ISSN 0972-429X

Indian Journal of Science Communication

Communicating Science of Science Communication

Technology, literacy and communication

Science museums for science communication

Science commuinication in Assam

Prospects of Open Access

Science comics

IJSC Index 2002-2011

A dialogue on public communication of science, technology, culture and society

Volume 11 Number 1 January – June 2012

Indian Journal of Science Communication

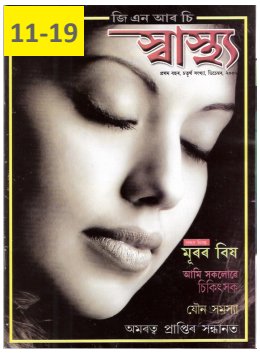
- The *Indian Journal of Science Communication* (IJSC) seeks to promote and disseminate knowledge and activities in the area of science and technology communication and provides a forum for addressing issues emanating from concept to research and practice.
- The phrase 'science communication' covers a broad canvas of communicating all basic and applied sciences, such as health communication, agriculture communication, environment communication, technology communication, innovation communication, etc. It also includes science and media interface with attitudinal, social and cultural implications.
- The IJSC is a peer reviewed half yearly international research journal published twice in a year in January and July.
- The IJSC is brought out and disseminated by Indian Science Communication Society (ISCOS) and catalysed and supported by NCSTC/ DST.
- The NCSTC/ ISCOS assume no responsibility for the opinions offered by the contributors.
- Address for submission of contributions for publication: The Editor, Indian Journal of Science Communication, National Council for Science and Technology Communication, Department of Science and Technology, Govt. of India, Technology Bhawan, New Mehrauli Road, New Delhi - 110016, India. Phone: +91-11-26537976, Fax: +91-11-26590238, E-mail: mkp@nic.in; editorijsc@gmail.com. Refer **Instructions for Contributors**.
- Address for subscription and advertisements: The Coordinator IJSC, Indian Science Communication Society, Chandrika Bhawan, 577-D, Near Dandahiya Masjid, Lucknow – 226022, India, Phone: +91-8090907153; E-mail: info@iscos.org. Payments may be sent by demand draft/ cheque issued in favour of Indian Science Communication Society, payable at Lucknow or online bank transfer. Refer **Subscription Form**.
- The IJSC follows **Open Access** (OA) policy and available online for reading and academic consultation only; it cannot be used for any commercial purpose. The print version is available on subscription.
-
- Price per copy for Individual:

  Inland: ₹ 100
  Overseas: US $ 5

Indian Journal of Science Communication
Indian Science Communication Society
Chandrika Bhawan, 577-D, Near Dandahiya Masjid, Lucknow – 226022, India
Phone: +91-7703009757; +91-11-26537976, Fax: +91-11-26590238
E-mail: info@iscos.org; mkp@nic.in; editorijsc@gmail.com
Website: www.iscos.org

Indian Journal of Science Communication

CONTENTS



RESEARCH PAPERS

ARTICLES

COLUMNS

COVER

Experiment demonstration communicating agriculture research

International cooperation in science communication

Emphasis on different aspects of science, technology, communication, culture and society could be increasingly relevant in today's world. The national and regional programmes and activities can be integrated, converged and connected in a way so that a scientific atmosphere is created. These efforts while bringing nations together are symbolic of geophysical, economical, and ethnic diversities, present mutual solutions to certain challenges. Mutual investments in cooperative, educational, and cultural strategies will form grounds for enabling 'science communication' processes to help shape a scientific outlook and scientific citizenship towards a new world order! International, intercultural, intergenerational and interdisciplinary approaches are now increasingly becoming more frequent and evident. There has been a remarkable shift of focus in science policies involving soft sciences as well to their fold, thanks to frequent 'science communication' activities held in developing and developed world during recent past, which have played a crucial role for evolving and addressing issues and aspects intended at dissemination and linking scientific research to common public. International cooperation could be a key to achieve that, whereas development of new models, tools, means, and best practices is paramount. Encouraging young science enthusiasts towards exciting careers in science and science communication and motivating scholars for interdisciplinary research in these areas, could be some of the measures to be taken to promote cooperation.

The 12th International PCST Conference held during April 18-20, 2012 in Florence, Italy offered a rich platform for brainstorming on these issues with a focal theme 'Quality, Honesty, and Beauty'. In India, a series of international cooperation events took place in recent past with a number of initiatives taken in this subject. It began with organization of the 'International Hands-on Science Conference' held in Ahmedabad during October 27-31, 2009 under the aegis of the International Hands-on Science Network, Portugal and with support from the Department of Science and Technology, Govt. of India. Similarly, another 'International Public Communication of Science and Technology Conference' was organized in association with International Public Communication of Science and Technology Network, Australia, spread over different locations, Khajuraho (December 4-5), New Delhi (December 6-9), and Jaipur (December 10-11), 2010, with support from the Department of Science and Technology, Govt. of India. These events have not only created a vibrant atmosphere for science communication but also motivated a number of young science enthusiasts. The Indian Institute of Science, Bangalore and Cornell University, New York, USA have joined hands together and put together an 'Indo-US Workshop on Science Communication' on December 13-15, 2010 held at Indian Institute of Science, Bangalore attracting participants from India, USA, U.K. and several other countries. The workshop was organized under the aegis of Indo-US Science and Technology Forum and can be a good example of international cooperation in this area. The University of Sao Paulo, Brazil is aiming to discuss, construct, and consolidate an India-Brazil academic network for the general comprehension of the society emphasizing on 'Science, Technology, Culture and Society' (Sc-T-C&S) and has organized a symposium and workshop during October 17-21, 2011 in Sao Paulo, Brazil. It also elaborated a graduate programme at master's and doctoral level in cooperation with Indian experts, besides opening opportunities of partnerships among the attendees. The reflections of the occasion are important and the model that emerged out of the programme can be useful for similar or other innovative cooperation initiatives to be undertaken in future in this field. A 'Science Writing and Science Journalism Workshop-cum-Training Programme' was organized by B.P. Koirala Memorial Planetarium, Observatory and Science Museum Development Board, Ministry of Science and Technology, Govt. of Nepal, in Kathmandu, Nepal during June 14-20, 2012 with active support and cooperation from Indian science communicators community. The overwhelming response from participants, organizers and resource persons from both the countries suggests a tremendous potential and impact of such regional cooperation on cross border sharing of knowledge, skill, and experience in this field of scholarship to encourage and develop a scientific culture.

The 'Indian Journal of Science Communication' (IJSC) is an initiative to internationalisation of such efforts and spreading specific knowledge through our esteemed advisers, contributors, scholars, researchers, supporters, sponsors, advertisers, subscribers and readers. The IJSC has successfully completed 10 years of its significant contribution to the field globally and has now entered the 2nd decade. On this occasion, we wish to thank and congratulate all concerned for their continuing encouragement, guidance, support and criticism that have immensely helped improve the journal over the years and look forward for the same in future as well!

Manoj Kumar Patairiya

Prospects of Open Access in Indian agricultural research: A case study

G. Aneeja
National Academy of Agricultural Management Rajendra Nagar, Hyderabad - 500407

Gutam Sridhar
National Research Centre for Medicinal and Aromatic Plants Boriavi, Anand - 387310
Email: gutam2000@yahoo.com

Agricultural research and education in India have been in the public domain. The Indian Council of Agricultural Research (ICAR) was established as an apex organization for effective research coordination among institutions and promotion of agricultural research in the country. For the dissemination of research output, the research journals published in India have been, for long, primarily a public funded activity and done mostly by government agencies. In case of agricultural research, the journals are being published by ICAR and by respective professional societies. Many of these societies are receiving financial assistance partly from ICAR. Each discipline of agriculture is having at least a professional society and for some disciplines, there are more than one societies and each society is publishing a peer reviewed research journal. Though many of these journals are sent for international indexing like CAB Abstracts, full-text database services, etc., look poor. Many of them are not even in the ISI Master Journal list for the impact factor or Science Citation Index (SCI) analysis. The main objective of authors is to have more impact, visibility and readership of his/ her contribution. These journals publish quality articles after stringent peer review process, but the time lag from submission to publication of an article or production of issue is more. There are instances where the articles sent for review were not returned back due to various reasons. The infrastructure for publishing online is also not available for these journals. Recently, a portal (www.indianjournals.com) had started providing free online access of some journals being published by professional societies. Under National Agriculture Innovation Project (NAIP), ICAR is investing considerably for ensuring availability of some non-free online journals along with all open access journals. Now the time has come to think about wider reach without restrictions on the lines of open access and open archiving of research publications. This paper discusses about the prospects of open access to ICAR system.

Keywords: Agriculture research, Online resources, Open access, Professional societies

Introduction

With the availability of open source software resources for transformation of traditional journals into open access journals and establishment of open archive online repositories for archiving research articles which can be harvested by search engines and made available for users thereby leading to availability of agricultural research knowledge to everyone online. This will increase the visibility of research output and eventually lead to make impact. This would further support the target community as well as the extension system directly without any time lapse.

India is a very vast country with 1.13 billion (Anonymous 2008a) people comprising of approximately one-sixth of the world's population of which about 70 per cent labour force engaged in agriculture. Thus, reaching individuals involved in agriculture and related areas across the 20 agro-ecological zones (Gajbhiye and Mandal) in an estimated total geographical area of 3.3 Million sq km (Anonymous 2008) is a herculean task. However, public funded research system is responsible for rainbow revolutions in India ultimately bringing considerable change in the livelihoods of farmers contributing to 26% of GDP, providing 60% of employment. It establishes the fact that technological progress in agriculture is crucial for the overall economic welfare of the country. In India's National Agricultural Research System (NARS), ICAR, a national apex body is a major player in agricultural research and education management in the country. The ICAR with its headquarters in New Delhi comprises 5 National Institutes; 5 National Bureaus; 48 Central Research Institutes, 12 Project Directorates in crop sciences and animal sciences; 32 National Research Centres; 75 All India Coordinated Research Projects and about 4,000 agricultural scientists (DARE/ ICAR 2007). All the research projects in ICAR except a few from private are publicly funded with a mission for sustainable growth of Indian agriculture by interfacing education, research and extension initiatives complimented with efficient and effective institutional, infrastructure and policy support, that will create a proper fit between the humanity and its habitat.

Therefore, the research output must be applied to achieve the broader developmental objectives of the society which may result in public accountability of the research. But, the dissemination of research output is a major challenge and until it is known to the world, the research has no meaning. Hence, the scholarly journals serve as vehicles of scientific information dissemination. There are various professional societies formed for the advancement of their interest in related discipline in the agriculture, and are publishing scholar journals. ICAR is also extending financial support for the journal publication. As the researcher's output is measured in terms of number of research papers published in various national and international journals and their Impact Factor (IF), most often these researchers send their articles to international journals with high impact factor. But, they may not get published because not fitting into the scope of international journals and as the agrarian situation is different in different countries. Access of most of these high impact factor journals' articles is on payment basis and comes with lots of copyright restrictions.

All the bundle of copyrights has to be transferred to the publisher and at times, even the author is not allowed to archive it in any electronic retrieval media. Few journals send the reprints free of cost and some for cost and only these reprints can be shared among peer group. At this juncture, the journals published by scholarly societies in ICAR institutes should play a key role for removing access barriers to this kind of literature which will accelerate research, enrich education, share the learning of the rich with the poor and the poor with the rich thus making the literature as useful as it can be, and lay foundation for uniting humanity in a common intellectual conversation and quest for knowledge. This is what called as Open Access (OA). According to Peter Suber, OA literature is digital, online, free of charge, and free of most copyright and licensing restrictions and what makes it possible is the Internet and the consent of the author or copyright-holder. OA gives readers extra power to find and make use of relevant literature, and that it gives authors and their works vast and measurable new visibility, readership, and impact. In this paper, an attempt has been made to analyze the system of publication and dissemination of the scientific literature by the various professional societies working in various ICAR institutes and the prospects of open access for Indian agricultural research.

Table 1 - Agriculture science journals by professional societies in ICAR, Impact Factors and rating

No.	Title	ISSN	IF-JCR 2005¥	IF-JCR 2006	IF-JCR 2007	NAAS£
1	*Agricultural Economics Research Review*	0971-3441				6.0
2	*Agricultural Engineering Today*	0970-2962				N.A.
3	*Agronomy Digest*	0972-6381				N.A.
4	*Animal Nutrition and Feed Technology*	0972-2963				4.0¤
5	*Annals of Agricultural Research*	0970-3179				1.0
6	*Annals of Arid Zone*	0570-1791				3.0
7	*Annals of Plant Protection Sciences*	0971-3573				2.0
8	*Indian Journal of Agricultural Sciences*	0019-5022	0.084	0.106	0.122	7.2¤
9	*Indian Journal of Agroforestry*	0972-0715				3.0
10	*Indian Journal of Agronomy*	0537-197X				6.0¤
11	*Indian Journal of Animal Nutrition*	0970-3209				4.0¤
12	*Indian Journal of Animal Sciences*	0367-8318	0.090	0.064	0.116	6.8¤
13	*Indian Journal of Entomology*	0367-8288				4.0¤
14	*Indian Journal of Extension Education*	0537-196X				4.0
15	*Indian Journal of Fisheries*	0970-6011				4.0¤
16	*Indian Journal of Genetics and Plant Breeding*	0019-5200				4.0¤
17	*Indian Journal of Horticulture*	0972-8538				4.0¤
18	*Indian Journal of Nematology*	0303-6960				3.0
19	*Indian Journal of Plant Genetic Resources*	0971-8184				4.0
20	*Indian Journal of Plant Physiology*	0019-5502				4.0¤
21	*Indian Journal of Plant Protection*	0253-4355				2.0¤
22	*Indian Journal of Poultry Science*	0019-5529				4.0¤
23	*Indian Journal of Pulses Research (Journal of Food Legumes)*	0970-6380				3.0
24	*Indian Journal of Small Ruminants*	0971-9857				2.0
25	*Indian Journal of Sugarcane Technology*	0970-3233				1.0
26	*Indian Journal of Veterinary Research*	0971-4251				4.0
27	*Indian Journal of Veterinary Surgery*	0254-4105				4.0¤
28	*Indian Journal of Virology*	0970-2822				4.0¤
29	*International Journal of Oil Palm*	0972-5806				2.0
30	*Journal of Agricultural Engineering*	0256-6524				4.0
31	*Journal of Arid Legumes*	0973-0907				1.0
32	*Journal of Horticultural Sciences*	0973-354X				N.A.
33	*Journal of Oilseeds Research*	0970-2776				1.0
34	*Journal of Ornamental Horticulture*	0972-0499				2.0
35	*Journal of Plant Biochemistry and Biotechnology*	0971-7811	0.338	0.316	0.414	7.4¤
36	*Journal of Plantation Crops*	0304-5242				3.0¤
37	*Journal of Rice Research*	N.A.				N.A.
38	*Journal of Root Crops*	0378-2409				3.0
39	*Journal of Soil And Water Conservation in India*	0022-457X				3.0
40	*Journal of The Indian Fisheries Association*	0971-1422				3.0¤
41	*Journal of The Indian Society of Agricultural Statistics*	0019-6363				5.0
42	*Journal of The Indian Society of Soil Science*	0019-638X				4.0
43	*Journal of The Inland Fisheries Society of India*	0379-3435				3.0
44	*Journal of Veterinary Parasitology*	0971-6157				4.0
45	*Journal of Water Management*	0971-6076				4.0
46	*Journal Spices and Aromatic Crops*	0971-3328				2.0
47	*Oryza*	0474-7615				4.0
48	*Pest Management in Horticultural Ecosystems*	0971-6831				2.0
49	*Pesticide Research Journal*	0970-6763				2.0¤
50	*Potato Journal*	0970-8235				3.0¤
51	*Seed Research*	0379-5594				3.0¤

¥ Impact Factor by Thomson Reuters; £ Rating by NAAS according to IF JCR 2006

¤ Listed in Thomson Reuters Master Journal List

Methodology

The ICAR being an apex organization at the national level for promoting S&T programmes in agricultural research and education, an attempt has been made to analyze the journals being published by various professional societies housed in various ICAR institutes for the cause of scholarly activities, some of these activities are funded by these institutes. As there is no database available for these professional societies, the data collection was mainly done by Google search.

The CAB abstracts list of serials from CABI portal and Thomson Reuters Master Journal List was consulted for the journals being published in agricultural and related sciences for their ISSN, periodicity and publishers addresses. For detailed information regarding professional societies, the www.indianjournals.com portal and portals of ICAR (www.icar.org.in) and IARI (www.iari.res.in) was referred and their addresses were confirmed. It was also confirmed whether these journals are being evaluated for Science Citation Index (SCI) by Thomson Reuters!

Results and discussion

Interestingly, many of these professional societies are functioning within premises of ICAR institutes and a few are housed in the National Societies Block of newly built National Agricultural Science Complex (NASC), New Delhi. There are about 50 professional societies in agriculture and related sciences. In some cases, there are more than one societies working under same discipline and for many years, in some cases more than 60 years. All these societies are publishing peer reviewed scholarly journals (Tables 1 and 2) and holding a national seminar/ symposium on their area of interest with support from ICAR. When the professional societies' websites' addresses were analyzed, it emerged that only 23 out of 51 journals have their websites (Table 2) and many societies don't have online or e-journals. Only a few provide information of forthcoming issues. Only two journals viz. Indian Journal of Agronomy and Agricultural Economics Research Review give full text download. It is found that these societies are not equipped with latest ICT innovations. 20 out of all these journals are figured in the Thomson Reuters Master Journal List and considered for evaluation in Science Citation Index. But all these journals were rated by NAAS on scale of 1 to 10.

Table 2 - Professional societies and their journals in ICAR institutes

No.	Society 'S Name	Society's URL	Society's Journal Name
1	Agricultural Economics Research Association	http://www.geocities.com/aeraindia/	*Agricultural Economics Research Review*
2	Indian Society of Agronomy	http://isa-india.in/index.htm	*Agronomy Digest*
3	Animal Nutrition Association	http://www.anft.org/html/home.htm	*Animal Nutrition and Feed Technology*
4	Indian Council of Agricultural Research	http://www.icar.org.in/dipa/journal.html	*Indian Journal of Agricultural Sciences*
5	Indian Society of Agronomy	http://isa-india.in/	*Indian Journal of Agronomy*
6	Animal Nutrition Society India	http://www.nutrisocietyindia.com/	*Indian Journal of Animal Nutrition*
7	Indian Council of Agricultural Research	http://www.icar.org.in/dipa/journal.html	*Indian Journal of Animal Sciences*
8	The Horticultural Soc of India	http://www.hsi1942.in/	*Indian Journal of Horticulture*
9	Nematological Society of India	http://www.nemaindia.com/	*Indian Journal of Nematology*
10	Indian Soc Plant Physiology	http://www.ispp-online.org/index.html	*Indian Journal of Plant Physiology*
11	Indian Poultry Science Association	http://www.ipsa-cari.org/	*Indian Journal of Poultry Science*
12	Indian Society for Sheep and Goat Production and Utilization	http://www.issgpu.org/	*Indian Journal of Small Ruminants*
13	Indian Association for The Advancement of Veterinary Research	http://www.iaavr.org/	*Indian Journal of Veterinary Research*
14	Indian Society Veterinary Surgery	http://www.isvs.org/	*Indian Journal of Veterinary Surgery*
15	Indian Virological Society	http://virologysociety.org/	*Indian Journal of Virology*
16	Society for Promotion of Oil Palm Research and Development	http://nrcop.ap.nic.in/sopoprad.htm	*International Journal of Oil Palm*
17	Indian Society of Water Management	http://www.iswam.in/index.html	*Journal of Indian Society of Water Management*
18	Indian Society for Root Crops	http://www.isrc.in/index.php	*Journal of Root Crops*
19	Soil Conservation Society of India	http://www.soilcsi.org/index.htm	*Journal of Soil And Water Conservation In India*
20	Indian Society of Soil Science	http://www.isss-india.org/	*Journal of The Indian Society of Soil Science*
21	Inland Fisheries Society Of India	http://www.ifsi.in/	*Journal Of The Inland Fisheries Society of India*
22	Association of Rice Research Workers	http://crri.nic.in/arrw/index.htm	*Oryza*
23	The Society of Pesticide Science India	http://www.spsindia.co.in/index.html	*Pesticide Research Journal*

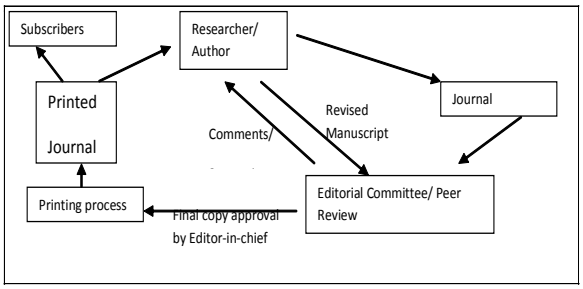


Fig. 1 - Traditional journal publishing system

The criteria adopted by the Academy for rating is given here: For non-Impact Factor Journals, marks from 1 to 6 were assigned corresponding to the grade from 'D' to 'B+' as suggested by the NAAS Fellowship and finalized by the Journal Rating Committee of the Academy. For Impact Factor Journals, marks from 6.1 to 10 are assigned. In the Thomson Reuters Impact Factor (2007 Index) analysis, only 4 of the surveyed journals are in the range of IF 0.122 – 0.414 (Table 2) and the highest IF (0.414) is measured for Journal of Plant Biochemistry and Biotechnology. Efforts are being made by National Academy of Agricultural Sciences (NAAS) and ICAR to revamp functioning of various professional societies and raise their publications quality. Recently, a Policy Paper No. 34, and Guidelines for Scientific Societies are brought out respectively by NAAS and ICAR.

The publishing system for these journals is a traditional process (Fig. 1). Author submits his/ her research article manuscript in two hard copies to the editor and upon finding the merit in it by the editorial committee, it is sent for peer reviewing. Then reviewer reviews and

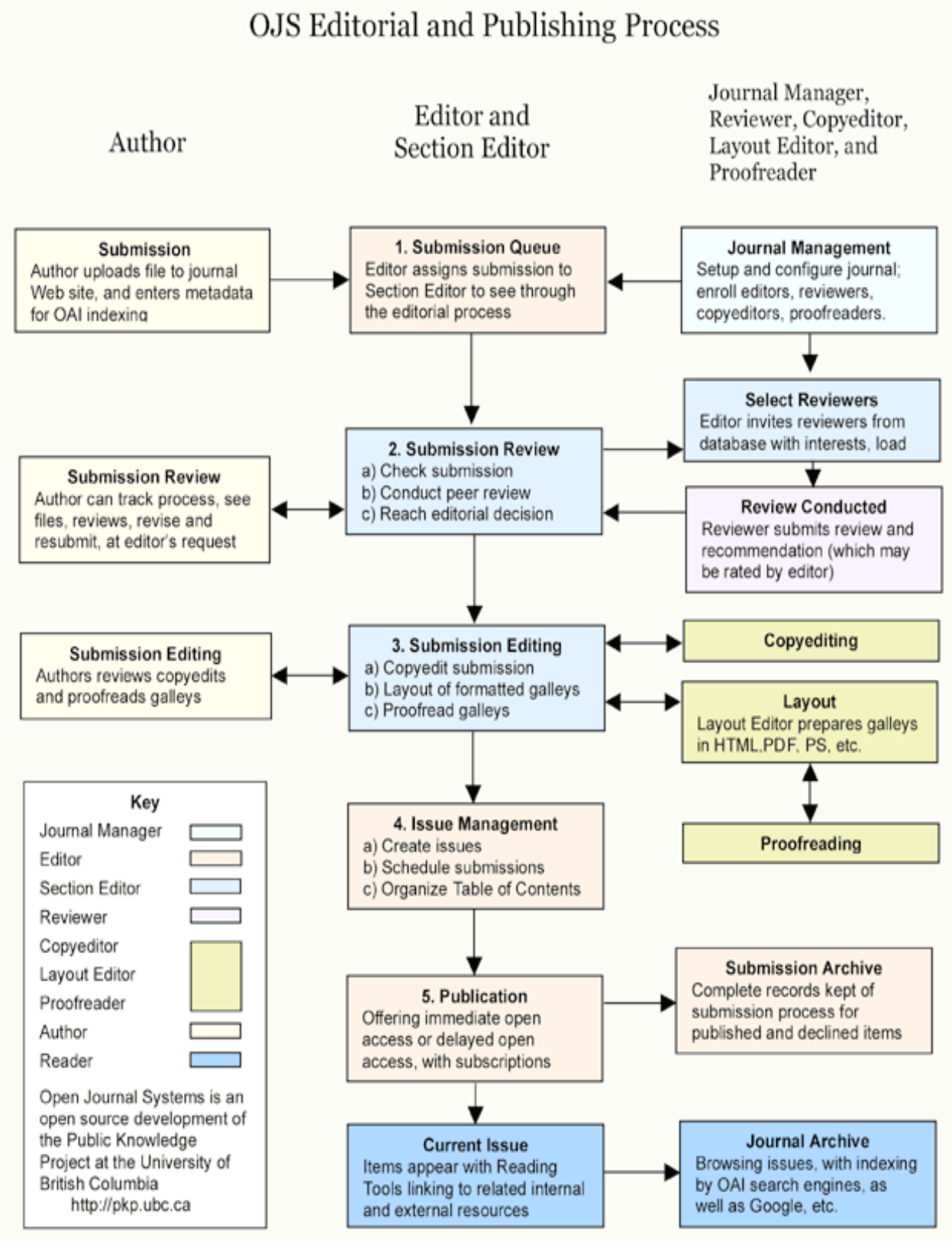
sends back the article with comments to the editor. The paper is returned back to the author if it is rejected or a revision is requested from the author if it can be considered after revision. Then the author re-submits the paper in tangible electronic media (CD-ROM) along with original reviewers' comments and it is finally accepted for publication, if the revised version is satisfactory.

The whole process of submission and communication takes place by post or at times by e-mail. It is a time consuming process from submission to acceptance and finally publication of paper. It nearly takes one year to two years when it reaches finally to readers. There is no mechanism to track and check the status of the manuscript during the process. Hence, the traditional publication system seems more disadvantageous, as besides delayed communication, sometime the research results become obsolete. To overcome such issues, e-publishing with Open Source Software could offer an answer, besides possibility of low cost online publications. Recently, some Indian and international web portals have come up to host these journals online, published by scientific societies. They provide free abstracts and full texts on payment. There is a need for a cooperative web portal to offer OA for all these scholarly journals in the larger interest of promising researchers.

The new Internet tools can reap benefits to agriculture research as well. Success stories of this field are witnessed through e-Choupal; MSSRF's Information Villages of Pondicherry; Hewlett-Packard's I-community; Nagaarjuna Groups' ikisan; and Madhya Pradesh Government's Gyandoot, and so on. OA is now gaining momentum and 'willingness of scientists to publish their research in scholarly journals without any remuneration for wider interest of society' helps converge in a manner to minimize time taken for publication. OA also helps enhance number of citations (Eysenbach 2006). According to Peter Suber, OA offers free and unrestricted availability of research journals. OA works on a principle that publicly funded research should be freely accessible online immediately after its publication. It encourages unrestricted sharing of research results with every one, everywhere, for advancement and enjoyment of science. OA philosophy was articulated in 2002, when Budapest Open Access Initiative was introduced. It quickly took roots in scientific and medical communities as it had the potential to offer alternative route to research literature that used to be mainly a closed door with costly subscription barriers. OA makes it possible the world over to access peer-reviewed journal literature online freely without restriction by scientists, teachers, students, scholars, and other inquisitive minds. It works for the public good by and large. Authors will see their papers more read, more cited, and better integrated into the structure of science. Academic readers in general at institutions that cannot afford subscription of a journal, or where the journal is unavailable, can be greatly benefited. The taxpayers and general public have an opportunity to see what scientific research is all about.

Some of these efforts are: Open Journal Systems (OJS) of Public Knowledge Project and Open Archive Repository softwares like 'ePrints' and 'DSpace' which can be used at no cost for digital publication and archiving. OJS is open source software journal management and publishing system that has been developed by the Public Knowledge Project through its federally funded efforts to expand and improve access to research. It is made freely available to journals worldwide for the purpose of making open access publishing a viable option for more journals, as open access can increase a journal's readership as well as its contribution to the public good on a global scale. The unique features of OJS are that it is installed and controlled locally.

The second of the two primary vehicles for delivering OA to research articles is OA archives or repositories. OA archives or repositories do not perform peer review, but simply



Source: Public Knowledge Project

Fig. 2 - OJS Publishing System

make their contents freely available. They may contain un-refereed preprints, refereed post prints, or both. Authors may archive their preprints without anyone else's permission. When archives comply with the Meta Data Harvesting Protocol of the Open Archives Initiative, then they are inter-operable and users can find their contents without knowing much about a particular archives, where the archives is located, or what it contains. Now open-source software for building and maintaining OA I-compliant archives is available. Universities and research centers throughout the world are actively planning implementation of institutional repositories. Such planning entails policy, legal, educational, cultural, and technical components, most of which are interrelated and each of them must be satisfactorily addressed for a repository to succeed. As recommended by the Berlin Declaration, in the 'Registry of Open Access Repository Material Archiving Policies (ROARMAP), institutions like National Institute of Technology, Rourkela, Bharathidasan University and the National Knowledge Commission have adopted mandate for institutional repositories in India. According to the Registry of Open Access Repository (ROAR), there are about 40 institutional repositories in existence and data shows that the number of archives and the records in those archives are increasing (Fig. 3).

Conclusion

The open access journals make the peer reviewed scientific contents freely available to the world. The ICAR institutions are producers of refereed research output, in all subjects, under its domain. If authors are made aware and start archiving their refereed research in a central repository, OA can be achieved. National Informatics India repository OpenMed (http://openmed.nic.in) can be used to deposit provisionally, then they can be automatically exported to central institutional repositories, as all repositories are OA I-Interoperable. The College of Veterinary Science and Animal Husbandry,

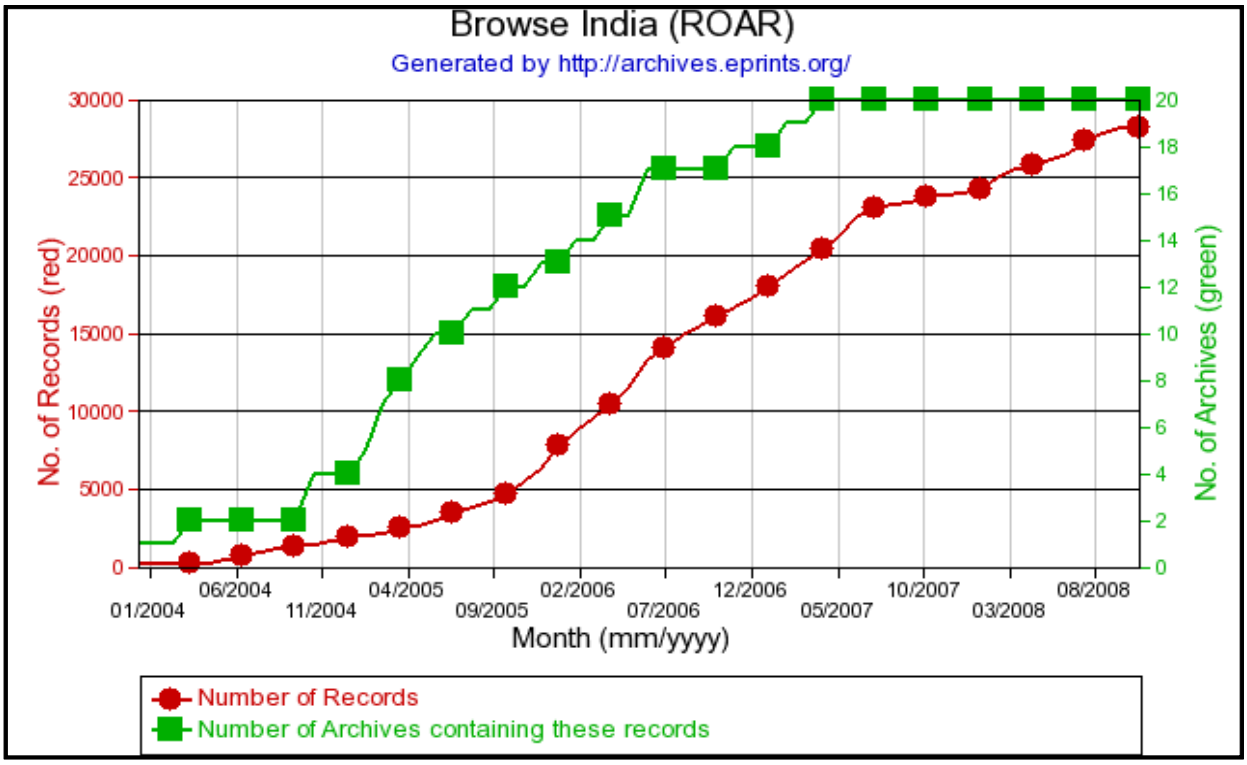


Fig. 3 - Registry of Open Access Repositories

Anand Agricultural University has about 52 records as deposits of various research articles and un-refereed master's and doctoral theses in OpenMed repository. NAIP is under consortium for e-Resources in Agriculture (CeRA) from 2007-08 to 2011-12 is providing access to e-resources to 126 libraries (All SAUs and selected libraries of ICAR) to nucleate e-access culture amongst scientists/ teachers in ICAR institutes/ agricultural universities and finally to develop Science Citation Index Facility at IARI for evaluation of scientific publications. This is a welcome effort towards bringing e-resources to scientists, however it also needs to make an effort to transform Indian agricultural journals into OA journals and creation of Open Archives Institutional Repositories for accelerating growth in agricultural research, its dissemination and archiving, besides adopting an OA policy.

References

1. Anonymous 2008a. Demographics of India. http://en.wikipedia.org/wiki/Demographics_of_India. Retrieved on 29th Nov. 2008.
2. Anonymous 2008b. India at a glance. http://india.gov.in/knowindia/india_at_a_glance.php. Retrieved on 29th Nov. 2008.
3. Asian Journals Online. Accessed at http://www.asiajol.info/index.php/about. Retrieved on 1st Dec. 2008.
4. Budapest Open Access Initiative. Accessed at http://www.soros.org/openaccess/index.shtml.
5. Consortium for e-Resources in Agriculture. Accessed at http://www.naip.icar.org.in/downloads/CeRA.pdf. Retrieved on 1st Dec. 2008
6. DARE/ICAR Annual Report 2007-2008. Accessed at http://www.icar.org.in/anrep/200708/AR200708.htm Retrieved on 29th Nov. 2008.
7. DSpace. An open-source solution for accessing, managing and preserving scholarly works. Accessed at http://www.dspace.org/. Retrieved on 2nd Dec.2008.
8. Eysenbach G. Citation Advantage of Open Access Articles. PLoS Biol. 2006;4(5) p. e157.
9. Gajbhiye, KS and Mandal C. Agro-Ecological Zones, their Soil Resource and Cropping Systems. Accessed at http://www.agricoop.nic.in agricoop.nic.in/Farm%20Mech.%20PDF/05024-01.pdf Retrieved on 29th Nov. 2008.
10. ICAR guidelines of financial support to scientific societies. Accessed at www.icar.org.in/rep2007/societyguide.pdf. Retrieved on 29th Nov. 2008.
11. Indian Agricultural Research Institute. Accessed at http://www.iari.res.in. Retrieved on 1st Dec. 2008.
12. Indian Council of Agricultural Research. Accessed at http://www.icar.org.in
13. Indian Journals. Accessed at http://www.indianjournals.com.
14. Indian Periodical. Accessed at http;//www.indianperiodicals.in.
15. Indiana. Accessed at http://www.indianajournals.com.
16. NAAS 2006. Guidelines for Improving the Quality of Indian Journals and Professional Societies in Agriculture and Allied Sciences. Policy Paper No. 34, National Academy of Agricultural Sciences, New Delhi pp.15.
17. Open Archives Initiative. Accessed at http://www.openarchives.org/. Retrieved on 1st Dec. 2008
18. Open Journal Systems and Public Knowledge Project. Accessed at http://pkp.sfu.ca/?q=ojs
19. OpenMed. Accessed at http://openmed.nic.in/view/subjects/irs.html. Retrieved on 1st Dec. 2008.
20. Peter Suber. A Very Brief Introduction to Open Access. Accessed at http://www.earlham.edu/~peters/fos/brief.htm. Retrieved on 29th Nov. 2008.
21. Rating of Scientific Journals. National Academy of Agricultural Sciences. Accessed at http://naasindia.org/rating.html. Retrieved on 1st Dec. 2008.
22. Registry of Open Access Repositories accessed at http://roar.eprints.org/index.php?action=home&q=&country=in&version=&type=&order=name&submit=Filter. Retrieved on 1st Dec. 2008.
23. Registry of Open Access Repository Material Archiving Policies accessed at http://www.eprints.org/openaccess/policysignup/. Retrieved on 1st Dec. 2008.
24. The National Knowledge Commission. Report of the Working Group on Open Access and Open Educational Resources. Accessed at http://knowledgecommission.gov.in/downloads/documents/wg_open_course.pdf. Retrieved on 1st Dec. 2008.
25. The World Fact Book – India. Central Intelligence Agency, USA. Accessed at https://www.cia.gov/library/publications/the-world-factbook/geos/in.html Retrieved on 1st Dec. 2008.
26. Workshop on Electronic Publishing and Open Access. Accessed at www.ncsi.iisc.ernet.in/OAworkshop2006/. Retrieved on 29th Nov. 2008.

■

A retrospective of science communication in Assam: Media coverage, challenges and some initiatives

Dr. Ankuran Dutta
Associate Professor, School of Professional Studies, K.K. Handique State Open University, Dispur, Guwahati (Assam)
Email: ankurandutta@yahoo.co.in

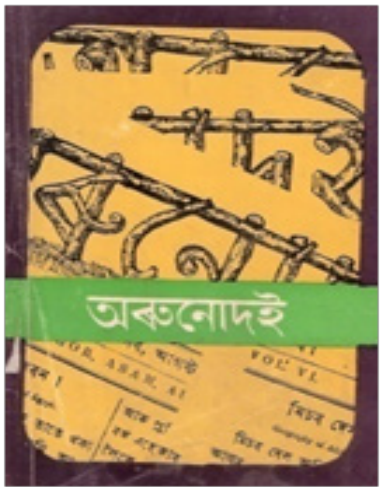
Anamika Ray
Senior Faculty in Science Communication and Course Coordinator, Media and Communication Study Center, EDC, Cotton College, Guwahati (Assam)
Email: anamikaday@rediffmail.com

Science communication is not new to Assam, as it exploits the art to convey information on science topics to public forum for long time. The communication of scientific knowledge via mass media is continuing a special relationship between science and news media beginning from publication of Orunodoi (1846). In the recent past, a section of newspapers in Assam has started giving special stress on science and technology related stories, though it needs more focus. On a positive note, some institutions are coming forward with science communication courses and modifying their curriculum of mass communication to give room to science communication – thanks to NCSTC's initiatives and patronage. An attempt has been made through this paper to assess and highlight the status and state of science communication in Assam.

Keywords: Assam media, History, Media coverage, Science communication, Science writing

Introduction

Science seeks to comprehend the nature and explain it through evidence. Scientific knowledge and its logical and ethical implications are important for wellbeing of a society. As such, scientific method cannot infer anything about the area of actuality that is ahead of what is visible by existing or theoretical means. When an expression of our reality earlier considered as supernatural is understood, in the terms of causes and consequences, it obtains a scientific justification. The fundamental goal or intention of science to society and individuals is to create useful models of reality. Thus science is also a way of understanding things that permit us to compete more effectively with our surroundings and to better adopt and develop as a whole as well as independently in a society. In recent years, the amount of science news has grown in media. The exchanges between scientific community and news media are therefore expected. Science communication can fulfill the need of a scientific approach amongst general mass and bring in authenticity, while making them creative in general understanding. Media can act as



an effective intermediary of education by giving striking picture, story, cartoons, articles, short stories, current events, etc., on current science issues. But generally science writing is limited to topics of scientific study and translated jargon that is difficult to understand for non scientists. Science and technology with their incredible power to create, analyze and connect must be understood by the people in their language for its impact on society.

The pre - *Orunodoi* era

Marzia Mazzonetto wrote in the *Journal of Science Communication* as "the most recent history of science communication in India dates back to the end of the 19th century, when the first science books imported from Britain were translated into main local languages and distributed amid the upper echelons of society1". But Dr. Partha Bandyopadhyay argued in June 2005 issue of the journal that 'science communication in India "started in early rather than 'late' 19th Century - in the 20's and 30's. As a point of reference one could mention the works of Raja Ram Mohan Roy (1772-1833), a polyglot, scholar and social reformer. He, among other things, translated books on geography and geometry into Bengali and also wrote popular articles on such subjects as "echo" and "magnet" in a Bengali journal named *Sangbad Koumudi*, which he himself edited in early 1820's[2]". However, Dr. Manoj Patairiya has cited in his paper *Science Journalism in India*, that science communication in modern India was started in 1818 with the publication of an educational monthly *Digdarshan*[5], which was published in Hindi, Bengali and English, carrying a few articles on science and technology[6]. Therefore, *Digdarshan*, stands as the first Indian print media that carried science and technology subjects.

Assamese science journalism can be traced back to the mid 19th century, when *Orunodoi*, the first Assamese newspaper was started in January 1846[7], after 28 years of the publication of *Digdarshan*. The review of literature however suggests that Assamese science literature in written form goes back to 15th century. Under sponsorship of King Naranarayan during the Vaishnavite movement, Bakul Kayastha translated a popular Mathematics book namely *Kitab Manjuri* in 1434. Bakul Kayastha may be regarded as the Assamese science writer as well as Kitab Manjuri as the first Assamese science book3. Prior to that, Assam has a long and magnificent tradition of popularization of science. Dr. Dinesh C. Goswami has opined, "The Assamese society paid a lot of importance to scientific temper and scientific practices in day to day life. The sayings of Daka Purusha who flourished in Assam during 4th or 6th century, very well depict the practice of science and its acceptance by and influence on the society. Daka's sayings cover almost all aspects of the day to day rural life including agriculture, health, hygiene, gynecology, pediatrics, infant care and food and nutrition".

Orunodoi era

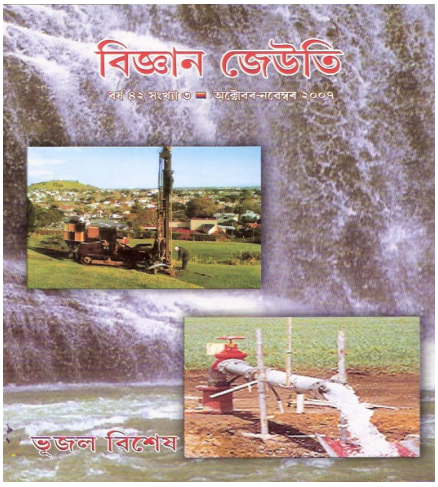
This Assamese newspaper *Orunodoi* represents Baptists' role of benefaction towards the people of Assam. From the beginning the publishers used to give a print line as "The *Orunodoi*- A monthly Paper, devoted to Religion, Science and General Intelligence, is printed and published at the Sibsagor Mission Press, by O.T. Cutter, for the American Baptist Mission in Asam8". Pandit Dr. Maheswar Neog stated 'the *Orunodoi* was devoted to science and general intelligence" is especially to be emphasized, as its pages went a long way to extend the intellectual horizon of the readers. The columns brought various news from all corners of the globe. It explained global geography and gave descriptions of the night sky with its stars and planets.

However, the first issue of *Orunodoi*, published in January 1846, did not carry any science news. But in the February issue, i.e. in the second issue, the *Orunodoi* carried two features with about 35% total space covered in aggregate. The first two essays published were "*Grahar Bibaran"*[10] and "*Prithibir Akarar Bishai*"[11] about the description of planets and about the size of the planet Earth with two illustrations. In the third issue a big feature on the discovery of printing press[12] was published. The fourth issue carried a detailed write-up on description of the world with two drawings of the globe from west and east sides. The issue also carried an article on the description of lion with a sketch followed by other animals in the subsequent issues[13]. Regarding the writing style of the scientific events and news in the *Orunodoi* Pandit Neog opined[14], 'they could have the intelligence of scientific inventions and discoveries in a simple and digestible form.' Science books were published towards the end of 19th century, i.e. Nathan Brown's "*Bhogol Siksha*" (1849), Nidhi Liwai Pharowel's "*Padartha Bidyasar*" (1855), "*Bigyanar Barematara*", "*Lara Siksha*", etc.[15]

Post - *Orunodoi* era

In the beginning of the 20th century, magazines like "*Assam Bandhu*" (1906), "*Alochani*" (1908), "*Jonaki*", "*Assam Bandhav*" (1909), "*Bahin*" (1909), "*Milan*" (1922), "*Assam Hitaishi*" (1926), "*Abahan*" (1929), and "*Jayanti*" (1938), etc., had published science articles, news on regular basis.

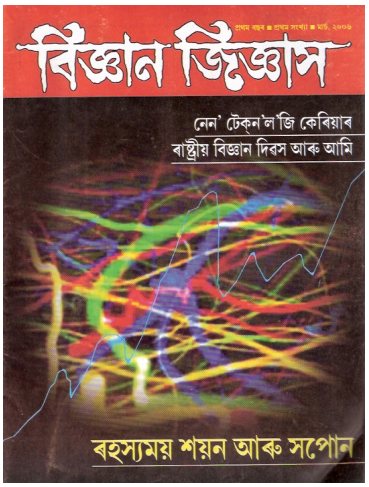
Famous literature Kaliram Medhi created an environment to popularize scientific temperament among readers and wrote a series of science articles in the *Assam Bandhav* and *Alochani. Darwinar mator jatkinchit abhas* (an introduction to the ideas of Darwin; published in *Assam Bandhav*, Vol. 3, No. 4,1912), *Helir nejal Tara* (Hailey's comet; published in *Assam Bandhav*, Vol. 1, No. 8 & 9,1910), *Prithivi* (world; published in Alochani), *Surya* (Sun), *Baidyutik Paramanu* (ion), *Pani aru Baraf* (water and ice; published in *Bahin*, Vol. 20, No. 01, p. 35), etc., were the contents of these magazines. *Bahin* gave special stress on science and technology section. On the other hand, the journal of "Asom Chatra Sanmilani" *Milan* (1922) started publishing various science news and awareness stories. In an article published in *Milan* (Vol. 6, No. 2) on the journey to the moon in the section *Bijnan Jagatar Jilingani*, a science communicator encouraged the general people with the last line – " whatever the case may be, that men will one day reign supreme on the moon, is certain." In addition to that, *Jayanti* (1938) gave inclination to the social awareness related to scientific developments. In the pre-independence era, it is not true that all magazines and newspapers published and covered science and technology news. For instance *Usha, Asom Pradipika* like popular magazines did not give attention on science news16.



Sarbeswar Sarma Kataki, Lakshmi Prashad Chaliha, Sarat Ch. Goswami, Lakshminath Das, Saifuddin Ahmed, Mahananda Barua, Birinchi Kumar Barua, Nagendranath Phukan, Girish Ch. Barua, Damudar Hazarika, Nalini Kumar Mishra, Dimbeswar Neog, Kiran Ch. Goswami were some successful science writers of this period, who tried to create an environment to popularize science 17.

Post independence era

In the post independence period some new areas of science and technology communication emerged. *Bijnan Baichitra* was a regular column published in popular magazine *Ramdhenu*. A series of articles on psychology were published in it. *Amar Pratinidhi* introduced and continued a special column named



Bijnanstambha. Again Sadiniya Navayug published two important sections: *Swasthyar Sitanat* (health), and *Bijnanbedya* (science)[18]. Children's magazines like *Akash*, *Safura*, *Mukuta*, *Mouchak*, *Abiskar*, *Jnan-Bijnan*, etc., also tried to develop children's mind and inculcate a scientific attitude by providing them reading material on science issues. Dr. Dinesh Chandra Goswami, a popular contemporary science writer wrote a science based children novel titled *Tritonar Abhijan* for *Mukuta*.

Science magazines in Assam

The first Assamese science magazine is *Pashu palan* - edited and published by Dr. Kanak Chandra Sharma, dealing with the subject of agriculture and veterinary science. This was a monthly magazine published from 1925 to 1948. During the period from 1939 to 1961, some 30 science books were published enriching Assamese science literature 19.

In 1953, the emergence of Assam Science Society is credited as a milestone in popularizing science in Assam. *Bigyan Jeuti*, the second science magazine in Assamese language was published in 1962 by Assam Science Society and since then *Bigyan Jeuti* has been playing vital role in development of Assamese science literature. Some other science magazines published in 1970s are:

Deh-man (1970), *Swasthya Pradip* (1971), *Lahar* (1973-74), *Spandan* (1974-75), *Padartha Bigyan Patrika* (1975), *Bigyan Rasana* (1976), *Bigyan Barnali* (1979-80), *Bigyan Patra* (1979), *Bigyan Barta* (1979), *Jnan Bigyan* (1979), etc. *Nuclear* (1981), *Dristi* (1982), *Bigyan Safura*, *Bhougolika* (1985), *Abiskar* (1987), *Natun Abiskar* (1988) are published in 1980s. In the last decade of the 20th century only 2-3 science magazines were published.

In the first decade of 21st century a large number of science magazines started. The nature of the recent science magazines are basically health

Table 1 - Assamese Science Magazines

No.	Year of Publication	Name of the Magazines	Publisher/ Editor
1.	1925	Posupalan	Edited by Kanak Ch. Sarma
2.	1962	Bigyan Jewti	Assam Bigyan Somittee
3.	1970	Deh-man	------
4.	1971	Swasthya Pradip	-------
5.	1973-74	Lahar	Gauhati University
6.	1974-75	Spandan	Cotton College
7.	1975	Padartha Bigyan Patrika	Dibrugarh University
8.	1976	Bigyan Rasana	Assam Bigyan Somittee (ABS)
9.	1979-80	Bigyan Barnali	ABS (Nagaon Branch)
10.	1979	Bigyan Patra	ABS (Nalbari Branch)
11.	1979	Bigyan Barta	ABS (Lakhimpur Branch)
12.	1979	Jnan Bigyan	ABS (Dibrugarh Jila Sommonoi Rokhi Somittee)
13.	1981	Nuclear	Bigyan Bharati & Somittee.
14.	1982	Dristy	Edited by Dr. Dinesh Ch. Goswami
15.	----	Bigyan Safura	Assam Science Education
16.	1985	Bhougolika	North East India Geography Association
17.	1987	Abiskar	
18.	1988	Natun Abiskar	Edited by Santanu Tamuli
19.	1999	Rasayan Siksa	Chemistry Education Organization, Assam
20.	1999	Swasthya Charcha	Edited by Dr. Asraphur Alam
21.	2000	Gyan Aru Bigyan	Edited by Munin Kakoti
22.	2001	Swasthya aru Dirgha Jeevan	Edited by Sarat Raikhowa
23.	2006	Bijnan Jigyasa	Edited by Dr Jayanta Kumar Sarma
24.	2007	Soundrya Aru Sasthya	Edited by Hemanta Kumar Saikia
25.	2007	GNRC Sasthya	Edited by Homen Borgohain

based. With the help of Aids Control Society, Public Health Department and National Rural Health Mission are running a health awareness campaign in the state. A section of monthly magazines, like *Prakash, Sutradhar, Prantik*, etc., have created a science popularization movement with a simple and interesting writing style. Dr. Paramananda Mahanta has said that we can divide writing styles or genres of these magazines into three types. First one is the pure and applied science writings, second one is the descriptive science writings, and third one is news based science writings. Though, it is observed that science sections in other Assamese magazines are comparatively negligible except a few magazines like *Prantik*, etc.

The authors have carried an analysis of the coverage of science stories in family and commercial magazines in Assam. From the analysis we found that *Prantik* regularly dedicates a large section to the science and technology, followed by *Satsari*, that gives at least 5% of it space to science and technology. Some other commercial magazines, like Priyo *Sakhi*, *Trisnatur*, *Rahashya*, *Saparibar*, and *Jiban*, etc., allocate some minimum space for science, especially health.

Table 2 - Science Sections in other Assamese Magazine

No.	Name of the Magazines	Published From	Type	Founder Editor (F.E.) / Present Editor (P.E.)	Name of the Regular Science Sections	Total Space allocated for Science Communication (approx.)
1	Prantik	1980	Serious Family	F.E. – Dr. Bhabendranath Saikia P.E. – Pradip Barua	1. Parivesh 2. Prakriti 3. Regular articles	7.5 %
2	Satsari	2005	Literary	F.E. - Homen Borgohain P.E. - Ms. A.S. Pujari	1. Bijnan 2. Swasthya aru Soundrya	5/88 (pages) 5.6 %
3	Gariyashi	1994	Literary	F.E. Chandra P. Saikia P.E. Harekrishna Deka	NIL	0 %
4	Jiban	2005	Youth	F.E. – Suresh Ranjan Gaduka	1. Susasthya	1/58(pages) 1.7 %
5	Saparibar	2007	Family	P.E. Hemanta kr. Saikia	1. Jaiba Baichitra 2. Regular Feature	3/90(pages) 3.3 %
6	Nandini	2000	Family/ Women	P.E. Maini Mahanta	Rarely publish features no regular column	0 %
7	Priyo Sakhi	2000	Family/ Women	P.E. Sashi Phukan	1. Narir Sasthya 2. E-Jagat 3. Health awareness features	4 %
8	Bismoy	1969	Commercial	P.E. Sashi Phukan	NIL	0 %
9	Trisnatur		Commercial	P.E. Munin Kakoty	1. Magajur Khurak	1/112(pages) .9 %
10	Rahashya	1974	Commercial	P.E. Damudar Sarma	Regular Feature No dedicated section	2 %
11	Maya		Commercial	P.E. Bitupon Bora	NIL	0 %
12	Pratipakhya	2005	Family	P.E. Braja Kishore Saikia	NIL	0 %

Science in newspapers in Assam

In an article, published in the *Prantik* (1-15 March, 1988), Promod Ch. Neog and Dr. Dinesh Ch. Goswami have mentioned that science writing in newspapers and magazines in Assam was satisfactory as compared to other states.

From a detailed content analysis, we have seen that in Assam, the dailies rarely cover science news on front page. Even in the other pages also science and technology news is difficult to find. We can get a few technology advancement and new discovery related news only on international or business pages of the regional language dailies in the state. Compairing to the language dailies, *The Assam Tribune* covers a little bit more science news, with a regular section *Beyond Frontiers* (published on the page 13) except Friday, that allocates maximum space for science and technology features. In addition, they have a separate supplement with Saturday edition named Horizon and it has regular column, 'Science Zone'. It is encouraging to note that *The Assam Tribune* devotes nearly 11 broadsheet pages out of 120 pages (nearly 10%) in a week for science and technology.

Contrary to that, many regional language dailies in Assam do not provide enough space for science. *Asomiya Khabar* has three columns in a week on health (Susasthya), Science and Technology (Bijnan Aru Prajukti), Agriculture (Kheti–pathar) publish regularly on Thursday (page 3), Wednesday (page 12) and Tuesday (page 5) respectively. *Ajir Asom*, a Sentinel's sister publication, gives more pages for science, i.e. Women Health - *Sreemati* (Swasthya), Good Health - *Susasthya*, Agriculture - *Krishi Jagat*, Science and technology - *Bijnan*/ *Prajuktibidya*, Environment - Paribesh; these regular sections are published once in a week. *Asomiya Pratidin*, the highest circulated Assamese daily has three sections: *Prakriti* (nature), *Swasthya Nidan - Bibidha* (health), and *Jnan Bijnan* (scientific knowledge) published with free supplements on Wednesday and Sunday. *Ajir Dainik Batori* has not such a dedicated page for science. *Amar Asom*, a leading Assamese daily publishes a section on nature every week.

Dainik Asom, *Dainik Agradoot*, and *Dainik Janasadharan* give little more space to science issues as compared to *Dainik Batori* and *Amar Asom*. They have some sections on weekly basis on agriculture, health, nature and environment, science and technology, etc. Health is a common section for all the daily newspapers. Though the coverage of other areas like science, technology, discoveries, scientific advancements, various problems like power, pollution, etc., are comparatively less or negligible. As an average, the science coverage in Assam is about 3.55 %.

Table 3 - Space Allocated for Science in Dailies of Assam

No.	Name of Dailies	DIPR *, Circulation figure in 2006	Sections on Science		Percentage of Space (approx.)
			Name	Space and Day	
1	The Assam Tribune Edited by Prafulla Gobinda Barua 67 years of publication	63,645 * Directorate of Information and Public Relations, Govt. of Assam	Beyond Frontiers	Monday, Tuesday, Wednesday, Thursday, Saturday Sunday (P. 13)	1/16(pages) 6.25 %
			Horizon (Science Zone, Cover article etc.)	Saturday Supplement	2/4(pages) 50.0 %
			Health Wise	Supplement(p.2)	2/4(pages) 50.0 %
				At least Two editorial feature in a week	6.25 %
			Total Space in a Week		**11/120(pages) 9.2 %**
2	Asomiya Khabar Edited by Dr. Khiren Roy 7 years of publication	77,273	Susasthya	Thursday (p.3)	1/12(pages) 8.3 %
			Bijnan Aru Prajukti	Wednesday (p.12)	1/16(pages) 8.3 %
			Kheti –Pathar	Tuesday (p. 5)	1/12(pages) 8.3 %
			Total Space in a Week		**3/92(pages) 3.3 %**
3	Ajir Asom Edited by Apurba Sarma 21 years of publication	18,921	Sreemati (Swasthya)	Saturday (p.11)	.5/12(pages)
			Susasthya	Sunday (p. 11)	1/12(pages)
			Krishi Jagat	Tuesday (p.8)	1/10(pages)
			Bijnan/Prajuktibidya	Wednesday(p.8)	1/10(pages)
			Paribesh	Thursday (p.8)	1/10(pages)
			Total Space in a Week		**4.5/74(pages) 6 %**
4	Asomiya Pratidin Edited By Haider Hussain 13 years of publication	1,53,800	Prakriti Swasthya Nidan	Wednesday (Supplement)	2/16(pages)
			Bibidha Jnan Bijnan	Sunday (p. 5,8)	2/12(pages)
			Enajari (Bhakutkut in Umalaghar) occasional	Saturday (Supp)	.5/16(pages)
			Total Space in a Week		**4.5/92(pages) 4.8 %**
5	Ajir Dainik Batori Edited By R MBhagawati 3 years of publication	69,554	Sadharan Jnan (Career)	Tuesday (p.10)	.5/12(pages)
			Bidyarthi (course)	Saturday	----
			Total Space in a Week		**.5/84(pages) 0.6 %**
6	Amar Asom Edited By Homen Borgohain 11 years of publication	74,729	Prakriti	Monday (p.10)	1/16(pages)
			Total Space in a Week		**1/94(pages) 1 %**
7	Dainik Asom Edited By Jyoti P. Saikia 43 years of publication	13,776	Sundar Prithivi	Wednesday(p.5)	1/12(pages)
			Sanjivani	Tuesday (p.5)	1/12(pages)
			Dristipat	Sunday (p.7)	1/12(pages)
			Total Space in a Week		**3/84(pages) 3.6 %**
8	Dainik Agradoot Edited By Kanaksen Deka 13 years of publication	85,265	Prakriti, Paribesh, Krishi	Wednesday(p.5)	1/12(pages)
			Sariram	Tuesday (p.2)	.5/12
			Total Space in a Week		**1.5/84(pages) 1.8 %**
9	Dainik Janasadharan Edited By Manoj Goswami 5 years of publication	37,445	Siralu	Wednesday(p.2)	.5/ 12(pages)
			Jnan- Bijnan	Tuesday (p.2)	.5/12(pages)
			Bijnan- Janasastya	Monday (p.5)	1 / 12(pages)
			Total Space in a Week		**2/86(pages) 2.3 %**

Some challenges

- It is a common belief that media persons, especially editors are willing to publish special pages for science and technology or even science news on the front page, but the lack of interest of the general readers is the main barrier for encouraging science readership.
- The health sections of the dailies or magazines attract more general readers. Though, we can find a common assertion that general readers are sometime confused with varying advices of different experts published in health sections, even by same daily in different issues.
- Writing style is another challenge for science writers. It is difficult to write something on science to make it understand for the general people. It should not be literature. As Dr. Manoj Patairiya has mentioned "Science articles published in newspapers/ magazines today are no different from what they used to be years ago, i.e. with prosaic style, technical jargon and excess of avoidable statistics". It should be a writing method of colloquial style with science contents using simple words.
- Use of science terminology is difficult to understand and also not attractive as such for the readers. It is better to use some original English word, which is popular among the masses.
- As many scholars have observed that translation, trans-creation or transliteration is one of the barriers to present science in its original form and therefore lacks efficacy in communication amongst general mass. Accordingly, mere application of Assamese terminology cannot make popular science writing intelligible and popular; self caliber, capacity and the ways of expression of a journalist or writer can make a difference.
- Generally, young and adult people are not satisfied with science sections of newspapers. Especially science for children is not presented in an effective way. Children, basically do not want to read, they love to see visuals, comic characters, photographs, sketches with colourful and poetic presentation.
- Lack of space is a significant challenge. Due to limited space, editors cannot provide illustrations, sketches and charts for better understanding of readers.
- There are no dedicated staff science journalists as such in print media in Assam. A staff reporter cannot give more time to understand a scientific matter and to write a report.
- Local science news could be more attentive. Media can take special care to publish local science news, for instance, *Deep Bahan* - a beautifully designed rickshaw by IIT, Guwahati, etc.
- Irregularity of publication of science magazines is frustrating for the readers. For instance, now we have only one reliable science magazine *Bijnan Jeuti* published by the Assam Science Society, though not regular.
- It is a good sign that popularity of Assamese health magazines is increasing gradually. In the last 7 years nearly 5 health magazines started. Besides that, almost all other general magazines have started publishing health sections. However, except health, other categories of science and technology sections or purely science magazines are decreasing day by day. 1970's was the golden decade for science coverage in Assam. A science-society movement was also launched these days effectively. Assam Science Society had published separate science magazines, such as *Bigyan Rasana*, *Bigyan Barnali*, *Bigyan Patra*, *Bigyan Barta*, etc. But in the 1980's and 1990's all these magazines were stopped. Now, again there is a crying need for some specific magazines on agriculture, veterinary science, and technology issues, etc., in Assamese.
- Rural people do not get magazines and newspapers regularly and in time. Our main focus should be on rural masses. They are more susceptible to believe superstitions. If dissemination of information and news is considered as a service to the society rather than a trade or business, then the aspects of social responsibility should get preference. The general reader expects that being mirror and guide to the society, media should target the rural people also to create an environment conducive for developing a scientific temper, rather than superstition and age old social evils.
- Many journalists treat a science story like other stories. They do not differentiate it while presenting in their media. If needed, the media organizations may provide necessary training or orientation to their reporters, who work on science.

Some initiatives

Assam Science Society was established in 1953 and registered in 1960-61, is pioneer in the field of creating scientific awareness among people of Assam. The society has published over 140 popular science and reference books in Assamese and English languages, including Explanatory Science Dictionary (2 Vol.), Glossary of Scientific Terms, Children's Science Encyclopedia (5 Vol.), etc. It has 2 periodicals to its credit: *Journal of Assam Science Society* (Half yearly) since 1955, and and *Bigyan Jeuti* (bimonthly popular science magazine in Assamese) since 1962. The society regularly organizes various science communication activities in the state and has established Institute of Advanced Study in Science and Technology at Pashim Boragoan, Guwahati, Science Complex with proposed Aquarium, Reference Library, Planning and Research Center, Biodiversity Photographic Gallery, etc. 20

The NCSTC, in association with North Eastern Council Secretariat, had organized a regional workshop on science communication at Shillong in 1994 involving a number of participants and resource persons from NE region and Assam. The workshop has played a seed and lead role in recreating a spark in science communication activities in North East Region in general and in Assam in particular. Since then, a number of NCSTC's workshops, conferences, and academic courses were organized in Assam, especially Academic Courses on Science Communication at Cotton College and Guwahati University, Coordination Meeting on Science through Community Radio, 9th Indian Science Communication Congress at Krishna Kanta Handique State Open University, and National Children's Science Congress (1995 & 2004), with a major and visible impact in the form of more science communication professionals, enhanced science coverage in mass media, increased science activities, and a favourable environment for promotion of science awareness and scientific temper.

Evidently, Assam has a long legacy of science writing and science communication having a glorious past in the field and marching ahead with more preparedness in the area of distance learning courses on science communication to create science writers and to train working journalists, and to develop a scientific temperament among students community through a variety of science popularization programmes and activities to accelerate growth and development.

References

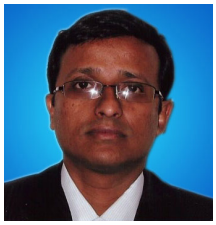
1. Mazzonetto, Marzia, "Science communication in India: current situation, history and future developments" in *Journal of Science Communication*, March, 2005 published by SISSA – International School for Advanced Studies, online available at http://jcom.sissa.it/
2. Bandyopadhyay, Partha, "About science communication in India" - a letter published in *Journal of Science Communication*, June, 2005 published by SISSA – International School for Advanced Studies, online available at http://jcom.sissa.it/
3. Asom Sahitya Sabha, *Asmiya Bijnan Sahitya* as cited by Dutta, Rana, *Growth and Development of Assamese Science Magazine*, unpublished dissertation of Gauhati University, Guwahati, 2002. p. 15
4. Goswami, Dr. Dinesh Ch., Science Popularisation Activities in Assamese (*paper presented in CIIL, Mysore in 2004*) published in *Indian Journal of Science Communication*, Vol. 6 (2), July – December 2007, p. 3
5. *Satyaprakash, Bharatiya Vigyan Ke Karnadhar*, (Research Institute of Ancient Scientific Studies. New Delhi,1967) as cited by Dr. M. Patairiya in Science Journalism in India, available online at *http://www.pantaneto.co.uk/issue25/patairiya.htm*
6. Sharma Kuldeep, *Kuchh Roti Kuchh Sisakati Vigyan Patrikyein*, (*Hindustan*, New Delhi, 1993)
7. Patairiya, Manoj, *Science Journalism in India < http://www.pantaneto.co.uk/issue25/patairiya.html >*
8. Dutta, Ankuran, Asomor Gana Madhyam in *Axom Darpan*, Deka, Dr. N. (ed), (Bani Mandir, Guwahati, 2007) pp. 461-464
9. Dutta, Ankuran, Asomor Mudran Madhyam in *Sahitya Sanskritir Bibidh Prasanga*, Nath, S.K. (ed), (Asom Sahitay Sabha, Sipajhar Session, 2005)
10. Neog, Dr. Maheswar (Compiled and Re-edited), *Orunodoi* 1846- 1854, (Publication Board, Assam, 1983) First Edition in Assamese. P. .65
11. *Ibid*. pp.12-13
12. *Ibid*. p.13
13. *Ibid*. pp. 23-24
14. *Ibid*. pp.28-29, 32
15. *Ibid*. p. .66
16. Dutta, Rana, *Growth and Development of Assamese Science Magazine*, unpublished dissertation of Gauhati University, Guwahati, 2002.
17. Mahanta, Dr. Paramananda, 'Asomiya Batori Kakatat Bijnan Samparkiyo Rachana aru Alochana' in *Asomor Batari Kakat Alochanir Dersa Bachariya Itihas (1846 – 1996)*, Edited by Saikia Ch. P. (CC of 150 yNPA, Guwahati, 1998), pp. - 536-541.
18. *Idem*.
19. *Ibid*. pp. 541-543
20. Dutta, Rana, *Growth and Development of Assamese Science Magazine*, unpublished dissertation of Gauhati University, Guwahati, 2002.
21. Activities of Assam Science Society, online available at *http://assamsciencesociety.org/active.html*
22. *Ajir Dainik Batori*, December 1, 2007 issue.

■

Science museum for science communication: A case study

Bharati Bharali
Centre for Mass Communication and Journalism, Entrepreneurship Development Cell, Cotton College, Guwahati, Assam

Rajesh Chakrabarty
Department of Inorganic and Physical Chemistry, Indian Institute of Science, Bangalore, Karnataka



Communication of science in an effective way is essential to involve the public in the processes and culture of science and to create an awareness of what science is attempting to achieve. Science museums acquire, conserve, and demonstrate science exhibits for the purpose of dissemination of scientific concepts in an enjoyable manner, offering an appropriate tool for science communication. Regional Science Centre (RSC), Guwahati, which is the only science amusement institution in Assam, helps promote a scientific temper in northeast India. A study was carried out to understand the challenges and opportunities of RSC and its mode of functioning during the period 2005-2008 vis-à-vis popularization of science in urban and rural areas, for benefits of students, teachers and common people. Findings of the study reveal that there exists an information gap between the target audience and institutions regarding the events conducted. The lack of insufficient media attention was also found in a survey analysis of some of the largest circulating dailies in the state.

Keywords: Science communication, Science muséum, Public participation, Media interaction

Introduction

Communication of science is an essential part for a country's growth, security, economic and social uplift (Patairiya, 2002). Reflection of scientific temperament in knowledge, perception, attitude and practice in a community necessitates a proper platform. A science museum, as a dedicated body that provides opportunities for appreciation, understanding and promoting science through enjoyment is an appropriate tool for communication of science in an effective way. As Ex-President of India and eminent scientist Dr. A.P.J. Abdulkalam said "in a world dominated by science and technology, science communication and popularisation is of utmost importance especially for our country where a large population needs to be told about the impact of science and technology in their daily lives".

Historically, the emergence of museums dates back to the age of renaissance when many aristocrats collected antiquities for display. However, these private collections were only accessible for middle and upper classes. The first truly public museum was the Louvre Museum in Paris, opened in 1793 during the French Revolution, which enabled for the first time in history free access to the former French royal col-

lections for people of all status. The Industrial Revolution in 19th century led to the creation of another line in the genealogy of museums called science museums. It intended to showcase the triumphs of both science and industry. It was only in the 20th century that the concept of modern interactive science museum was developed. Munich's Deutsches Museum which is the world's largest museum of technology and science pioneered in encouraging the visitors actively participate in the interactive programmes. Since then many western countries have established science museums making science accessible and enjoyable to the common peoples.

Science and technology communication through interactive science museums in India got boost with the establishment of National Council of Science Museums (NCSM), an autonomous society (presently) under the Ministry of Culture, Government of India on April 4, 1978. Today, it administers some 27 science centres/ museums spread all over India. To name a few - Birla Industrial and Technological Museum (Kolkata), Visvesvaraya Industrial and Technological Museum (Bangalore), Nehru Science Centre (Mumbai), National Science Centre (New Delhi), Science City (Kolkata) along with 10 Regional Science Centres have been working towards science popularization through exhibitions, galleries and extension programmes.

Beyond the traditional activity of students' visits to exhibits, science museums have enormous potential for supplementing classroom instruction in science. This potential is often unrealized because of the lack of effective coordination and use of various media in reaching to the students and general people. Keeping in view the above facts, a need was felt to study the effect and utilization of various channels of communication in the activities of Regional Science Centre, Guwahati in promotion and communication of science in the northeast region of India.

Objectives

The present study aims to analyse the recent activities of the Regional Science Centre (RSC), Guwahati during the period of 2005-2008. The study has been made with a view to know the effectiveness of the science museum in this region with reference to science communication and also to explore the possibilities of enhancement of this medium for better communication. The scope of the study includes the assessment of participation of students and general people in various activities of the centre, such as interactive science, mobile science exhibition, creative ability camp, and teachers' training, etc. The coverage of the activities by the regional media in terms of subject areas of coverage, type of presentation, message appeal, etc., was also included in the study. The main objectives of the study are:

- To analyse activities of Regional Science Centre, Guwahati in relation to communication of science and technology in urban and rural areas for students and common masses.
- To assess the utilization of various channels of communication by the centre.
- To determine constraints of the centre in their functioning.
- To explore the ways and means for improvement of the centre in terms of function, presentation, levels of interactivity, involvement of media and information technology.

Methodology

This study uses a descriptive qualitative approach based on semi-structured interviews as the primary source of method (Berg 1989, Flick 2003). Qualitative kind of research has been adopted as it is relevant in study. The survey research employed personal interview method to achieve the desired objective. The statistics of year long activities of Regional Science Centre, Guwahati during 2007-2008 were analysed. The target groups for the study were categorised broadly into two - students and general people. The participation of media in the activities was surveyed in the study period of 5 months (June - October 2008) by content analysis of 5 vernacular (Assamese) dailies besides two English language newspapers published in the state of Assam.

Regional Science Centre, Guwahati was established on 15 March, 1994 for dissemination of science in the northeast part of the country. The centre was the first of its kind in the northeast and 14th in India. Previously the centre was jointly funded by North Eastern Council (NEC), Assam State Government and the National Council of Science Museums, Kolkata (50%). Presently it is funded by the

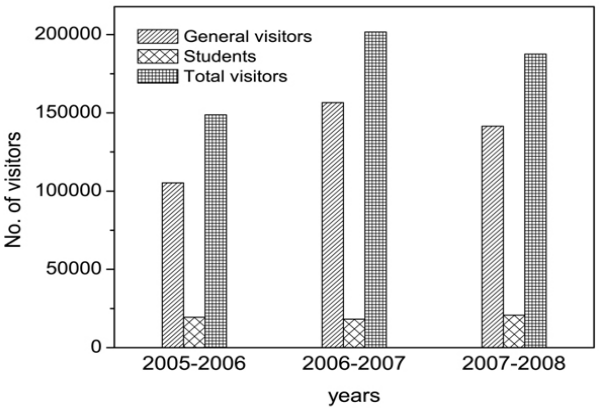
National Council of Science Museums. The centre covers an area of 9-10 acres of land and is situated at Jawahar Nagar, Khanapara, Guwahati. The centre is around 12 km. from Guwahati railway station and 32 km. from the airport.

Various galleries and facilities of the centre include, butterfly corner, children's corner, taramandal, aquarium, prehistoric life park, medicinal and aromatic plants garden, fun science, mirror magic, mock-up coalmine, agriculture, forest chemistry, and illusion, etc. The centre has in place a permanent planetarium, exhibition hall, auditorium, library, conference hall, computer section and recently installed 3D presentation system. The centre conducts daily shows on different themes such as taramandal, science magic and miracle, chemistry for fun and 3D theatre show. Various indoor and outdoor activities include commemorative events, community programmes, creative ability camp, popular science lecture, science fair, science demonstration lecture, science quiz, science seminar, science shows, sky observation camp, taramandal shows, training programme and vacation hobby camp, etc.

The centre conducts teachers' training programme so that teachers can learn how to make science interesting eventually to their students. They are also trained in making teaching aids from low cost materials. A NGO Aaranyak is providing helping hand in programmes for last four years. The Assam Science Technology and Environment Council has also helped the centre to organize teachers' orientation programme. The centre conducts interactive demonstrations before a large number of teachers coming from different parts of the states. They are also provided the chance to visit different laboratories during the programme. In 2007-2008, the centre conducted 3 teachers' training programmes where 75 teachers participated and 20 teaching-learning aids were developed.

Observations and findings

A survey of the visitor records of the centre during the study period of three years shows a gradual increase of the number of visitors in the museum, which by and large remained same. It indicates that the activities of the centre need to be nudged to attract more people. The number of visitors increased from 1,48,821 to 1,87,505 with a moderate growth



Number of visitors at Regional Science Centre (2005-2008)

of 26% over three years (Figure). However, number of student visitors remained almost same over the period, with a nominal increase of 7%. This sluggish growth is despite the introduction of many new facilities and galleries recently. This also points towards the lackadaisical attitude of schools in the region to encourage young students towards science.

The mobile science exhibition organized for 57 days over three years could attract 26,601 participants. Other activities of interactive science such as science demonstration lecture, sky observation programme, taramandal, science quiz, popular science lecture, etc., got moderate success. Following are the statistics of yearlong activities of the centre during 2007-2008.

A quarterly house journal titled 'NE Vigyan Batori' (NE Science News) is published by the centre. In addition to the presentation of activities of the centre, this black and white, four pages journal has space for mathematics kit, information about upcoming events, and facilities of the centre, etc. Colourful and attractive leaflets explain all the wings of the centre. Press releases to various media houses of the region are also issued from time to time for wider media coverage of centre's activities.

Overview

The study throws light over the fact that despite having many facilities and galleries, some of which were developed recently, the centre is unable to generate much interest about science amongst students in particular and people in general. Many

programmes conducted by the centre are at par in number and quality with other RSC's, though media participation was inadequate. This could be gauged from the fact that a five month content analysis (June - October 2008) of seven daily newspapers (2 English and 5 vernacular language) revealed only one news coverage about the 'summer camp' held on July 12, 2008 (Dainik Janasadharan Vol. 6, No 189, 2008), a 3 columns news without photograph. The establishment of 3D theatre hall was featured in The Assam Tribune (Vol. 70, No 183, 2008). Rest of the newspapers did not show interest to cover this new achievement.

I. Exhibit Development

Activities	Number of Programmes
Gallery Exhibits	35
Park Exhibits	1
Kits/ Aids	3
Total	39

II. Interactive Science

Activities	Number of Programmes	Number of Participants
Science Demonstration Lecture	61	NA
Sky Observation Programme	75	1999
Taramandal	766	13396
Science Quiz	45	4329
Popular Science Lecture	16	NA
Total	963	19724

III. Creative Ability

Activities	Number of Projects	Number of Schools	Number of Participants
Science Fair	21	-	42
Science Seminar	26	26	28
Creative Ability Camp	20	-	25
Total	67	26	95

References

1. Powell, A. T. (2002). Web Design: The complete reference. 2nd Ed. New York: McGraw-Hill/ Osborne.
2. Stopsky, F. (2000). The Internet and the quest for knowledge. College Teaching, 48, 37-38.
3. http://en.wikipedia.org/wiki/Museum#History
4. http://www.ncsm.org.in
5. http://www.amnh.org/science/
6. http://www.exploratorium.edu

■

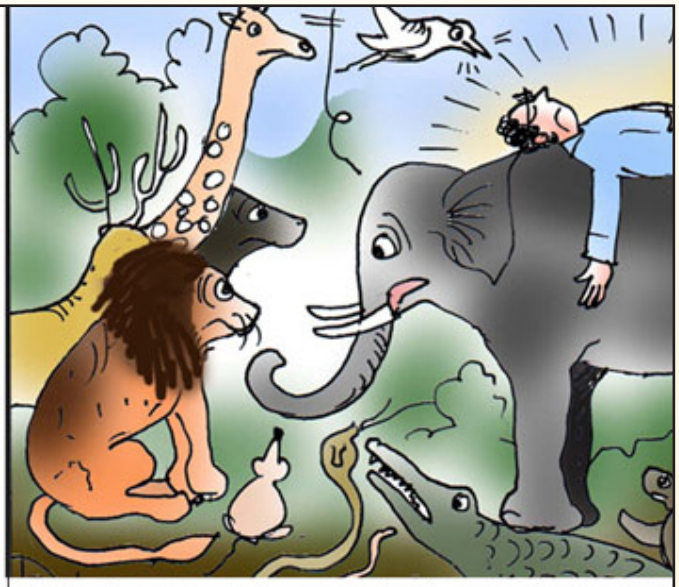
Professor Frank Fenner

Emeritus professor of microbiology at the Australian National University, Australia has predicted that the **human race will be extinct within the next 100 years.** He has claimed that the human race will be unable to survive a population explosion and 'unbridled consumption.' Fenner *(scientist who helped eradicate smallpox)* further said that 'A lot of other animals will too become extinct.'

'It's an irreversible situation. I think it's too late. I try not to express that because people are trying to do something, but they keep putting it off.'

http://www.dailymail.co.uk/sciencetech/article-1287643/Human-race-extinct-100-years-population-explosion.html

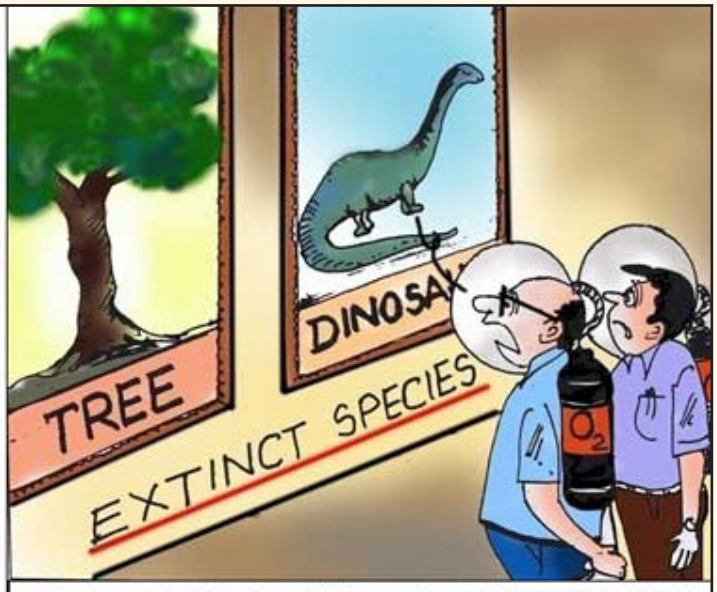
Cartoon idea: Courtesy: Prof. G.S. Randhawa, IIT, Roorkee, India



"I thank you all for participating in the funeral journey. It is our sacred duty to carry the dead body of the last human being to the graveyard. Friends, now we all have to take care of the planet earth."

"Climate change is the biggest new extinction threat," said Lee Hannah, a co-author, at Conservation International in Washington DC. Many species would simply be unable to adapt or migrate to new habitats.

The survey, the largest of its kind to date, studied global warming links to 1,103 species of plants, mammals, birds, reptiles, frogs and insects in South Africa, Brazil, Europe, Australia, Mexico and Costa Rica and extrapolated findings as far as 2050. It did not examine the oceans.



"What a period that would have been? Can you believe? Nobody had to move like us carrying oxygen cylinders in the year 2010.This miracle was possible due to this left thing with brown base and green top. It was called TREE."

Promoting energy and environment consciousness using knowledge convergence

Dr. Jagdish P.N. Giri
Senior Executive, Oil and Natural Gas Corporation Limited
Executive Director, Aaditya Energy Foundation, Kottur (Kotturpuram), Chennai - 600085, Tamil Nadu.
Email: jpngiri@aadityaenergyfoundation.org.in

Introduction

Energy is the most vital link between environment and economy; as the natural resource its production and consumption impact the environment and climate at large, and in terms of growth and development its availability defines the economic progression and developmental indices of a nation. Energy choices and challenges will become increasingly complicated as the nation and the world balance the expanding need for energy supply with the importance of increasing energy efficiency and conservation, protection of environment and climate as well as preservation and sustainability of natural resources. The world energy market grows regularly with new stakeholders, new limitations, new resources, and new challenges. The energy world is ever-expanding, and our goal is to prepare future leaders to make those difficult decisions, train educators to teach energy with a balanced perspective on environment and climate, and reach parents and community decision makers through energy and environmental outreach and integrated energy and environment education development programmes.

Integrated National Energy and Environment Education Development Project under AEEED (Aaditya Energy and Environment Education Development Project) aims at promoting energy consciousness and environmentally educated national society by creating effective networks of students, educators, business, government, legislators, social and community leaders to design and deliver objectively defined, multi-sided energy and environment education programmes, across the education matrices from basics to research and literacy missions of the nation. It is dedicated to promoting a realistic understanding of scientific, economic and environmental impacts of energy production and consumption profiling, climate change issues, low carbon economy and the pathways for sustainable development in cyclic integration of energy, environment and economy, enabling the society at large to make informed decisions to achieve Millennium Development Goals.

The present programme is targeted to include innovative curriculum materials, skill and professional development, implementation and evaluation tools, and recognition of societal abilities to analyze and decide on critical energy, environmental and economic issues in the broader perspectives of necessary policies, regional and international agreements, as well as in the framework of specialized agencies of United Nations. The programme teaches scientific concepts of energy and provides objective information about conventional and emerging energy sources - their use and impact on environment, economy, and society. The programme also educates students about energy efficiency and conservation, development and uses of sustainable or renewable energy portfolios to reduce greenhouse gas emissions, while providing tools to help educators, energy managers, environmental activists and consumers to use energy wisely, minimizing its impact on environment and climate.

A new approach

The innovative modules under the project make teaching and learning about energy, environment and economy exciting while developing students'

leadership and critical thinking skills, for analyzing and debating issues to formulate policy approaches, action plans and training modules to enhance societal educative resource base. To ensure that teachers and students are working with accurate information, as the learning materials need to be updated on regular basis, using the latest data from National Energy and Environment Information Systems, as well as from a wide range of energy industry partners. It is proposed to work with educators and students to develop educative resource base to meet national and state curriculum requirements. In a special partnership with the Energy and Environment Information Systems, the programme helps make energy and environment information and data available to students via its website www.aadityaenergyfoundation.org.

The evolving learning partnerships will allow more teachers and students to benefit from comprehensive energy and environment education curriculum, training, and student leadership programmes. In the new partnership with educational institutions, government and business, the Foundation plans to release new education materials and training resources highlighting the basics of oil and natural gas exploration, production and refining and its impact on environment and climate. It will further reinforce the need for developing sustainable and renewable energy portfolios through its education resource base, while leading a global movement for sustainable energy, environment and economy in 21st century; and targeting to evolve a national/ global society in partnership with Millennium Development Goals, Sustainable Development Plan and United Nations' Framework Convention on Climate Change. Designing and formulating the steps for promotion of energy and environment consciousness has been the major focus while integrating energy and environment in national education curriculum.

Training and professional development

New curriculum includes many activities to help reinforce energy lessons and create connections between Physical Science, Biological and Environmental Sciences, Society, Business and Economics on one hand and students' daily lives, and the entire world on the other. The knowledge convergence between subjects and disciplines provides a wider and creative canvas for free quench of young minds to flourish. The educators can apply their energy knowledge to analyze current energy consumption data and its impact on environment and climate to forecast future trends, using Energy and Environment Analysis and the Energy and Environment Information Systems. The synthesis and reinforcement step incorporates many different subject areas, including language arts, performing arts, social studies, math, and leadership.

Teachers are the key to success of the present programme. Providing teachers with innovative training programmes and opportunities to increase their own energy and environment knowledge base is a major objective of the programme. Training is offered at local, state, regional and national levels. During the school years, project coordinators, lead teachers, and student leaders facilitate workshops for teachers, students, parents, and community members that may range from a few hours to several days. At these workshops, attendees will receive an introduction to the new curriculum. Additional training for special topics like solar, hydrogen, wind, energy on public lands, or energy and environment management are also covered during the workshops. In the summer, national energy and environmental conferences/ seminars for educators give teachers and energy and environment professionals the opportunity to meet other educators from across the country, design and develop units for classrooms, increase their knowledge base, and earn graduate credit. They will participate in these activities and field trips to energy sites such as nuclear power plants, coalmines, offshore oil production facilities, solar energy facilities, hydroelectric dams, and energy efficiency projects and review environmental impact assessments of energy production units.

Networking is the key

Networking is the key to long term success of the project that depends on the support of its network. The educators, students, directors, social and community leaders, coordinators, sponsors, stakeholders and business partners support the programme through collaborative, associative and interactive network amongst themselves. The Foundation facilitates the implementation of strategic plan for

expansion and furthermore helps support the goal of providing energy and environment education programme to every interested school in India. The members volunteer their time and talents to make sure that the programmes and materials reach the greatest number of people each year. State programmes will be the vital component of this mission. State coordinators and lead teachers, partners, stakeholders and sponsors provide day-to-day guidance to local programmes, in conducting regional and local training programmes, designing and distributing materials, support teachers, and helping to develop new and innovative programmes and activities.

Evaluation and recognition

A National Teacher Advisory Board of outstanding educators and an Advisory Board of energy and environment experts, economists, community leaders, business and government is in place to review:

- The learning materials for scientific accuracy, comprehensiveness, objectivity, educational soundness and effectiveness;
- The programme participants - students, educators, sponsors, and partners - evaluate materials and training programmes as well as new activities. Using evaluation tools included with every unit, teachers evaluate individual activities and the entire programme. In addition, it provides a variety of assessment instruments and tools for measuring students' knowledge and performance; and
- The programmes increase energy and environment knowledge and awareness amongst students. The Energy and Environment Education Report Card offers details of the increase in students' knowledge in a number of energy areas and related environmental issues, as well as attitudinal changes and leadership development.

This ambitious project seeks to encourage and reward student leadership and innovation by sponsoring a Youth Awards Programme for Energy and Environment Achievements. Schools participating in these programmes submit reports on their energy and environmental activities. Outstanding teachers and student leaders are recognized for their efforts at state level and invited to attend national recognition ceremonies held on Foundation's Day each year on June 1st.

Conclusion

The programme is committed to expanding its reach by partnering with energy and environment sectors' organizations and companies and is continue to provide unique, high quality, affordable curriculum materials and classroom training on energy, environment, climate change and economic development issues nationwide. These concepts are targeted to make the programme successful in the sense that energy and environment finds place in national education curriculum, through more exciting, productive, and efficient learning modules and nationwide networking. The programme will continue to work towards bringing knowledge resources together and to make new curriculum accessible to all schools. Evidently, the group is expanding and we are aligning with dedicated members, committed supporters, talented teachers and students each year. On the occasion of the 8th Indian Science Communication Congress (ISCC-2008), the Foundation has launched a new series of performance improvement metrics designed to sustain steady expansion of activities and to maintain high quality programmes. Considering the youth as the key to future progress in this direction, a small component of programme is targeted to create a National Youth Forum on Energy and Environment Education Development. The evolving forums and action plans bring new ideas from the energy industry, local, state, public agencies and educational institutions and partnering with the project to create effective programmes with local focus.

The programme continues to recognize the fact that the tremendous energy that young students and teachers are bestowed with could be useful in promoting economic development through sustainable environmental framework. Collectively, the country is well positioned to harness that energy to bring comprehensive energy and environment education curriculum and training modules to schools nationwide - inner city public schools, rural private schools, correctional education centers, home schools, and tribal schools.

■

Technology, literacy and communication

Dr. Afrina Rizvi
Associate Professor, Department of Mass Communication, Aligarh Muslim University, Aligarh.
Email:afrinarizvi@gmail.com

As a rapidly developing economy, India is increasingly adopting newer technologies to keep pace with advanced nations and meet the expectations and needs of our people. Be it information technology, stem cell research or nanotechnology, India is at the forefront of technological advances in almost every field. However, when it comes to the general public, researches suggest that a large cross section of population is not even well-versed with the technology that they are using and many are even untouched by the benefits that technology can offer. On the whole as a society we are still not technologically literate. This makes the Indian populace unsuitable for making informed choices in the decision making process in the area of technology innovation, adaptation, application and convergence. This may also be the reason behind the large gap that exists between haves and have-nots. Technological literacy thus remains a prerequisite for the overall development of a society. To take optimum advantages of technology people should have a good knowledge and understanding of the technology available or accessible to them.

Technology has reached a stage where mostly it takes a lead role keeping manual skills aside. So rather a manual skill, one must learn to handle and operate a technological tool or apparatus to achieve desired results, it saves time, labour and resources as well. This is true especially with information communication technology. The accessibility has removed the significance of its location, there is no place where technology comes from; it looms large for everyone everywhere. Its ubiquity has developed an acceptable ignorance and as such there is a felt need for technological literacy. We hardly know little more than operating the steering wheel, accelerator and brakes of our high-tech cars. We only learn how to operate the internet and transmit data to the other corner of the world without bothering much about the technological system that makes it to work.

However, the society needs to be technologically literate if it is to take full advantage of technological advances. Technological literacy will not only enable improved handling of technological artefacts and an enhanced understanding of the changes coming in our lives but will also lead to superior adaptability for a technologically advanced society. This in turn will translate into greater participation by the masses in helping further advancement of technology. This paper therefore seeks to address different aspects related to technological literacy, technology communication and discusses characteristics desired in technologically literate people. An effort will also be made to suggest ways to improve technological literacy among masses.

Hirsch has pointed out that literacy means in a cultural milieu of a society the sharing of a body of knowledge that enables persons to communicate with each other and make sense of the world around them. Hirsch is pointing out the importance of literacy in sharing of the body of knowledge including technological development with emphasis on making sense of the world around including the technological development which will then become part of the cultural milieu necessary for its development. India as a fast growing economy is prone to invasion of technology which may not always be beneficial and may entail grave societal implications. Technology can only be assessed in a context; the absoluteness of technology could be controversial. The gravity of the situation requires our society to rapidly increase technological communication and spread its literacy to fight off the possible evils of technological advancement. It is unfortunate that our educational setup has not recognized the importance of technological literacy, signs of which are visible in

the confusions prevailing over the recent technological aspects. Neither public nor its representatives seem to be fully aware of the technological implications of a crisis situation. For example, a little is understood of the nuclear energy and GM foods. In this particular field developments are considered to be solely scientific and the catalytic role of technology is ignored. This separation of achievements of technology and science often presents a great difficulty which comes mainly due to the lack of technological literacy.

Technological literacy can be defined in the simplest manner as the ability to understand and evaluate technology. It includes a critical thinking skill based on understanding general patterns that transcend specific technologies. The International Technology Education Association (ITEA), USA, describes technological literacy as not only the ability to use technological tools but also to manage, assess, and understand technology. Technological literacy thus requires the application of both knowledge and abilities to tackle real-world situations as technologically literate citizens employ systems-oriented thinking in interacting with the technological world, cognizant of how such interaction affects individuals, our society, and the environment. There is a general agreement on this definition reflected by the North Central Regional Educational Laboratory (NCREL), USA, stating that technological literacy is knowledge about what technology is, how it works, what purposes it can serve, and how it can be used efficiently and effectively to achieve specific goals. The importance of technological literacy is fiuther elaborated by William Wulf, the President of the US National Academy of Engineering. According to him there is a major difference between technological competence and technological literacy. Literacy is what everyone needs. Competence is what a few people need in order to do a job or make a living. Technological competency thus could be understood as the ability to create, repair, or operate specific technologies.

A close look at the literature on interrelation of society and technology hints at some of the following features shaping technological literacy:

1. Recognition of technology, especially as distinct from science, to enable a better understanding of technological progress and achievements.
2. Be acquainted with nature, limitations and risks of the technological design processes, such as time deadlines, financial limits, or ecological implication, in order to make informed decisions.
3. Recognition that technology influences changes in society that in turn shapes technology itself, which is the reason for naming eras after the material used by the technology of the time, such as Stone Age, Iron Age, Bronze Age, Industrial Age, and Information Age.
4. Inquisitiveness about new technologies affecting the society and ability to extract relevant information from a newspaper story, television interview, or discussion.

A technologically literate person may not necessarily have extensive technical skills. Such literacy is more a capacity to understand the broader technological world than it is the ability to work with specific pieces of it. However, simple specialized technical skills also do not guarantee technological literacy. It will be important, as well, to enhance the process by which people make decisions involving technology. One of the ways for members of the public to become educated about technology is to engage them in discussions of the pros and cons, the risks and benefits, and the known's and unknown's of a particular technology or technological choice. Engagement in decision making is likely to have a direct positive effect on the non-expert participants, and involving the public in deliberations about technological developments as they are taking shape will boost their confidence. Equally important, public participation may demand design changes which will better reflect the needs of the society.

Globalised markets are full of goods and services tempting consumers to attract huge benefits. Technological literacy may help individuals to make the right choices as consumers. Though it would definitely be difficult to learn about the technology behind a product and how it works; a technologically literate person will be in a position to make an informed purchase decision and put the product or service to good use or to reject it altogether based on proven demerits. Apart from the consumers, employees, members of families, communities and citizens of a democracy, technological literacy is required to make intelligent personal decisions that involve development or use of technology. There is no

doubt that informed decision making is important for all citizens, however it is imperative for leaders in government and industry to be technologically literate as their decisions influence the health and welfare of a large cross section of society.

India with its fast growing economy and an equally rapid technological influx need to be technologically literate to avert crises, such as environmental for which Indians ought to be aware of sustainability of green technology. Mass media can play a significant role in improving technological literacy by highlighting the technological aspects of different events, phenomenon of societal importance and gadgets in use. Ideally technological literacy should be promoted right from the school stage where it should be an important part of the curriculum. Reforms are needed at that level to make school children appreciate and use technology which will gradually make them technology savvy as they grow up. For instance due to the initiatives taken by authorities, computers were introduced quite early at school level. But unfortunately they are used only as a means to teach students various subjects including computers, but technological knowledge and appreciation of technology behind it remain ignored.

For those, who are out of the fold of a school or college system, science and technology museums/ centres and technology parks could be of immense use. This will also partly take care of those belonging to the rural part of India, who do not have access to mass media either because they are not literate or cannot afford. One can conclude that in order to make Indian society technologically literate, integrated communication strategies need to be evolved and rigorously implemented.

References

1. Beynon, John and Mackay, Hughie (Editors), Technological Literacy and the Curriculum, The Falmer Press, 1992.
2. Bybee, Rodger, W. "Achieving Technological Literacy: A National Imperative, in The Technology Teacher, pp. 23-28, September 2000.
3. Durant, J. R., What is scientific literacy? in J. R. Durant & J. Gregory (Eds.), Science and Culture in Europe (pp. 129-137), Science Museum, London, 1993.
4. Gagel, C. W., Literacy and technology: Reflections and insights for technological literacy, Journal of Industrial Teacher Education, 34(3), pp 6-34, 1997.
5. Gamire, Elsa and Pearson, Greg (Editors), Tech Tally: Approaches to Assessing Technological Literacy, The National Academies Press, Washington, D.C., 2006.
6. Hirsch, E. D., Jr., Cultural literacy: What every American needs to know, Houghton Mifflin, Boston, 1987.
7. Jenkins, H., Convergence Culture. Where Old and New Media Collide, New York University Press, New York, 2006.
8. Laugksch, Rudiger, C., Scientific Literacy: A Conceptual Overview, in Science Education 84, pp 71-94, 2000.
9. Lewis, T., & Gagel, C. W., Technological literacy: A critical analysis. Journal of Curriculum Studies, 24(2), pp. 117-138, 1992.
10. Pearson, Greg and Young, Thomas, A., (Editors), Technically Speaking: Why All Americans Need to Know More About Technology, The National Academies Press, Washington, DC, 2002.
11. Savage, E., & Sterry, L.). A conceptual framework for technology education, The Technology Teacher, 50(1), pp. 6-11, 1990.
12. www.nae.edu
13. Patairiya, Manoj, Technology Communication, NCSTC Communications, May 2001.

■

Science comics attract children

Mico Tatalovic
Large Animal Research Group, Department of Zoology, Christ's College, University of Cambridge
Cambridge, U.K.

Writing forms literature, drawing forms art. Put the two together you get comics. You also get literature and art combined. Comics have long been on the margins of the art and literature lime lights but are becoming more and more appreciated for their contribution to literature and for their artistic value. For example, a popular French-based Iranian comic novel writer Marjane Satrapi expressed her experiences of growing up in Iran in a successful comic book Persepolis (2003) that has been turned into a popular film as well (Persepolis, 2007). More and more scientists are becoming aware of the appeal comics have to people and are starting to use the comics to communicate scientific ideas. Scientific research, lives and academic mishaps of great scientists are all becoming a growing inspiration for comic books writers. In this fusion, science inspires art and literature, science becomes literature, and art allows science to reach more people then it ever would otherwise. Science communication and education is making use of more and more art forms: while science lectures are being put online for 24/7 access using blog/podcast media, science is also being made more digestible to school students by introducing science to them via comics. Art, on the other hand is taking more and more inspiration from the science, from theatre, stand-up comedy and film through to poetry, painting and comics. So what exactly is available out there when it comes to science comics?

Jay Hosler is one of the most popular scientists/cartoonists in the USA. He started of drawing weekly strip comic for his undergraduate newspaper and now he's drawing graphic novel as an alternative to biology text book. He is a biologist but his love of comics led him eventually to experiment with this media for telling scientific stories. His most popular graphic novels are Clan Apis and the The Sandwalk Adventures. Clan Apis is a life story of a bee, Nyuki (Svahili for a honey bee), and her life journey. In an interview for WPSU radio Hosler said: "As she (Nyuki) goes through these different transitions and jobs in the hive…we have an opportunity to sort of explain what's going on, give a little of the biology but hopefully tell a story that everyone can relate to…".

The Sandwalk Adventures is a story of a small follicle mite, the kind each of us has in our hair follicles, that lives on Darwin and thinks Darwin is her creator. Darwin, however, doesn't care much for creationism and so explains to the little mite how she is a product of evolution by natural selection and not divine creation as such. This comic is important in education as it is in fight against intelligent design, whose protagonists also use comic form to spread their ridiculous ideas.

Optical allusions (2007) is another Hosler's comic which focuses on biology and evolution of eyes and vision. This might be the first ever biology text book in the form of a comic. The need for such alternative approaches to science education are highlighted by decreasing proficiency of USA students in science and by the fact that this comic book project was funded by a grant from the National Science Foundation. Hosler's shorter comics include The Conundrum of the Killer Coronavirus in which a SARS virus is being cross-examined by the police in relation to his involvement in killings. Yet the virus argues his vector is still unknown despite other circumstantial evidence against him and he gets out on bail from a civet; this is where the detective realizes civet is the vector of this virus and shouts after the virus: "I'll get you yet, SARS!" and the virus replies: "You just might, detective, if you're not careful!". Hosler's comics are comic art at its best, and even if you read them just for fun you will learn loads of science, because the characters and the storylines are inevitably intertwined with

the scientific issues. The fact that the Science Foundation is funding what is essentially an art project: creation of a graphic novel, is an excellent example of how art can be important for science and can even get funding from scientific sources.

Jim Ottaviani is another American scientists/ comic book writer who collaborates with professional artists to create comics about various scientific and social issues. His comics include the Fallout (2001), a comic about science and politics of nuclear bombs, Dignifying Science (2003), a comic about women and science and Suspended in language (2004) a story about Niels Bohr and the quantum mechanics. Ottaviani uses a variety of styles to create his comics and many more can be found on his website g.t.labs.com where it says "Comics about scientists? What a dangerous experiment!". Just like Hosler though, he admits in an interview for the NPR radio that he identified himself with Spiderman's Peter Parker, a nerdy scientists set out to save the world, and that the comic art had a tremendous influence on him as a child. And to answer why he writes science comics Ottaviani says: "...besides enjoying comics, and wanting to work in the medium simply because of that enjoyment, I saw a need for them." Obviously, art can influence and inspire people to do wonderful things such as take the tools of art and use them to convey scientific ideas.

Larry Gonick is a mathematician and a cartoonist who has been writing many comics about many aspects of science since the 1972. Examples of his work include Cartoon Guide to Chemistry (2005). The above three scientists produce comics in the sense of sequential art, where a story is told in sequences of pictures and words. South African painter Rose Rigden, on the other hand, turned her vividly colourful paintings of the interactions of humans and the African wildlife into always humorous and sometimes sarcastic cartoons with a punch line. These have been so successful that one can buy individual cartoons as postcards or book series Wildside pretty much in any tourist shop in South Africa.

Apart from individual scientists, some institutions also produce comics to promote understanding of their work. Cindi in Space (2005) is a cool, sleek, superhero-style comic produced by the University of Texas, Dallas about NASA's mission to research the ionosphere with an aim to be able to predict 'space weather'. Japan's Solar-Terrestrial Environment Laboratory at the University of Nagoya produced several science manga comics which are visually appealing and deal with a range of topics from What is Aurora?! (2004) to What are Cosmic Rays?! (2006). Manga is a special Japanese style of comic and it is great to see that science can touch upon various artistic styles within the comic medium.

In the UK, Biotechnology and Biological Sciences Research Council (BBSRC) funded the project of turning real life research and scientists (from PhD students to professors) from the Rothamstead Research Institute in Hertfordshire into comic stories and characters. Science Stories is a short series of comics such as Slugging it out, Down in the dirt, How to confuse a moth, Sulphur power and Killer caterpillar that outline some of the research that's been going on at Rothamstead Research. These comics, available online, are written by a science research student from Southampton University, Emma Naper and drawn by a professional illustrator, Phil Elliot; once again we see collaboration between arts and sciences to produce this new genre of science comic.

References and sources for illustrations

1. http://www.jayhosler.com/
2. http://www.npr.org/templates/story/story.php?storyId=4495248
3. http://www.bbsrc.ac.uk/life/comic/index.html
4. http://www.amazon.com/s?ie=UTF8&keywords=-Science&rh=n%3A4366%2Ck%3AScience&page=1
5. http://cindispace.utdallas.edu/education/science_comics.html
6. http://www.gt-labs.com/
7. http://www.thenaturalselection.co.nz
8. http://www.scientoon.com

■

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*'.

A dialogue on public communication of science, technology, culture and society

Sharing Science
Edited by Dr. Manoj K. Patairiya,
Dr. Maria I. Nogueira

Science and technology interventions are instruments of accelerating the pace of growth and if deeper percolate into the society can get more edges to strengthen and build capacities amongst citizens to be able to contribute to the main stream of development.

The plurality and commonality of their needs, concerns and challenges offer opportunities for both the giants to joining hands and synergizing efforts in the area of public communication of science and technology to benefit the people at large. Brazil and India two fast emerging economies of the world are on move. Science communication in both the nations is developing fast may be because of the fact that it keeps pace with the developments taking place in different sectors, such as research and development in leading edge science and technology, agriculture, environment, industry, computers, education, social welfare, mass media, service sectors, and so on.

India and Brazil have remained the centres for science and its propagation for a long time in modern world as well. The urge for scientific explorations as well as sharing its excitement with the public has been very common throughout. Similarly, a combination of creativity driven science and media has been able to lay down the foundations of rich science communication culture. The present book is a compilation of papers, views and expressions presented at an International Symposium and Workshop on Public Communication of Science, Technology, Culture and Society organized at University of Sao Paulo, Brazil during October 17-24, 2011 marking the beginning of Brazil - India Knowledge Network for sharing science in society.

Therefore, the book is immensely useful for researchers and practitioners of science communication paving the way for scholarly discourses and bringing further advances in the science – society issues. The Editors of the book are well-known experts of their fields. The contributions are of a varied nature, i.e. research papers, articles, opinion, review, and new ideas, etc., in the area of public communication of science, technology, culture and society from eminent experts, presenters, participants of the symposium and workshop. The book also incorporates key contributions of pioneering science communication experts of both countries, i.e. His Excellency Dr. A.P.J. Abdul Kalam, Prof. Yash Pal, Dr. Krishna Lal, Dr. Jayant V. Narliker, Prof. Ved Prakash, and Dr. Narender K. Sehgal.

The book is a monumental document as a sequel to PCST-2010 offering a link to such future endeavours. A few best PCST-2010 and HSCI-2009 papers from Brazil-India scholars are also included. A pre-print of 'Sharing Science' was released at the inaugural function of the symposium held in University of Sao Paulo, Brazil on October 17, 2011. To

'Sharing Science' was released at University of Sao Paulo, Brazil, October 17, 2011

begin with, the first edition has been brought out in English with only one chapter in Portuguese, spoken in Brazil, but it is hoped that next editions may be bilingual.

[Mr. Tariq Badar, Secretary, Indian Science Writers' Association, BB-17/C, Janakpuri, New Delhi - 110058]

■

Index: 2002-2011

A treasure of knowledge: IJSC 2002-2011

Articles

Debate

Editorials

a meeting point!, pp. 2-2. Vol. 9 (1), January-June 2010.

Patairiya, Manoj K., *Energizing Coverage of Energy Issues in Mass Media*, pp. 2-2. Vol. 9 (2), July-December 2010.

Patairiya, Manoj K., *An organic approach to science communication yields results!*, pp. 2-2. Vol. 10 (1), January-June 2011.

Patairiya, Manoj K., *Hands-on Science: A Tool for Excellence*, pp. 2-2. Vol. 10 (2), July-December 2011.

Events

National Workshop on Usage of Puppetry for Science and Technology Communication, Vol. 1 (1), January–June 2002.

7th International Conference on Public Communication of Science and Technology, Vol. 1 (1), January–June 2002.

International Conference on Information Technology, Communication & Development, Vol. 1 (2), July–December 2002.

2nd National Science Communication Congress (NSCC-2002), Vol. 1 (2), July–December 2002.

8th Public Communication of Science and Technology (PCST) Conference, Vol. 2 (1), January–June 2003.

3rd National Science Communciation Congress (NSCC-2003), Vol. 2 (1), January–June 2003.

International Conference for Science Communicators (ICSC-2003), Vol. 2 (1), January–June 2003.

National Seminar on Scientific Temper and Mass Communication, Vol. 3 (1), January–June 2004.

Ateneo de Manila University (CFJ), Manila, Vol. 3 (1), January–June 2004.

4th National Science Communication Congress (NSCC-2004), pp. 40-40. Vol. 3 (2), July–December 2004.

Science, Communication and Society: Needs and Challenges in South Asia - Public Discussion Meeting, pp. 40-40. Vol. 3 (2), July–December 2004.

The Marine Biological Laboratory Science, pp. 39-39. Vol. 4 (1), January–June 2005.

5th National Science Communication Congress, pp. 39-39. Vol. 4 (2), July–December 2005.

AAAS Science Journalism Awards, pp. 39-39. Vol. 4 (2), July–December 2005.

National Seminar on Innovative Science Communication, pp. 39-40. Vol. 4 (2), July–December 2005.

Ist People's Education Congress on Science Communication, pp. 40-40. Vol. 4 (2), July–December 2005.

Scientific movie and video festival, pp. 39-39. Vol. 5 (1), January–June 2006.

National Conference on 'Challenges and Vision 2026 in Science Communication', pp. 39-39. Vol. 5 (1), January–June 2006.

Workshop on biosafety for Science Journalists/ Communicators, pp. 40-40. Vol. 5 (1), January–June 2006.

National Science Communication Congress (NSCC-2006), pp. 36-37. Vol. 5 (2), July–December 2006.

First African Science Communication Conference Science in Society/ Society in Science Africa Forum 2006, pp. 37-38. Vol. 5 (2), July–December 2006.

National Seminar on Towards a Scientific & Technological Culture, pp. 38-39. Vol. 5 (2), July–December 2006.

National Conference: Vision 2026 - Challenges in Science Communication, pp. 40-40. Vol. 5 (2), July–December 2006.

2nd European Communication Conference, pp. 36-36. Vol. 7 (2), July–December 2008.

The 8th Indian Science Communication Congress (ISCC-2008), pp. 36-38. Vol. 7 (2), July–December 2008.

The First Ever National Discussion 'Science Fiction: Past, Present, Future', pp. 38-39. Vol. 7 (2), July–December 2008.

Scicom 09 – Education, dialogue or event? Challenges for a target group oriented science communication, pp. 38-38. Vol. 8 (1), January-June 2009.

International Conference on Development Communication in the Era of Globalisation, pp. 38-39. Vol. 8 (1), January-June 2009.

6th World Conference of Science Journalists, pp. 39-39. Vol. 8 (1), January-June 2009.

Australian and New Zealand Communication Association (ANZCA) Conference 2009, pp. 39-40. Vol. 8 (1), January-June 2009.

New Media Technologies and Freedom of Expression, pp. 40-40. Vol. 8 (1), January-June 2009.

The 9th Indian Science Communication Congress (ISCC-2009), pp. 35-36. Vol. 8 (2), July-December 2009.

The 6th International Conference on Hands-on Science (HSCI-2009), pp. 37-39. Vol. 8 (2), July-December 2009.

Guidance

Mollick, Subhas Das, *How to prepare a programme for Radio*, Vol. 1 (1), January–June 2002.

Banerjee, Tarun, *Technical Report Writing*, Vol. 1 (2), July–December 2002.

Chawla, Parvinder, *From Chaos To Coherence : The Basics of Science Editing*, Vol. 2 (1), January–June 2003.

Sheikh, Kalimuddin, *Generating a Science Programme for Television*, Vol. 3 (1), January–June 2004.

Usmani, J.A., Khan, M.E. and Hasan, M.M., *Submission of a Paper for an International Conference: A Sample Format*, pp. 31-33. Vol. 4 (2), July–December 2005.

Tips for Radio Writing, pp. 40-40. Vol. 6 (2), July–December 2007.

Science Reporting Basics, pp. 35-38. Vol. 7 (1), January–June 2008.

Sheikh, Kalimuddin, *Generating a Science Programme for Television*, pp. 31-33. Vol. 10 (2), July-December 2011.

Information

Yadav, R.S., *Vigyan Ke Prasaar Mein Radio*, Vol. 1 (2), July–December 2002.

Pant, Ramesh Chandra, *Vaigyanik Monograph Prakashan Yojna*, Vol. 2 (1), January–June 2003.

Sreedhar, R., *Radio Vision: A New Concept for Courseware Dissemination*, Vol. 2 (2), July–December 2003.

Pandey, D.K., *2004: The Year of Scientific Awareness*, Vol. 3 (1), January–June 2004.

Kanda, Arun, *EKLAVYA Technology Channel*, pp. 37-37. Vol. 3 (2), July–December 2004.

Singh, Karanvir, *Current Literature on Science of Science (CLOSS)*, pp. 38-38. Vol. 4 (1), January–June 2005.

Bhatia, B.S., *Development and Educational Communication Unit (DECU)*, pp. 34-35. Vol. 4 (2), July–December 2005.

Indian S&T Journals, pp. 29-35. Vol. 5 (1), January–June 2006.

'Effective Science Communication in an Era of Globalisation' Workshop for Science Journalists from East Asia: A Repot, pp. 32-34. Vol. 5 (2), July–December 2006.

Patairiya, Manoj K., *UN Declaration on Science and the Use of Scientific Knowledge*, pp. 30-33. Vol. 6 (1), January–June 2007.

UN Declaration on Science and the Use of Scientific Knowledge, pp. 38-39. Vol. 6 (1), January–June 2007.

Praveen, M., Mukesh, P., Subhash, K. and Swamy, N. Rama,

News

Obituary

Off the beaten track

Papers

Neelamalar, M. and Xavier, A. Martin, *The Effect of Online Communication on Higher Education in India*, pp. 3-8. Vol. 10 (2), July-December 2011.

Kumar, Meenu, *Exploring New Media for Science Popularization*, pp. 9-13. Vol. 10 (2), July-December 2011.

Deepa, G. and Aram, I. Arul, *Tackling Tuberculosis with Self-help Group and Short Film–An Evaluation*, pp. 14-21. Vol. 10 (2), July-December 2011.

Report

Nangia, Y.L., *Impact Study of Contact Programmes for Talented School Children*, pp. 22-34. Vol. 7 (1), January–June 2008.

Review

Book: Popularising Science in Schools, Vol. 1 (1), January–June 2002.

Kala, L.D., *TV Programme: Imaging Science*, Vol. 1 (1), January–June 2002.

Book: Uncharted Terrains, Vol. 1 (2), July–December 2002.

Kala, L.D., *Book: Vigyan Sanchaar Kya Hai?*, Vol. 1 (2), July–December 2002.

Patairiya, Manoj K., *Hindi mein Vaigyanik prakashano ka taaza dastawez*, Vol. 2 (1), January–June 2003.

Kala, L.D., *Science and the Parliament*, Vol. 2 (2), July–December 2003.

Chittori, Vijay, *Vigyan Kathaon ke Zariye Vigyan Sanchaar*, Vol. 3 (1), January–June 2004.

Kala, L.D., *Calendar with a difference*, pp. 35-36. Vol. 3 (2), July–December 2004.

Kala, L.D., *National Directory of Science Communication*, pp. 34-34. Vol. 4 (1), January–June 2005.

Kala, L.D., *DVD on Nanotechnology*, pp. 36-36. Vol. 5 (1), January–June 2006.

Mishra, Arvind, *First India Science Report*, pp. 34-35. Vol. 6 (1), January–June 2007.

Mishra, Arvind, *Ullekhniya Vigyan Kathayein*, pp. 34-35. Vol. 6 (2), July–December 2007.

Goswami, Sanjay, *Vigyan ko Samarpit Hindi Patrika*, pp. 34-34. Vol. 7 (2), July–December 2008.

Badar, Tariq, *Scientoonic Tell - Tale of Genome and DNA: The first Scientoon based book*, pp. 18-18. Vol. 10 (1), January-June 2011.

Scientoon

Srivastava, Pradeep K., *Desert Formation*, Vol. 3 (1), January–June 2004.

Paliwal, Prasoon, *Save Tears, Save Water*, pp. 33-33. Vol. 3 (2), July–December 2004.

Paliwal, Prasoon, *Save Water, Save Nation*, pp. 33-33. Vol. 3 (2), July–December 2004.

Srivastava, Pradeep K., *Brownian Movement*, pp. 33-33. Vol. 4(1), January–June 2005.

Srivastava, Pradeep K., *Human Immuno Deficiency Virus (HIV)*, pp. 33-33. Vol. 4(2), July–December 2005.

Srivastava, Pradeep K., *Scientoon*, pp. 35-35. Vol. 5(1), January–June 2006.

Srivastava, Pradeep K., *Consap*, pp. 29-29. Vol. 5(2), July–December 2006.

Srivastava, Pradeep K., *Pyrethrum*, pp. 29-29. Vol. 5(2), July–December 2006.

Srivastava, Pradeep K., *Parasitology*, pp. 33-33. Vol. 6(1), January–June 2007.

Srivastava, Pradeep K., *Save Water - Save Nation*, pp. 32-32. Vol. 6(2), July–December 2007.

Srivastava, Pradeep K., *Pyrethrum*, pp. 30-30. Vol. 7(1), January–June 2008.

Srivastava, Pradeep K., *Environmental Pollution*, pp. 33-33. Vol. 7(2), July–December 2008.

Srivastava, Pradeep K., *Ecofriendly Sustainable Technology for Taxotere: Anticancer Drug*, pp. 32-32. Vol. 8(1), January-June 2009.

Srivastava, Pradeep K., *Nanotechnology*, pp. 26-26. Vol. 8(2), July-December 2009.

Srivastava, Pradeep K., *Ozone Layer*, pp. 26-26. Vol. 8(2), July-December 2009.

Srivastava, Pradeep K., *Insecticides*, pp. 36-36. Vol. 9(1), January-June 2010.

Srivastava, Pradeep K., *Entomology*, pp. 22-22. Vol. 9(2), July-December 2010.

Srivastava, Pradeep K., *Air Pollution in Metropolitan City*, pp. 22-22. Vol. 9(2), July-December 2010.

Srivastava, Pradeep K., *Deoxyribo Nucleic Acid (DNA)*, pp. 39-39. Vol. 10(1), January-June 2011.

Srivastava, Pradeep K., *WWF*, pp. 22-22. Vol. 10(2), July-December 2011.

Srivastava, Pradeep K., *Synthetic Cell*, pp. 22-22. Vol. 10(2), July-December 2011.

Short Communication

Mollick, Subha Das, *Science Journalism: Some Stray Thoughts*, Vol. 2 (1), January–June 2003.

Tiwari, Vishwa Mohan, *Vigyan Sanchaar: Samasyaein evam Samadhan*, Vol. 3 (1), January–June 2004.

Singhal, Vineeta, *Public Understanding of Science : Issues are many!*, pp. 29-30. Vol. 3 (2), July–December 2004.

Behera, S.M., *Science Literacy amongst Weaker Sections*, pp. 29-30. Vol. 4 (2), July–December 2005.

Godin, Denzil J., *Science Communication and Student Involvement: A Case Study of Gomati Bachao Andolan*, pp. 22-24. Vol. 5 (1), January–June 2006.

Kamble, V. P., *Hindi Prasar aur Vigyan Sanchar Mein Sahayak Software*, pp. 23-24. Vol. 5 (2), July–December 2006.

Bandiste, D.D., *Attitude Matters for Science Communicators*, pp. 25-27. Vol. 5 (2), July–December 2006.

Nambiar, C. Shekhar, *Popularising Science: Avoiding Pitfalls*, pp. 28-29. Vol. 6 (1), January–June 2007.

Mohan, K.R.K., *Science Communication in Regional Media in the Changed Scenario*, pp. 20-21. Vol. 7 (1), January–June 2008.

Human, Irfan, *Samanyajan tak Vigyan Natako ki pahunch : Ek Adhyan*, pp. 25-26. Vol. 8 (1), January-June 2009.

Srivastava, A. K., *Status and Problems of Science Communication for Environmental Protection of Mines*, pp. 27-29. Vol. 8 (1), January-June 2009.

Thakre, Prabhu, *Communication of Science for Existence of Human Capital*, pp. 30-31. Vol. 8 (1), January-June 2009.

Vendan, S. Ezhil and Kaleeswaran, B., *Is it girls are more curious than boys in education?*, pp. 37-37. Vol. 9 (1), January-June 2010.

Nair, Pradeep, *Low-cost Computers: A Scientific Innovation to Get Have-nots On-line*, pp. 34-36. Vol. 10 (2), July-December 2011.

■

Indian Journal of Science Communication

An International Half-yearly Research Journal in Science & Technology Communication

A Joint Publication of

National Council for Science & Technology Communication, New Delhi

and Indian Science Communication Society, Lucknow

SUBSCRIPTION FORM

To
The Coordinator
Indian Journal of Science Communication (IJSC)
Indian Science Communication Society (ISCOS)
Chandrika Bhawan, 577-D, Near Dandahiya Masjid
Lucknow - 226 022, India
Email : info@iscos.org, mkp@nic.in

Please enroll me as a subscriber of Indian Journal of Science Communication. I am enclosing herewith a demand draft / cheque No. ..... dated ..... issued in favour of Indian Science Communication Society, payable at Lucknow, India, towards subscription fee as indicated below :

Name.....

Mailing Address .....

.....

.....

Date : ..... Signature : .....

SUBSCRIPTION FEE*

Period	**Institutional Inland**	**Individual Overseas**	**Institutional Overseas**	**Individual**
One year	Rs. 400	Rs. 200	US$ 20	US$ 10
Two years	Rs. 600	Rs. 300	US$ 30	US$ 15
Three years	Rs. 1,000	Rs. 500	US$ 40	US$ 20
Five years	Rs. 1,500	Rs. 750	US$ 50	US$ 25

* Please indicate : Your category ..... Subscription period .....

* Overseas subscribers can send subscription through Bank Transfer (Account Number 5008, State Bank of Travancore, Aliganj Branch, Lucknow - 226024, India) or through International Money Order to ISCOS at the address given above.

Indian Journal of Science Communication

Instructions to Contributors

- The scope of the IJSC encompasses all aspects of Science Communication and Popularisation (SCP); including Public Understanding and Engagement of Science (PUES); Public Communication of Science and Technology (PCST); and Science Technology and Society studies (STS). The communication of 'science' incorporates all its forms, i.e. Science, Technology, Research and Innovation (STRI), including Method of Science, Scientific Temper, and Scientific Culture. The communication of 'science' is inclusive of all basic, applied, and derivative sciences consisting of physical, chemical, biological, health and medical, animal husbandry and agricultural, environmental, space, nuclear, defence, and earth sciences, etc. It excludes contributions on basic and applied sciences and anything bracketed as popular science writing or science education. It also excludes technology development but includes its social and cultural implications and such studies.
- The IJSC invites original research papers, review papers, case studies and other contributions in any aspect of 'science communication' in the form of articles, assessment studies, book and programme reviews, survey reports, guidance and science dissemination project analyses from scientists, scholars, researchers, communicators and authors. Write-ups on science communication skills, innovative ideas to communicate science, cartoons (scientoons), etc., are also welcome. Science software materials, such as books, monographs, copies of TV and radio programmes, science kits and toys, etc., are considered for review, for which two copies may be submitted. News, views, opinions, debates, letters to the editor and suggestions are solicited for inclusion.
- Manuscripts should be submitted in hard copy and electronic form. Good quality printouts (two copies) in the Times New Roman font size 11 point are required. The pages should be numbered. The corresponding author should be identified by an asterix (include E-mail address). Electronic form of the manuscript should be submitted via E-mail and/ or in a CD/ DVD. Text should be entered using word processing software MS Word without any commands, formatting or designing.
- For illustrations, Corel Draw, Harward Graphics or any compatible format software (BMP, GIF, JPG, PCX, TIF) may be used. Label the CD/ DVD with the author(s) name(s), the word processing package used, software for illustrations and the type of computer. The illustrations should preferably be in camera ready form on white drawing paper suitable for reproduction without retouching and about twice the printable size to facilitate reduction. The photographs, charts, graphics and diagrams to be referred as figures(s), should be numbered and the captions be provided on a separate sheet. The figure numbers should be marked on the back of figure with the author's name. In case of photographs, only originals should be provided.
- The authors' photographs along with names and E-mail addresses may be provided for publication.
- The papers should be arranged in the order of - Title, Name(s) of author(s), Affiliation(s), Abstract, Keywords, Main text, Acknowledgements, Appendices, References, and then Footnotes/ Endnotes.
- Each table should be given on a separate sheet of paper and not to be adjusted into main text. Tables should be numbered consecutively and given suitable titles.
- Normally, the abstracts should not exceed 250 and the papers should not exceed 2500 words.
- The number of keywords should be around 5 and be placed in alphabetical order.
- The acknowledgements, if necessary, may include only special nature of assistance; no routine 'permissions' or 'thanks' to be mentioned.
- The references for sources cited in the text should be given at the end of text, numbered consecutively. In the text, the reference should be indicated by a number placed above the line (superscript). If done so, the reference should be listed in that order. If a reference contains more than one author, the names of all the authors should be given. References should be given in the following form:
    1. Patairiya M.K., Nogueira M.I. (ed.), Sharing Science, NCSTC, New Delhi and USP, Sao Paulo, 2011.
    2. Sharma R.D., Communication of science and technology in ancient India, *Indian Journal of Science Communication*, 1(1), pp 3-7, 2002.

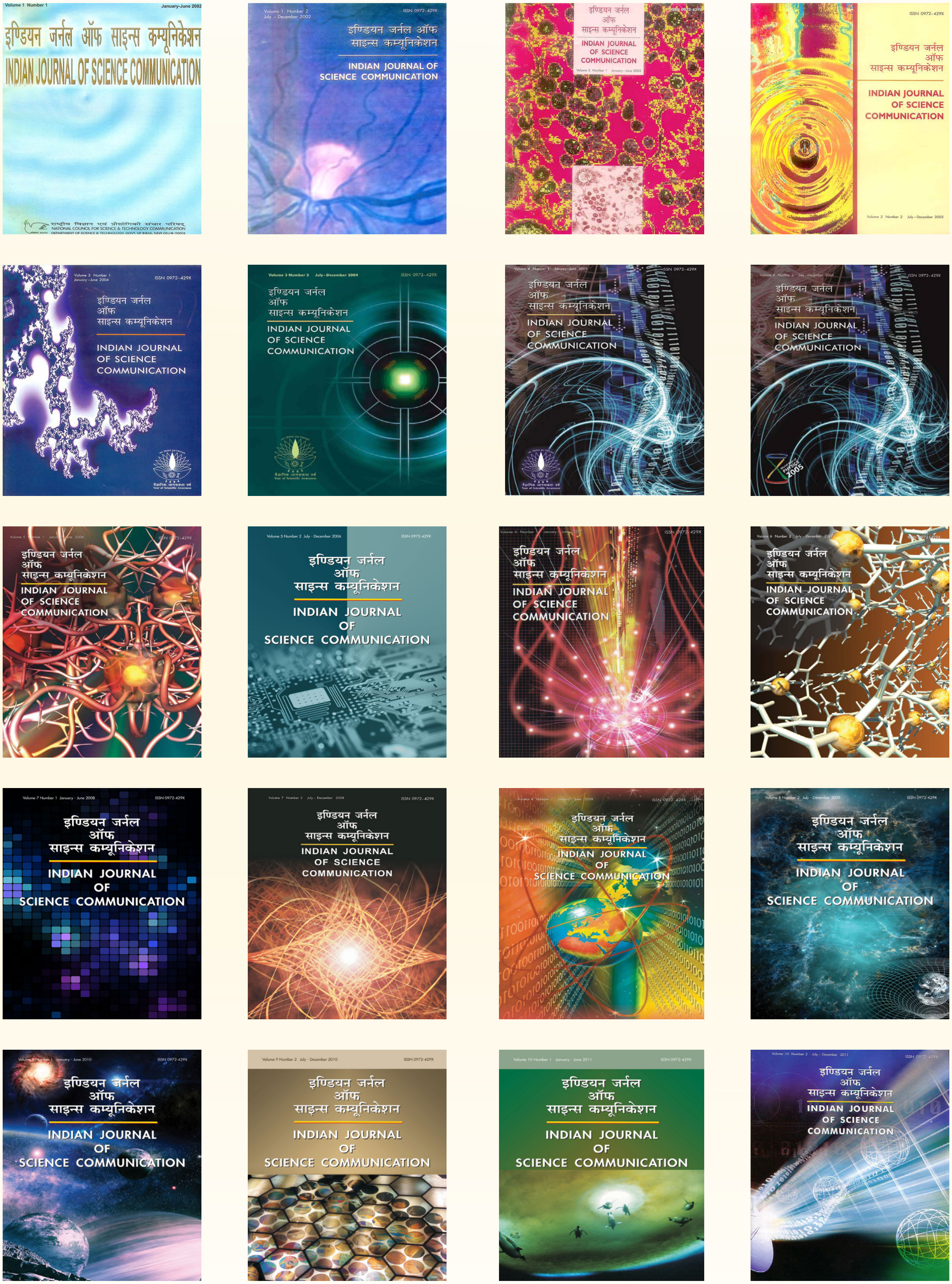
    The sources such as unpublished papers and personal communications should also be included in the references in the following form:

    3. Menon P.K.B., Personal communication, 2000.
    4. Das Anamika, Unpublished work, 2002.
- The use of SI units in papers is mandatory. Commonly used units may also be given in parentheses following SI units.
- The national currencies may be converted into US $; the equivalent national currencies be given in parentheses following US $.
- No fee is charged from authors for their contributions for publication in the journal, similarly no remuneration is paid to them for their contributions.
- The IJSC follows zero tolerance policy for research misconduct or unethical practices. It is urged to refrain from plagiarism, copying, or using any material, information, text, visuals or data for your contributions for IJSC without proper permissions and citing references to avoid eventual consequences.
- The lead author or corresponding author is required to put his original signature on the manuscripts and give a certificate, along with the contribution, duly signed stating that: i) The contribution is the original work of the author(s), ii) The contribution has no infringement of the copyright and the necessary permission, if any, has been taken; and ii) The contribution is unpublished and is neither submitted earlier nor will be submitted later for publication elsewhere.
- Since the periodicity of the IJSC is 6 months and even if your contribution is scheduled for the next issue, it may take at least one year for publication!
- The contribution once submitted to IJSC normally cannot be withdrawn.
- Contributions submitted for publication should necessarily conform to these guidelines and while submitting manuscripts, the guidelines become acceptable to the authors.
- All contributions may be sent to:

The Editor
Indian Journal of Science Communication
National Council for Science and Technology Communication (NCSTC)
Department of Science and Technology (DST), Govt. of India
Technology Bhawan, New Mehrauli Road, New Delhi-110 016, India
Phone: +91-11-26537976, Fax: +91-11-26590238
E-mail: mkp@nic.in; editorijsc@gmail.com; Website: www.dst.gov.in

Volume 11 Number 1 January – June 2012 ISSN 0972-429X

A Decade of IJSC: 2002-2011



Published and printed by Dr. Manoj Kumar Patairiya for and on behalf of ISCOS, NCSTC, DST, Technology Bhavan, New Delhi-110016, India. Printed at Sonu Printing Press, S-217, Munirka, New Delhi-110067