formed the basis of thinking about 'Benaras Document

on SF 2008'.



Science Fiction in India: Past, Present and Future (Edited by Dr. Manoj K. Patairiya, Dr. Arvind Mishra, Dr. R.R. Upadhyaya, Prof. S.M. Gupta)

A definition of SF still needs to be clearly enunciated as there are many of them floating in the literature. Giving definitions about any concept dealing with human society is always a difficult, if not impossible task because life itself cannot be contained within the boundaries of definitions. Also there are ambiguities on the scope of SF which need to be clarified. Prof. S.M. Gupta took the lead and a group was spontaneously formed to assist him. The second issue was promotion and popularization of SF - Media's role is important in popularization. Noted SF writer and a scientist Dr. Vibhaawaree Deshpande took the lead and another group was formed. It was felt by the delegates that one of the reasons for SF being not popular is ignorance about it, its purpose, content and style. Is it possible to educate people on this subject? Dr. Madhu Pant took the lead and yet another group was formed to ponder upon. It is considered by some that SF must deal with future. If literature can deal with past, present and future why not same is the case with SF also? A delegate mentioned that impact of science can be better grasped by taking the concepts of S&T into future. It was decided to form still one more group for this subject 'Futurism' in SF, and Mr. G.S. Unnikrishnan took the lead of this group. AVM Tiwari proposed that SF being a new genre, it may need new rules of ethics. Dr. R.D. Shukla was requested to put forth his views. He convincingly argued in favour of ethics as a dominant value for SF. He was chosen by the delegates as the leader of this another parallel group. All the groups were given time to deliberate and come out with conclusions. A brief resume of various group discussions is given here:

1. The scope of SF

The scope of SF is expanding, like the universe. It might have been dominated by adventure stories in the beginning, now it is exploring not only all the fields of science and technology but also creatively predicting future possibilities in S&T, good or bad. At the same time it is experimenting with scientific interpretation of myths, cyber punk, space opera, science satire, etc. SF has proved popular in films in the West. Apart from all the subjects that SF films have explored, serious philosophical subjects are being taken up in films like Matrix, and 'What the Bleep Do You Mean'. SF's scope is same as that of literature i.e. 'Life'; it is only the dominant role of S&T in its works that makes it different from standard literature. Prof Amit Goswami has added a new component to its role as, 'the critique, extension, revision, and conspiracy of revolution, all directed against static scientific paradigms.' Here Amit Goswami is bringing out a surprising fact that the tendency of human beings which is to get attached to 'ideologies' is present even among scientists and SF writers. In addition to creation of better understanding of modern world, and possibilities of future world, SF may also through the story, indirectly communicate science to its readers and may ignite interest in science, help to develop scientific temper in people, and help people improve the society with better use of science. SF looks sympathetically, intuitively, critically and intelligently at life. Thus SF may do all this, but SF is more than the sum of its parts, because it is literature which sees what even Sun cannot see, as a proverb in Hindi claims. Having decided on the scope of SF, many definitions were discussed. Famous SF writer (the member of the trio of SF, I. Asimov, Arthur C. Clarke, Robert A. Heinlein) has given a definition of SF: "Realistic speculation about possible future events, based solidly on adequate knowledge of the real world, past and present, and on a thorough understanding of the nature and significance of the scientific method." SF is more than speculation. SF has an aim, nobler than entertainment, to restore humanism in humans. SF uses speculation. SF looks realistically,

imaginatively, critically, sympathetically and intelligently at life. This definition is not broad enough for our grand SF. Another SF author, Theodore Sturgeon gave one definition, "A good science fiction story is a story about human beings, with a human problem, and a human solution, that would not have happened at all without its science content." A good practical sort of definition, though this seems to be somewhat vague about the role of science in SF. Amit Goswami, a famous Theoretical Quantum Physicist, gave this definition, "Science Fiction is that class of fiction which contains the currents of change in science and society. It concerns itself with the critique, extension, revision, and conspiracy of revolution, all directed against static scientific paradigms. Its goal is to prompt a paradigm shift to a new view that will be more responsive and true to nature. This is a definition, which may be better applied to hard core SF. It is important to know the relationship of fantasy with SF. Somebody suggested that SF is a beautiful balance between fantasy and facts. This sounds attractive but, as will be seen soon, it is not tenable. It was also suggested that fantasy cannot be ruled out from SF because as Clarke proclaimed any sufficiently advanced technology is indistinguishable from magic (or fantasy). This being true, it does not mean that all fantasy would become sufficiently advanced technology. It means that some fantasies may become part of SF, but most of them cannot. It is worthwhile to note Mr. Rod Serling's thought on SF which is, "Fantasy is the impossible made probable. Science Fiction is the improbable made possible." It does distinguish between SF and fantasy, an important distinction. Thus it rules out any definition of SF which is based on SF. Fantasy has its uses, but is different from SF, although the line dividing them may be thin. Speculative Fiction is obviously not SF for it does not obey the main principles of SF as explained. Majority of the group then gave their definition of SF, "SF deals with the impact of actual or imagined science upon society or individuals; it often involves speculation based on current or future science including technology.' Strictly speaking it is not a definition because it does not tell what SF is but what it deals with and what it involves with. Further in this definition neither impact of men on science, nor impact of men on men in a world made complex by S&T is included. After all the considerations made so far, another definition is proposed, "SF is a means of understanding and exploring the world through an interesting story in which S&T have a strong role, and, possibly, raise the awareness to change the world for a better place."

2. Futurism in SF

Many delegates insisted that SF must be futuristic. In SF interaction with S&T and human beings is explored and dramatized. If one wants to show the impact of a scientific idea or technology which is not clear in the 'present' then one must go into the future to see its consequences. This may be a valid method of doing so, but it does not mean that 'Futurism' is essential for SF. Also to say that 'Futurism' in SF is not essential is neither to deny this method nor to deny that a futuristic SF appears to be more appealing and more useful. It is to say that exploration in SF is possible in present time as well. A case in point is the famous suggestion by Arthur C. Clarke of a 'Geosynchronous Point' for communication satellites; it involved no reference to future. All the knowledge required to produce that wonderful idea was available to everybody, but the brilliant thought occurred to Clarke. Synchronic and futuristic are both useful in SF. Unlike in the normal literature anachronism has a place in SF, but with caution. Anachronism is mixing up of time periods in a narrative, like in 3000 AD, one cannot show the use of a present day mobile phone, unless someone might have discovered the mobile phone of today lying somewhere and then by suitably modifying it he can use it, to produce a dramatic effect. Further, as a word of caution, time travel is a fantasy, it is against all the known principles of science. By using S&T, human tragedy - comedies, dystopia, utopia and realism etc., SF is in a better position to explore the interactions of S&T and society, thereby making a people aware of strengths and weaknesses of S&T whilst at the same time narrating a wonderful SF story.

3. Education of SF

Every member agreed on the need of education in SF. Literature is being taught from primary standards to post graduate levels. Academics has to be approached for its inclusion in curriculum of students of all stages, just as standard literature is. Indeed SF should be treated as integral part of literature, and taught like it. This issue is more to do with literary institutions like Sahitya Academies. etc. Therefore. they need to be approached to accept SF as integral part of literature. Teaching of SF should not mean teaching of science. Opposition to this effort is coming mainly for three reasons. First is resistance to change and second is clash of interests. Curriculum - time being limited, some aspects and works, etc., of literature would have to be replaced by some SF works. Third reason is lack of

high class SF literature in Indian languages. Despite this resistance, efforts have to be made. As the introduction of education of SF is a difficult project, the task should be taken up by a special cell.

4. Role of ethics

Whilst agreeing that the creative writers or poets cannot be dictated by any written code which may impinge on their creative freedom, necessity of responsibility and discipline for any creative work must also be realized. 'Human Values' must be preserved in the SF works that are created. The SF work must not be didactic, like any good literature, but the suitable message ought to be there submerged in the created work. Ethics need not be confused with religion, although ethics is generally derived from religious scriptures. It is humane behaviour that is recommended by ethics that is desirable in SF. Humane values such as love, truth, forgiveness, control on self, non stealing, non – imposing pain or misery on innocents, tolerance of different view points, kindness, cleanliness, fortitude in adversity, wisdom, etc., are to be encouraged. Without human values, SF or any fiction may be pure entertainment, but it would neither be responsible literature nor contributing to progress of a society without various types of conflicts e.g. conflicts with other man, with nature, with oneself.

5. Promotion of SF and its popularisation

To be in forefront in S&T is vitally important for a nation today if it desires to remain free from technological and economical domination by advanced countries. Promotion of growth of SF means growth of S&T. Poor science literacy no doubt discourages people to read SF. Addiction to pop soaps on TV on the one hand, and no SF education and lack of interest in science among the public and lack of availability of good SF in Indian languages on the other hand are obstacles in growth of SF and popularity of SF in India. Although it must be admitted that availability of good SF and popularity of SF may be in a catch 22 syndrome. Spread of SF literature would help our society in rationally accepting the influence of S&T, which otherwise has a tendency to dehumanize the thinking of the people. By using dystopia, utopia and realism, SF is in a better position to analyze interactions of S&T and society, thereby making people aware of strengths and weaknesses of S&T. However the problem of popularization presents a disappointing scenario. Visual and print media, the most powerful arms of mass contact, just do not show interest in giving coverage to S&T, they having sold themselves to lucre. Internet is a good medium for spread of S&T and SF, within its limited reach today. Apart from a change in media's attitude, SF has to improve itself so that media accepts to publish their work. SF is in a pioneering state, and obstacles in its path are many, SF writers who love this genre have to work enthusiastically and selflessly for promotion and growth of SF; other agencies also need to be urged to be positively responsive in this field. Having studied the problem of promotion of growth and popularization of SF, it is essential that a separate cell for this task be set up.

A Promotion of Growth and Popularization of SF Cell may be set up in universities followed by other academic institutions. Voluntary organizations need to work with multi agencies in this field and may help each other and balance each other's shortcomings. Here are important suggestions: The Cell should generally work to achieve growth and popularization of SF. Urge educational institutions to improve the standard of science teaching and science laboratories in schools. While teaching science aim also must be to impart capability of scientific thinking. Students must understand the concepts and not learn them by rote. Work towards introduction of SF as part of literature in education system, and acceptance by Sahitya Academies of SF as part of literature. All activities that are performed for literature should be applicable to SF as well, including organization of national and international conferences on SF. Awards/ fellowships for research on Inidan SF must be considered. SF clubs, broadcasts and telecasts of SF activities should be promoted and workshops on SF for new SF writers and students be organized. Incorporation of SF as a part educational curriculum and preparation of syllabi, translation of SF works preferably among Indian languages, and also into and from English may be encouraged, besides organizing competitions in SF writing. Scientists should be portrayed in SF works as humane and inventive persons who are busy solving problems faced by society, so that they can become a role model for people at large.

If India has to be self respecting and an advanced country then science ought to be taught in Indian languages, and SF must be written in Indian languages. Cross translation of SF works among regional languages must be encouraged. Growth of SF in India is sine qua non for progress in S&T and also for a rational society not falling prey to its dehumanizing effect. Although SF deals with science, so to say, it was an emotive subject, for it is a literature genre as

well. The delegates took active part in the deliberations, sometimes heated, but always giving more light than smoke. It is hoped that 'Benaras Document' will carry the gems of knowledge condensed in these discussions to various agencies who can help in promotion of growth and popularization of SF and to various SF lovers, especially the creators of SF.

The 'Benaras Document on SF 2008' session was chaired by Dr. Manoj K. Patairiya and moderated by Dr. Arvind Mishra, while Dr. Geetha B served as rapporteure. The panelists included Air Vice Marshal V.M. Tiwari, Dr. R.R. Upadhyaya, Ms. Reema Sarwal, Dr. Taralika Trivedi, Dr. Afrina Rizvi, Ms. Meenu Khare, Mr. K. Mohan, and Mr. Vishnu Prasad Chaturvedi. The following recommendations were made by the delegates to ensure the promotion and propagation of SF:

1 A SF Cell to be set up in a university with the following primary responsibilities:
a) The Cell will look after the promotion and propagation of SF and SF studies.
b) It will award fellowships to researchers for research on SF.
c) It will arrange conferences on SF in which publishers to be involved.
d) It will organize workshops for new writers and students to train them in the art of SF.
e) It will organize contests among SF writers.
f) It will promote translation of regional and Hindi SF writings into English and vice versa.

2 Arrangements would be made to publish, broadcast and telecast SF.

3 Serials on SF Like 'Star Trek' would be telecast and broadcast on regular basis.

4 Blogs and websites would be created to promote SF.

5 Education Boards and Universities to be approached to include SF in curriculum.

6 12 Effective teaching strategies to be evolved to teach SF in classrooms.

SF is an important genre of literature as we are living in the age of information revolution created by tremendous advances of science and technology. The advances are taking place at the speed of light and the society is hardly able to cope with the consequent changes, resulting in social discord, distortions and loss of orientation. Some delegates pushed the idea of restraining literature with ethical rules. They claimed that the freedom of a creative artist must not be restrained as it may interfere with his creativity. The experts say that liberty without responsibility is in fact a counter productive option. Then, literary creativity itself needs a discipline of language, of style, of form and of social good. Fiction written only for entertainment does not make sense for good literature. As already said the aim of literature is to keep the humanism alive. Therefore, ethics must form part of SF also. It has always been the responsibility of litterateurs to protect the humane values which are under constant threat owing to negative traits like greed, extreme selfishness, etc., and dominance of technology. However, as the common man's knowledge of science and technology in India is limited resulting in a highly reduced readership in SF, it discourages the authors and publishers of SF. Therefore, the need for accelerating the growth of SF is paramount.

[Dr. Arvind Mishra in association with Prof. Sagarmal Gupta, Dr. Rajiv Ranjan Upadhyaya, and Air Vice Marshal V.M. Tiwari, Indian Science Fiction Writers' Association, 16 Cotton Mill Compound, Chowkaghat, Varanasi-221002] ■

Science Communication through Folk Arts at Lakshadweep Islands

A Regional Workshop on Science Communication through Folk Media held at Agatti Island, Lakshadweep for five days during April 18-22, 2010. This was jointly organized by M.T.S. Academy, Chennai, National Council for Science and Technology Communication, Ministry of Science and Technology, Government of India, New Delhi, Tamil Nadu Science and Technology Centre, Government of Tamil Nadu, Chennai, Science and Technology Centre, Kavaratti, Lakshadweep and IXORA, Agatti, Lakshadweep.

Dr. Manoj K. Patairiya, Director (Scientist F), National Council for Science & Technology Communication, stressed the importance of science communication for bridging the gap between scientists and general public. He said that India lives in villages and folk arts are very popular among rural mass. To create more awareness about the developments of science and technology, promote scientific attitude, scientific method and scientific wisdom, folk arts can be used as tools to reach the village people since they are more familiar with folk arts. Usually, the folk artistes are performing their arts before the villagers and narrating the folk or mythological stories. The prime aim of this workshop is combining science and arts together for taking science and technology to the grass root level through their folk arts. He further added that the participants are expected to eventually communicate scientific achievements to their own people through folk arts. He also requested the folk performing artistes to express scientific messages in a creative manner through folk arts.

In his presidential address, Shri Kunj Koya, Deputy Collector of Agatti Island, emphasized that this is an opportunity for the youngsters of Agatti and nearby islands to know about latest scientific and technological developments and meeting devoted science communicators, scientists, science professors, media experts and folk performers. Utilize the golden chance for learning methodologies and the techniques of science communication and impart the same to the youth of Agatti and nearby islands for their own benefit. He thanked the NCSTC, MTS Academy and Tamil

Shri Kunj Koya, Deputy Collector of Agatti Island inaugurates the workshop in presence of Smt. Shahar Bhan, Chairperson of Agatti Panchayat Office, Dr. Manoj Patairiya and Dr. N. Murugan

Nadu Science & Technology Centre for choosing Agatti Island, Lakshadweep for organizing the workshop.

The Guest of Honour of the Inaugural Function, Smt. Shahar Bhan, President of Agatti Panchayat Office, informed that the women in Agatti are very active, vibrant and cooperative for any developmental activities. Highlighting more number of women participants in the workshop, she insisted that male students should come forward at par with women. She advised the participants of the workshop to attend all the five days with due care, devotion and involvement so as to become effective science communicators for improving status of Agatti and nearby islands of Lakshadweep.

Prof. Dr. S. Sambasivam, Head, Department of Zoology, Presidency College, Chennai elaborated the importance of natural resources especially the marine areas which are plenty in Lakshadweep islands. The youth of Agatti should know the marine wealth of their islands and make use of their individual and community prosperity with a broad outlook for nation building.

Dr. Cheyon, Asst. Station Director, All India Radio, Chennai and Principal Coordinator of the workshop detailed the prime role of participants and the resource

A split-group of participants discusses the project work

persons. He informed that every day, there will be interaction with the participants in addition to the technical sessions in which subject experts and the resource persons will deliver lectures in their respective fields. Popular folk performers will present demonstrations of folk arts and its role in communicating scientific achievements and scientific concepts. Shri. Abdul Raheem, Wild Life Warden, Department of Forests, Agatti Island and President IXORA welcomed the gathering and Shri. Abdul Nazar, Scientific Officer, Department of Science & Technology, Kavartti, Lakshadweep, proposed a vote of thanks.

Some 60 participants from educational institutions, colleges, universities and popular media in and around Agatti Island, Lakshadweep participated in the workshop with enthusiasm and vigour. Dr. Phone Kumar, Senior Scientist, National Institute of Ocean Technology (NIOT), Agatti, Smt. Sasirekha, HRD Consultant, Chennai, Shri. V. Krishnan, Air India, participated as resource persons and delivered lecturers in their respective areas which were very well received by the participants. Every day end, all the participants submitted creative presentations on various topics in different formats suitable to the media and target audience.

There were 10 technical sessions and a field visit during this workshop. The following topics were dealt with:

1 Introduction to Science Communication through folk media by Dr. Manoj Patairiya, Scientist F & Director, NCSTC, New Delhi

2 Formats of Science Communication in Media by Dr. Cheyon, Asst. Station Director, All India Radio, Chennai

3 Panoramic Views of Marine Resources in Lakshadweep by Dr. S. Sambasivam, Head, Zoology Department, Presidency College, Chennai

4 Significance of folk arts in Kerala and Lakshadweep by Shri. Abdul Raheem, Wild Life Warden, Department of Environment Forests, Agatti, Lakshadweep

5 Ocean Energy Management by Dr. Phone Kumar, Senior Scientist, NIOT, Agatti, Lakshadweep.

6 Role of Folk Arts in Lakshadweep by Shri. Mutthu Master, Agatti

7 Role of Science Communicators for Popularization of science by Dr. Cheyon

8 Pivotal Role of Folk Arts for Science Communication by Prof. Dr. S. Sambasivam

9 How to bridge the gap between Scientists and Rural Public by Shri. Abdul Raheem

10 Transformation of Human Resources into Human Capital Smt. Sasirekha Krishnan, HR Consultant, Chennai.

Participants expressed that they were much benefitted by the valuable lectures and it reflected in their script writing and feed back at the valedictory function. Most of the participants viewed that this workshop encourages them to know more about science communication and its importance to dispel ignorance of darkness for glowing the light of knowledge. It is not only promoted their scientific temper but also enhanced their scientific knowledge and scientific wisdom.

A field visit to various places in and around Agatti Island was organized including participants, resource persons and journalists; they visited Desalination Plant, Govt. Aquarium, Solar Energy Panels, etc. An excellent show was performed by the youngsters who are very much interested in folk arts.

All the Resource Persons were very much impressed by the keen listening and thought provoking questions raised by the participants especially from rural island areas and sincere attentiveness in all the sessions. Out of 60 participants 40 were female and 20 were male. The resource persons were astonished by the total involvement of the participants and journalists for learning various formats of science communication in order to translate their ideas of respective fields into effective science communication through folk media to popularise science among common people.

While delivering the valedictory address on last day, Brigadier Shri. T.K. Murali, Deputy Director General, NCC, Kerala State and Lakshadweep, Union Territory emphasized that the youth of today should utilize this golden opportunity of learning science through folk media for their individual development and society improvement. Training will always motivate the youth for their betterment and prosperity. In addition to that learning with different kinds of youth belongs to various faculties and colleges will definitely promote unity in diversity and national integration. Folk Arts are the symbol of Indian culture and heritage and if those arts are utilized for popularisation of science among general public that is really a service to the nation.

Shri. V. Krishnan, Manager, Air India, Chennai presided over the valedictory function and delivered presidential address. In his address he recollected his college days and advised the participants to practice what all they learnt during these five days through

The valedictory session in progress

workshop. Following the principle of each one should teach one, they can carry the message gained from this workshop to their friends and native people in different villages they belong.

Smt. Sasirekha, H.R. Consultant, Chennai insisted the importance of science communication and its prime role in everyone's day today life. Realizing this, the trainees should try to disseminate the same to the general public through folk arts. The Arivukkalanjiyam Prizes were given to the following participants for their excellent performance.

1 Arivu Malar - Aneesa Marjan M.S.

2 Arivu Kadhir - Hasanath Begum B.

3 Arivu Thalir - Shahira T.M.

4 Arivu Thulir - Harshed Khan R.N.

5 Arivu Pudhir - Beebee Uraira B.P.

Though it looks difficult to organize such a workshop at Lakshadweep Islands in the beginning, but it turned out to be really a significant and remarkable success at the end due to unprecedented support by local authorities, educational institutions, participants, media and public representatives, and it is hoped by one and all whosoever witnessed the event that the outcome of the workshop would go a long way to towards developing a science culture.

[Mrs. Rajeswari Murugan, Former General Manager, BSNL, C-13, Nest Chaitanya Apartment, 9 Ratna Nagar Main Road, Teynamtet, Chennai - 600018]

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Letter to the Editor

Dear Editor,

All the articles and research papers published in the IJSC are really good and informative. Particularly, I liked the article by Dr. Y. Bala Murali Krishna that makes us think of the present scenario of science journalism in India. Similarly, an article by Mr. Ashish Baldi clearly describes the evolution of scientific communication efforts in our country. The Scientoon makes me understand that any kind of conservation action should not be compromised for the life style of mankind. The article under the information column gave me the useful collection of websites about online journals. At last but not least, the article on tips for radio writing is very much useful to the amateurs who are not professional broadcasters, but communicating with the community through community Radio. This article will definitely help people who are involved in writing for radio. I look forward for many more such useful material in the forthcoming issues of IJSC.
Thanking you,

[L. Jayanthi Kesavan, Head of Department, Department of Information Technology, CSI Polytechnic College, Salem] ■

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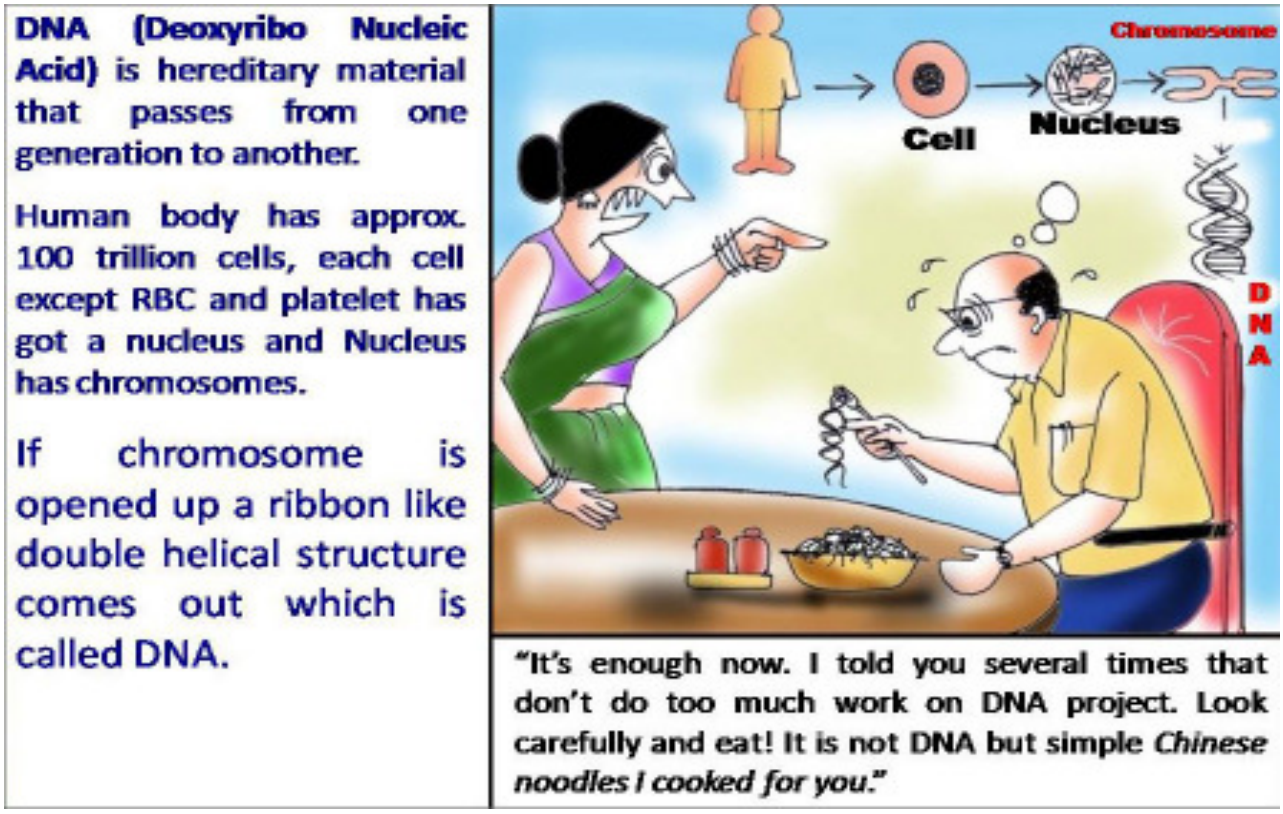

Indian Journal of Science Communication

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A Joint Publication of

National Council for Science & Technology Communication, New Delhi

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All above communications can be either in Hindi or in English language. Manuscript preparation is described below :

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