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The Development of Natural History in India

Readers' Views
Questionnaire inside



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Quality Material for Adult Learners

Semi-literates and neo-literates have special needs for their development and this is reflected in reading material developed for them. In this edition, we will reflect on issues related to development of content rather than matters related to availability and accessibility of good material. Resource persons face the challenge of developing interesting material with the focus on capacity building for decision-making.

A broad review of existing material developed in Hindi from several state centres and created for neo-literates reveals that it is generally exceedingly dull, replete with messages and with low production values. There is reinforcement of stereotyping of roles, presentation style that inadvertently emphasizes 'us' and 'them' and surprisingly is sometimes only repackaging of children's literature.

Before we proceed, our audience needs to be better profiled. These are people, adults or adolescents, who missed out formal schooling and have acquired skills of literacy through formal or non-formal approaches. They are motivated to improve themselves. Semi-literates have low literacy levels due to lack of practice even though they may have attained proficiency of up to Class V. We are addressing the needs of a substantial majority of our citizens, perhaps our own parents or grandparents. These are the people who have not only contributed to the economic well-being of the family but also nurtured and guided us often at very high personal costs. They have reached decisions individually and collectively even as technological advances have been baffling. They are certainly not to be categorised by descriptions such as ignorant, superstitious, ambitionless, vagrants, etc.

A National Readership Survey was conducted in 2006 to better understand

reading habits and assess availability of material for reading. There are many revealing conclusions of this survey. Two facets require to be recorded here:

- About 360 million people can but do not read; and
- Over 68% of these speak Hindi.

The survey has identified preferences of readers and drawn a priority list that includes stories from news, politics, sports and films in that order. The difference in the preference list between rural and urban readers was negligible. This needs to be internalised by science communicators.

Here is an opportunity to introduce scientific temper through direct and subtle illustrations. Logic and use of data for decision-making can be examined with case studies. Early success for the learner must be a goal for the educator who has a critical role in bridging the gap. The educator needs to be equipped with interesting material that is informative and entertaining. It is also important to look at gender issues. Existing equations and stereotypes need to be questioned where necessary.

Gender relations do not work in isolation and are closely linked to caste, class, religion and other identities. Role reversal in existing publications is too simplistic and will not be convincing. New material must encourage the reader to examine, reflect and question such relations and develop a gender sensitive perspective.

We need to sensitise the educators through an array of approaches. This can include interesting audio visual material to support the reading texts. Even before that we need to work on developing interesting resource material.

Formal language punctuated with figures of speech, complex sentences and long paragraphs were rewarded in high



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school essays. Writing for the unreached will call for different skills. Choice of words, presentation style, sentence structure and illustrations should together make the book enjoyable for the reader. One needs to remember that for these learners words are familiar but the script is not.

Resource persons with in-depth knowledge of their subject will have to be invited to contribute to this campaign. Orientation for writing for adults semi and neo literates may be necessary. This will include some of the issues touched above as well as discussion on the treatment of the subject. Methodologies for involving the people in some activities –say recording the history of local development can be an entry point and a learning tool for several skills.

Developing a culture of reading may have to be nurtured in some places. Libraries are often not well-equipped in rural areas. Improved vision and adequate resources are required to revive these at the rural level. Frequent addition to the stock must be scheduled. Village Knowledge Centres set up by the state or with community support need to be involved beside the adult education centers.

The need for science communication has been largely neglected by institutions and individuals. Let us attempt to cover lost ground and move with purpose. Societal development depends critically on internalising skills and knowledge of relevant science and technology.

□ **Anuj Sinha**

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Jons Jacob Berzelius

A Great Systemiser of Chemistry



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“Berzelius provided the first major systemization of 19th-century chemistry, including the first accurate table of relative atomic masses (for 28 elements in his list of 1828); the reintroduction and use of modern ‘initial letter’ symbols for elements; concepts including isomerism and catalysis, and the division of the subject into organic and inorganic branches; and, importantly, his theory of dualism, based on his work in electrochemistry.”

The Cambridge Dictionary of Scientists (2nd edition), 2002

“Berzelius was the person who authored the modern language of chemistry—the present day chemical symbols and writing of chemical formulae. He had a knack of coining the right terms for many newly discovered chemical phenomena like ‘catalysis’, ‘proteins’, ‘allotropy’ and ‘isomerism’. Many of the present day chemical apparatus, even the use of filter paper and rubber tubing to connect one vessel to another, owe their origin to him.”

N. C. Dutta in The Story of Chemistry, Universities Press (India) Pvt. Limited, 2005

Jons Jacob Berzelius was one of those scientists who laid the foundation of modern chemistry. He was great systemiser of chemistry. He developed chemical symbols for the chemical elements and did pioneering work in chemical analysis. He coined terms for many chemical phenomena and played an instrumental role in establishing the atomic theory. He proposed the dualistic theory according to which chemical combination resulted from mutual neutralisation of opposite charges. It may be noted here that the dualistic theory, which was the first successful attempt to explain chemical reaction and bonding, came in the way of acceptance of the Avogadro’s hypothesis by the chemists of the day. This is because the formation of diatomic molecules stipulated by Avogadro’s hypothesis could not be explained by this theory, as it was an accepted experimental fact that like charges repel each other. Berzelius certainly could not be blamed for the same. Not only Berzelius, but most of the chemists of his day believed in the dualistic theory. The true understanding necessary for satisfactorily explaining chemical bonding developed much later.

Berzelius discovered three elements—cerium (1803), selenium (1817), and thorium (1828). His students working in his laboratory discovered lithium (1818), and vanadium (1830). Berzelius classified

minerals by their chemical composition in contrast to the earlier method based on their crystal type.

Berzelius’s textbook, *Larbok i kemien* (1808-1818; Textbook of Chemistry), passed through many editions and was translated into many languages except English. He



Jons Jacob Berzelius

prepared a series of annual reports on the status of chemistry in Europe which were made available in other languages.

Berzelius was a great institution builder. He served the Royal Swedish Academy of Sciences as its Permanent Secretary from 1848 till his death. He revived the

organisation which had become a moribund organisation. It is said that he brought the Academy into a second golden era, the first being the period during 1749-1783 when the Swedish astronomer and demographer Pehr Wilhelm Wargentin (1717-1783) served as its Permanent Secretary. A large number of students came to study with him. Among his famous students were three noted German chemists: Friedrich Wohler (1800-1882), Leopold Gmelin (1788-1853), and Eilhardt Mitscherlich (1794-1863).

Berzelius was born on 20 August 1779, in Wafversunda, Sweden. His father, who was a teacher, died of tuberculosis when Berzelius was only four years old. His mother remarried but she also died leaving Berzelius an orphan. After his mother’s death he continued to stay in stepfather’s house for a few years, but it was not a very happy situation. As he grew up he was looking for an opportunity to leave his stepfather’s house. Finally in 1793 he went to attend school in Linköping. He had to struggle hard to meet his own expenses. He worked as a private tutor in the house of a wealthy landowner and also worked in the fields. During his schooldays he used to sleep in a cold storeroom in the midst of sacks of potatoes. Undeterred by the hardship Berzelius, encouraged by his teacher, developed an interest in scientific studies. He studied the works of the Swedish botanist Carolus Linnaeus (1707-1778), who is regarded as the founder of the binomial nomenclature that is the basis of modern taxonomy.

Though his stepfather wanted that he became a pastor, Berzelius decided to pursue a course in medicine after finishing his school education. In 1796, he joined the Medical School of the University of Uppsala. But then because of financial difficulties he had to discontinue his studies to take up job of a tutor. However, he came back to the university after he earned a scholarship.

Berzelius took up his first course in chemistry in 1798. It is interesting to note



Pehr Wilhelm Wargentin

that one who changed the course of chemistry by his pioneering discoveries, failed the final examination in the subject in the first year. His performance in the second year was also not very good. However, without being disheartened by his poor performance in examinations he began experiments in the laboratory of one of his teachers named Johann Afzelius (1753-1837). It was while working in this laboratory that Berzelius acquired a profound interest in chemistry. Today if Afzelius is remembered it is because Berzelius worked in his laboratory.

Berzelius' early research papers were based on the experiments carried out in Afzelius' laboratory. His first research paper was on chemical analysis of mineral water collected from a nearby health resort. He also wrote some other papers and which were sent by Afzelius to the Swedish Academy of Sciences for publication. Unfortunately the Academy did not accept the papers. The reason for rejection was that the papers contained some of Lavoisier's concepts, which were entirely new ideas in those days and were not accepted by senior members of the Academy.

In 1802, Berzelius received his degree in medicine. Because of his interest in chemistry he decided not to become a practising physician. His took up an assignment as an assistant to professor of surgery at the School of Surgery in Stockholm. It was a job for which Berzelius was not paid any remuneration. However, this voluntary job offered Berzelius a place for doing research in his spare time. He continued to pursue his interest in chemistry. He had only a small inheritance from his parents, which was not sufficient for comfortable living.

Somehow he managed to pull on. He started analysing minerals with Wilhelm Hisinger (1766-1852). Hisinger was not only an accomplished mining chemist but he also owned a famous Swedish mine at Bastnas, which was a source of interest for many mineralogists and chemists for its mineral called bastnasite. Soon after they started analysing minerals, they discovered the element cerium. They sent a paper on their discovery to a German journal. The publication of the paper took long time and the particular issue of the journal containing their paper also had a paper by the German chemist Martin Heinrich Klaproth (1743-1817) announcing his discovery of cerium from the same mineral. Fortunately Berzelius and Hisinger had printed 50 copies of a small pamphlet, which they had earlier circulated among friends and colleagues.

In 1807, Berzelius was appointed a professor in the School of Surgery. This was a great honour, but for Berzelius it also meant a much needed source of income. He had accumulated a large amount of debt. His failed venture of industrial vinegar production had significantly increased his debt. He had established the factory jointly with his partner Werner. They borrowed money to cover the cost. As their venture was not successful, they were heavily in debt amounting to some 10,00 thalers. Werner absconded to Russia. Later Berzelius recalled: "I am sorry to say that neither he (Werner) nor I had ever taken a vinegar factory before, and what was even worse that I had no talent for applying science to industry, a disability which was to cost a great deal of money during my lifetime. In our factory the acetic acid was only formed very slowly and was not strong enough."



Martin Heinrich Klaproth



Leopold Gmelin

During the Napoleonic war the professors at the School of Surgery were given equal status to that army officers and they were paid double their peacetime salaries. Berzelius was able to clear his debts. After one year of his appointment as professor he was elected to the Swedish National Academy of Sciences. It was a big achievement particularly considering the fact that he was not even 30.

It was Berzelius who proposed the symbols for chemical elements that we use today. Before Berzelius there were no standard symbols. Different people used different symbols. And the symbols used were originally adopted by alchemists from astrology and many of them were strange and mysterious. The symbol given to gold was a circle with a dot in the centre and antimony a little crown. John Dalton tried to improve the situation. He proposed a system that used a circle differentiated in some way for every element. But this system was also not easy to remember. Berzelius proposed that the first letter of each element's name be taken as its symbol. So the symbols of carbon, nitrogen and oxygen would be C, N, and O. When an initial letter was already used for other element then the next distinguishing letter was added to the first letter. Thus symbols of calcium, chlorine and caesium became Ca, Cl and Cs. But then there was a problem. A particular element was known in different names in different languages. Berzelius used the Latinised names for giving the symbols. This was simple system and it was easy to remember and this system is still in use.

It was Berzelius who first made distinction between organic and inorganic compounds. In 1807, Berzelius called the



Eilhardt Mitscherlich

class of chemicals produced by living things organic and those which did not originate in living things inorganic. He observed that there was lot of difference between organic and inorganic compounds. In fact Berzelius thought that the functioning of organic compounds is governed by altogether different laws than inorganic compounds. In those days it was generally believed that no organic compound was synthesised in laboratory and that it was some vital force in living beings which was responsible for creating organic compounds. Berzelius not only believed in the vital force theory but he also thought that nobody would ever be successful in synthesising an organic compound outside living body. But then a finding of Friedrich Wohler eventually persuaded scientists to rethink about the veracity of the vital force theory.

Wohler, who was a student of Berzelius, accidentally synthesised urea from ammonium cyanate in 1828. His aim was not to synthesise urea, because like most others he also thought it was not possible. He was working with cyanides for different reasons, but on heating an amount of ammonium cyanate he produced a substance that looked like urea. But then how could it be? Urea is an organic compound found in urine of human beings and animals and ammonium cyanate was an inorganic compound. Wohler was naturally surprised by the result of his experiment. He first tried to establish the true identity of the compound and soon he was convinced that he indeed had synthesised urea in laboratory. He informed his finding to his teacher Berzelius on 22 February 1828. Berzelius was not ready to believe it. He argued that ammonium cyanate was in fact

an organic compound and not an inorganic one. And so even though Wohler had synthesised urea from ammonium cyanate, it was a simple case of conversion of one organic compound into another. However, Wohler's discovery persuaded many chemists to take up the challenge of synthesising organic compounds from inorganic compounds. Not many years passed before chemists realised that it was indeed possible. In 1845, the German chemist Adolph Wilhelm Hermann Kolbe (1818-1884) synthesised acetic acid, undoubtedly an organic compound from its elements. This was the end of the vital force theory.

Berzelius was raised to the status of nobility by the King of Sweden, and his portrait appeared on a series of postal stamps commemorating the bicentenary of the Swedish Academy of Sciences. A school situated next to the school in which Berzelius studied is named after him. Berzelius died on 7 August 1848.

Commenting on Berzelius, Heinrich Rose (1795-1864), a German mineralogist and analytical chemist, who also worked with Berzelius, wrote: "The irresistible captivation which Berzelius exercised over those who enjoyed the privilege of a lengthened intercourse with him was only partly due to the lofty genius, whose sparks flashed from all his work, and only partly to the clearness, the marvellous wealth of ideas, and the untiring care and great industry that gave everything with which he had to do the stamp of highest perfection. It was also—and everyone who knew him intimately will agree with this—it was also those qualities which placed him so high as a man: it was his devotion to others, the noble



Friedrich Wohler



Adolph Wilhelm Hermann Kolbe

friendship which he showed to all whom he deemed worthy of it, the great unselfishness and conscientiousness, the perfect and just recognition of the services of others—in short, it was all those qualities which spring up from an upright and honourable character."

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(The article is a popular presentation of the important points of the life and work of Jons Jacob Berzelius available in the existing literature. The idea is to inspire the younger generation to know more about Berzelius. The author has given the sources consulted for writing this article. However, the sources on the Internet are numerous and so they have not been individually listed. The author is grateful to all those authors whose works have contributed to writing this article.)

Dr. S. Krishnaswamy

A veteran of documentary movement in India

Documentary film maker, producer, director and writer Padmashri Dr. S. Krishnaswamy has produced a series of remarkable educational and science films over the past five decades. After studying film and television at Columbia University, New York, he collaborated with Prof Erik Barnouw and wrote the acclaimed Indian Film (Columbia University Press 1963 & Oxford University Press 1980). Soon after, he founded Krishnaswamy Associates in 1964. In a career spanning 45 years he has made over 400 short films. He has addressed several international conferences around the globe and has held several honorary positions in international film festivals.

In 1974, he launched his ambitious film “Indus Valley to Indira Gandhi” and Warner Bros acquired it for worldwide distribution. To celebrate the Golden Jubilee of Indian independence, he made “India 5555” – a documentary on 5 millennia of civilisational values, 5 centuries of recent history, 5 decades of democracy, and 5 years of a new economic policy. It was chosen by the White House and screened for President Bill Clinton who was preparing for his visit to India.

In 2008, Doordarshan (National Network) telecast his 18-episode TV Serial, titled “Indian Imprints”, on the cultural impact of India on South-East Asia over 2000 years. Based on intensive research in collaboration with his wife, Dr. Mohana Krishnaswamy, he filmed at over 100 locations, in Indonesia, Thailand, Cambodia, Laos and Vietnam, Indian Imprints is widely acclaimed as a creative and historical landmark.

He has won four National Awards for his short films, and many prestigious international awards. In 2005, he received the coveted “Life Time Achievement Award” conferred by the US International Film & Video Festival, Los Angeles, and became the first Afro-Asian recipient of this honour in 40 years.

Er Anuj Sinha, Director, Vigyan Prasar and Consultant, Department of Science & Technology, Govt. of India interacted with Dr. S. Krishnaswamy on his contribution in documentary making, challenges in science communication through electronic media, and other developmental aspects. Here are excerpts of the interaction.

VP: You have a legacy in film making, your father being a pioneer in the industry. Has this been a burden on you and how have you overcome this?

SK: My father was – and continues to be even after his lifetime – a guiding spirit. It is true that a great man’s accomplishments and reputation is as much a burden for a young scion to bear. As a pioneer of South



Dr. S. Krishnaswamy

Indian Cinema, he had earned a place for himself which is unique, because he was deeply committed to his ideology – using cinema as a vehicle to propagate the ideals of the freedom struggle, the ideals of women’s emancipation and the empowerment of the marginalised. He made a lot of money but lost almost all of it, because of his uncompromising courage of convictions. Hence when I started my company to make non-fiction films in 1964, in financial terms, I started from scratch; but in terms of goodwill and in terms of commitment to ideology, I had inherited a fortune. It was soon possible to overcome the “burden” and enjoy the rich heritage of culture and values I had inherited from my father.

VP: Tell us about your growing-up phase in a home full of creative people and how early cinema influenced your values.

SK: My Mother was a musician, lyricist and composer with incredible talent as a veena player. All my seven siblings who grew up with me in the same household, and my one step-brother, who grew up in another household, blossomed in one way or another with great musical talent. I was the only one who could not sing. I felt it was a lacuna not to be able to sing. And then I read Gurudev Tagore’s lines “Leave the gaps in your life

where they are, for the music to come out of its depths”. Those lines were soothing and I began to discover melody and harmony, absorbing the music in the ambience.

Talking of early cinema, I grew up from childhood as a critic. The average film never satisfied me and I looked forward for something different. As an undergraduate student, I wrote a 100-page Thesis on Expression discussing cinema and other arts.

VP: You received higher education in the US and were preparing for a different career. How did you change your trajectory and do you, in retrospect, feel it was worthwhile?

SK: After getting my Bachelor’s degree in physics from Presidency College, Madras (now Chennai) and learning sound engineering privately, I proceeded to New York to study electronics. When I expressed my desire to do this, my father encouraged me whole heartedly and financed my initial education in New York, despite the fact that he was not in the best financial circumstances. Within weeks of my arrival in New York, I discovered that Columbia University was offering a Master’s programme in Mass Media with special reference to cinema and television. It attracted me a great deal, while the electronics course that I had joined was too elementary for a physics graduate. I met the head of media at Columbia (Prof. Erik Barnouw, with whom I collaborated in writing a book, two years later) and impressed upon him my interest in film and television by giving him a copy of my Thesis on Expression. That meeting with Prof. Barnouw was a turning point, since he became a major influence on me. I have never looked back.

VP: You have inspired the new generation including your very talented daughters into the art and craft of film making. Would some other means of expressing creativity been more satisfying to you?

SK: The documentary film has remained my first love for half a century. Of course I have made a lot of fiction material as TV serials and also one tele-film based on fiction. I used to write a regular column in the Illustrated Weekly of India in the 1960s. But my preoccupation as a film maker did not allow me to continue that. My writing since then has been confined to film scripts, but for

occasional articles in the print media. I enjoy film making thoroughly; but I feel I should be devoting more time to write for the print medium. I am satisfied with what I do; but there is an element of dissatisfaction, without which one may perhaps stagnate. I want to write a book again.

Regarding encouraging another generation, I suppose it has been by default. After all, 46 years is too long a period not to have done that. Yes! I am proud of my daughters, who have blossomed as very gifted and creative film makers – Lata whole-time, and Gita devoting part time in the midst of her other business as co-owner of a Gym. (I believe that every generation must overtake the previous one in excellence, for the progress of mankind as a whole.) There have been lots of others, who are very successful as cameramen, technicians, etc. One of them who started as my film editing apprentice is now Chairperson of a TV Channel, while another who got his first break with me as a musician is indeed a ‘Star music director’ of the film industry.

VP: What has been the role of Dr. Mohana in your professional growth and career decisions? Have you been over shadowing her talents? Or has she consciously dwarfed her creativity to help you develop yours?

SK: I admire the sensitivity of your question. Mohana has been a rank holder throughout her education, getting the University gold medal for first rank in B.Sc. After our marriage, she studied M.Sc. and then got her Ph.D. in Biochemistry. She pursued a productive research career at the Central Council for Ayurveda and Siddha. Besides publishing dozens of papers in scientific journals, she was invited to address seminars in USA and China. She won the Hari Om Ashram’s Gold Medal for research in Ayurveda. But sometimes, what is intellectually and socially acceptable as National policy, works against individual interest. As part of the socially laudable policy of “affirmative action”, the policy of “reservations” worked against her in fulfilling her cherished goal as a scientist as well as climbing the professional ladder.

As a scientist, she had offers from abroad including a lucrative one from Denmark. But the mother in her (by then all our three children had arrived) prevailed – to give her best attention to her children and not migrate to Denmark. Also by temperament she is very rooted in India. Scientists working for the government anywhere in India were at

that point of time, feeling strangled by a bureaucratic atmosphere stifling the scientific spirit, and Mohana was no exception. In the meantime, Mohana had pursued documentary film making as a hobby, born out of her own intrinsic interest in the arts – as a Hindustani singer, a Bharatanatyam dancer and as a linguist with proficiency in several languages. Even in the early stages of her involvement in documentary films, she won the IFUW International First Prize at Helsinki, for her film on issues of women’s empowerment in Tamilnadu



Dr. S. Krishnaswamy receiving his PADMASHRI Award from Hon'ble President of India

Realising that she was as much a person with talent in humanities as in science, I offered her to join my company which I had started two decades earlier. It may have been a tough decision for her, but she accepted the offer. As a way of acknowledging her leadership qualities and creativity, I requested her to become the Chairperson of our company. From that day onwards I have occupied the second position for the last twenty-five years. Her contributions to build our company dedicated to communications are immense, understanding the creative needs of our profession and at the same time, taking financially prudent decisions. In the earlier years when I was wearing both the hats of Producer and Director, not only was it a strain, but also there was a financial drain. As

Producer of all our work since then – both documentaries and TV serials, Dr. Mohana has inspired the creativity of all the talents and applied a philosophy of thrift which has resulted in the long term success of our “small is beautiful” enterprise.

I sometimes feel guilty that I have interfered in the career of someone who could have blossomed as a great scientist. But the atmosphere to encourage a scientist was absent in the Indian soil that day, and we were personally unwilling to pay the price of separation from each other, by her pursuing a career abroad.

VP: You have been richly decorated for your work in India and abroad. What recognition do you prize the most, and why?

SK: I value and respect all recognitions from all quarters – local, national and international. However, I will bracket three awards as of special significance – the Padmashri is listed on top of them since this is a national recognition from the Head of State. The Life Time Achievement Award conferred by the US International Film and Video Festival, Los Angeles, is another since I happen to be the first Afro-Asian to receive this in forty years of that festival; and the Honor Summus Award of the Watumull Foundation, Hawaii, to mark the 40th Anniversary of Indian Independence, which they conferred on 40 people from various fields, who contributed to India’s development.

VP: You are a voracious reader. What are the books that you are currently reading?

SK: Sometimes I read a book cover to cover. At other times, I read three or four books at one time often unrelated in subject matter. I am in the second mood right now. I am reading Unconditional Life by Deepak Chopra; besides Steven Levitt and Stephen Dubner’s Freakoconomics which takes an unconventional look at the Western Economy. I am also half way through Jeffrey Archer’s And Thereby Goes a Tale – his new collection of short stories.

VP: You have introduced a range of innovations on regional and national TV. Please share some of your experiences with our readers.

SK: Innovations are mainly of three kinds – the themes tackled, the methodology employed and the technology employed. In terms of the themes, during the first decade of my career, I found the release of documentary films in India was so totally dependent on the Films Division, Govt. of

India, which had monopolised the twenty-minute slot given for non-fiction films in the cinemas. I decided to make a feature-length documentary and test the waters by releasing it as a stand-alone programme. Amidst much opposition from well-wishers, I launched the project titled 'Indus Valley to Indira Gandhi' in 1973, and completed it in 1976. Narrating the 5,000 year story of India in four hours, shot in 120 locations across the country, I had burnt my boats in producing this. Some laughed derisively, while some sympathised with my commitment to an impractical ideal. Indian film distributors refused to touch the product. Six months later, Warner Bros (Hollywood) took interest and acquired the distribution rights of the film. It proved a runaway hit with the audience – more so in India. The film ran into controversy because of its title. But it had established that without a 'star-cast', a nonfiction film could commercially succeed in a spectacular fashion with audience "buying" tickets to watch a documentary.

Jumping four decades, the most recent, rather ambitious project, Mohana and I have been working on for some years, is on a bunch of three products – 'Indian Imprints', an 18-episode documentary serial telecast on the National Network of Doordarshan in 2008; a feature-length documentary titled 'A Different Pilgrimage', completed in 2010 and screened during the Cannes International Film Festival (yet to be released for public exhibition); and 'Tracking Indian Footmarks' – 4 episodes meant for a global audience. All these three titles trace the impact of ancient India on South-east Asia and we have treated them from different perspectives in the three projects. These three constitute a pioneering effort to unravel an aspect of history hardly ever tackled – filmed in hundreds of locations in Indonesia, Thailand, Cambodia, Laos and Vietnam, covering monuments, mythology, philosophy and dance forms.

'Indus Valley to Indira Gandhi' was a 35-mm Eastman colour film. For over two decades, we were working on 35-mm film. I evolved a policy of remaining technologically up-to-date by acquiring state-of-the-art cameras. The International Quorum of Film & Video Producers, Washington DC gives membership only by 'invitation' and not by

application. Usually there is only one member per region. In the 1980s, the Quorum made me a member representing South Asia. This helped a great deal to keep myself well informed about innovations worldwide and introduce them in our own work, adopting technology to local requirements. Thus we switched over to video production very early. Arguably, our company was the first in India to establish Betacam broadcast-quality equipment. We maintained the lead six years ago by being among the first few to be equipped with digital high quality production in DVCPRO 50.

I introduced 'Chroma key' facility in my studio long before Doordarshan did. It is a technology by which you create illusions of backgrounds. For one of our Tamil TV serials, the newspapers reviewed that it must have been

Rao, legendary Art Director of J Walter Thomson, and creator of Air India's Maharaja Mascot once said "Krishnaswamy has green fingers with agricultural films". We made promotional films, educational films and training films related to modern agriculture – hybrid seeds, use of fertilisers, etc. Several thousands of 35-mm prints were made supporting different brands of agricultural input products distributed throughout the country. I took whirlwind tours of villages in South India to study the impact of these films. It was most revealing and immensely satisfying to realise that we were among the instruments of change in the green revolution.

Madras Fertilisers Ltd, which, at that point in time was the largest fertiliser manufacturing company, found that their product was more identified with the "Puppet Character" that we had created in our ad-films and documentaries, than with the name of their company. Hence, they adopted the puppet as their monogram and the name of the Puppet character, "Vijay" as the brand name of their product itself.

We made a film on 'technology-transfer from the Lab to the Industry', for CSIR, some 25 years ago. We produced over fifty programmes on Home Science, anchored by my daughter Lata, with the cooperation of the Avinasingam Home Science College, Coimbatore. These programmes were so popular and successful that we derived a great sense of satisfaction.

We have dabbled in medical education films, engineering education films and a whole spectrum of science education for the classroom or for in-house training of specific industries. Our film on how the Bahai Temple in Delhi was built, filmed from a 'building technology' point of view, for Larsen & Toubro, was ranked as the best film on Construction Technology at an International Conference of Builders. The colleges and training institutions which have used these different films have given excellent feedback on their popularity with their students.

The most recent and highly satisfying science serial in Tamil aimed at the teenage audience is 'Ariviyal Aruvi' (loosely translated as "Shower of Science"), directed by Lata and produced by Dr. Mohana. A state-level conference and seminar in which teenagers



Dr. Krishnaswamy with Md. Wahid President of Indonesia

far too expensive to shoot one whole episode in Paris. In fact, it was all shot within our studio creating the illusion of Paris. We used a combination of virtual reality backgrounds and miniature sets while filming the Tamil classics 'Silappadikaram' and 'Manimegalai' as a Hindi serial titled 'Upasana'. The effect was spectacular but the cost affordable. We began with cell animation forty years ago for 35-mm film and have come a long way today with 3D animation with computers. They become handy in films related to science and technology.

VP: You have worked in science outreach extensively. What has been your motivation and do you feel satisfied with the change in the attitude of the common man?

SK: My first experience with science outreach was in the late 1960s. Mr. Umesh

from all over Tamilnadu participated exclusively to discuss this serial, produced immensely gratifying results by way of enthusiasm around the serial.

VP: How do you see the emerging future of TV as a medium for building interest in science among the audience? What complementary efforts are required to make it more effective?

SK: Television as a medium is neutral. It is part of societal responsibility to ensure that it is used productively. Woody Allen said, "Hollywood has invented a unique method of garbage disposal. They simply convert them to television serials". The problem is that with globalisation, this trend has been imported worldwide and India produces as much garbage as anybody else, for television. It remains to be seen whether this greatest challenge for civilisation will be successfully met with wisdom. As a neutral tool, television is capable of imparting science as well as spirituality by those who handle the medium with knowledge and wisdom. The complementary effort required is to ensure that the presentation and packaging of science is exciting, so that it can compete for the attention of the young audience with ephemeral and irrelevant programmes with titillating content.

VP: What are your current assignments? Where do you find the energy and ideas for new projects despite being in the industry for so long?

SK: I am presently involved in a few projects while my daughter, Lata, is directing several more. Dr. Mohana is involved in all of them since she is the producer whoever is the director. I am making a compilation of extracts from my father's important, socially relevant films and those which propagated the freedom struggle, with a thread of narration and docudrama re-enacting some aspects of his life – to try and bring out his personality and philosophy as a film maker. This should be ready by October 2010. I am doing the paper work for a long television serial on the life and message of Swami Vivekananda. The active production will commence later this year.

Lata is completing an omnibus documentary titled '5,000 Years In 50 Minutes' to introduce the 'idea of India' in less than one hour, from ancient times to the present day. She is also working on a bunch of films for the Ministry of Panchayati Raj which are basically training films for new members and office bearers of Village Panchayats.

Hopefully, we will launch the second season of Arival Aruvi (Science Trail) which we made for DST last year.

You have asked me "where do I find energy and ideas for new projects despite being in the industry for so long?" Let me narrate a story. Photographer William was taking portrait and full figure photographs of the Queen, regularly for half a century. Recently he submitted his portfolio of her new portraits to the Queen. Her Majesty raised her eyebrows and said "Bill! Your photographs are not as nice as they used to be". The photographer humbly replied, "Your Majesty! Perhaps age has caught up with me!".

I am 72, and I try to be active – not with the energy levels of youth, but with no regrets.

VP: Do you see the digital and multimedia making the TV obsolete in the near future? How should science journalists and communicators prepare for a digital revolution?

SK: To my way of thinking, no new medium has totally replaced an old one, but has merely captured a segment of the audience. According to Marshall McLuhan, every new medium takes over the ephemeral contents of communication, helping the older medium to mature and cater to a discriminating audience. Much earlier than McLuhan, Wolfgang Riepl (whose theory of media came to be called Riepl's Law) said, "The future merely composts the past....A convergence takes place in the media field, leading to a different way and field of use for the older forms." I believe science communicators should be prepared to hang on to television in addition to adapting themselves to new media. Coming to thinking of it, new media mainly consist of new distribution avenues, while the production methodology remains largely the same in aesthetic terms.

VP: Since you serve on several juries who, in your opinion, are the most promising science film makers on the national and the international firmament?

SK: It is true that I have served on several juries. It is regrettable that not many science films are entering into competition in the large category of non-fiction films. About twenty-five years ago, when I was Chairman of the Jury for National Awards For Non-fiction Films, there were only three awards for short films. I found several worthwhile entries which could not be accommodated within those three. I recommended to the government, eighteen categories awards

for non-fiction films, including science films, agriculture films, biographical films, anthropological films, etc. It was gratifying that my recommendation was implemented from the following year. When I was Chairman of the Jury again seven years later, I had a sense of fulfillment and joy to announce sixteen awards in these categories. I am afraid that in the recent festivals over the last three years where I have been on the Jury, I have not come across many films that can be described as science films. This may be because there are now separate festivals for science films and I have not been associated with them.

VP: What positive role can science fiction have on creating excitement and interest in science?

SK: Science fiction is a double-edged sword. When it is written by a well informed scientist with creativity, it is a great boon. Let me give you two examples. In the late 1920s, H G Wells' novel on invasion of the Earth by aliens from Mars was produced as a radio play. It resulted in several thousand radio listeners across the cities in America rushing out of their homes in panic thinking that it was Radio News!

In a later decade, Arthur Clarke's "Space Odyssey 2001" was a remarkable piece of science fiction. Clark was himself an eminent scientist and so he was able to create science fiction which may one day get transformed to near-reality. He conceived, for instance, the idea of artificial satellites to circle the Earth. Scientists translated this fantasy into reality decades later.

However, there is a lot of muck in the guise of science fiction, lacking in scientific possibility and any streak of creativity.

Hence in my opinion, science fiction can create excitement provided it is conceived by people who have a basic understanding of scientific concepts.

VP: What is the message that you would like to give young science communicators?

SK: The tools of communication are evolving with the speed of light. Scientific knowledge is expanding like the universe. It is a challenge for the new generation to be truly well informed on the one hand, and immensely talented in imaginatively using the tools on the other. However, neither knowledge nor skills can become fruitful without deep commitment. The challenge can be met by meditating on the reality hidden behind the phenomena – with the urge to understand Truth and not to be satisfied with mere Facts. ■

The Development of Natural History in India



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There is spectacular beauty hidden in all the creations of nature. Living and non-living things are found in nature. Among the living things plants and animals have a prominent place. The scientific study of plants and animals is called natural history. It represents the wide canvas of life sciences.

In the study of natural history, more emphasis is given on the observations of nature rather than on experiments. The information and conclusions related to nature are generally published in a popular form in popular magazines.

Natural history involves the scientific study of plants and animals in their natural environment. Starting from single organisms to whole of ecosystems, the identification of organisms, their life history, distribution, deficiency as well as abundance, and their inter-relationships are studied in natural history. This branch of science started in the ancient Greece and Rome. In fact, the word natural history, which is popularly used for the natural science, is the literal translation of naturalis historia.

Looking from a global angle, we find that Aristotle (384-322 BC) was the first who in his book *Historia Animalium*, containing 500 pages and running into 9 volumes, described the constitution, nature, classification, breeding, etc., of 500 animals. He is called the father of zoology. Pliny (AD 23-79) wrote the treatise titled *Historia Naturalis* which ran into 37 volumes. After a long time interval, two great scientists Carolus Linnaeus (1707-1778) and Charles Darwin (1809-1882) made notable contributions in the field of natural sciences. In 1735, Linnaeus in his book *Systema Naturae* gave the classification of plants and animals and laid foundation of binomial nomenclature of living creatures. Darwin, during his five-year-long voyage on HMS Beagle, collected innumerable samples of organisms from South America and, based on his own observations as well as by making comparisons with earlier available references, presented pure scientific conclusions.



Aristotle (384-322 BC)

Although Darwin is world famous for propounding his theory of the evolution of species by natural selection, his contribution in the field of investigation of natural history is especially significant.

In medieval Europe, when scientific contribution in the field of natural history almost came to a naught, the Arab scientist Al-Jahiz presented his idea about food web. Yet another Arab scientist Al-Dinawari in his ninth century work titled *Book of Plants*

described 637 plants, starting from their sprouting from seeds to their developing into mature plants. He has been regarded as the father of botany in the Arab land. The contributions of Abu-al-Abbas-al-Nabati and Ibn-al-Baiter in the field of natural science are also remarkable.

In modern Europe, streams like botany, zoology, geology, physiology, and paleontology emanated from the mainstream of natural history. The amateur (animal and plant) sample collectors also had an important albeit indirect role in the development of natural history. The ardent curiosity of man to know about organisms had a role in creation of natural history museums in many countries of the world including India. These museums also served to motivate research in the field of biology. For the study of natural history, many national, regional and local societies have also been founded where specimens of birds, mammals, insects and plants are preserved and their records kept. The Bombay Natural History Society situated in Mumbai is one such society which was established in 1883. These societies also play an important role in creating scientific interest in the common man about natural history.

India is a country of rich traditions and history. It has also a very long standing legacy of natural history. The oldest references to Indian natural history are found in the Vedas where information about various plants and animals of India are recorded. Depicted in the caverns of Bhimbetaka near Bhopal in Madhya Pradesh are the scenes of hunting of animals by men, which are about 9,000 years old. The evidences recovered in the Vedic period dating back to 1,500 to 500 BC include the lists of names of some 250 different kinds of birds in addition to those of plants and animals. Such animal behaviour as the koel dropping its eggs in the nests of crows finds mention for the first time in the Vedas. Besides the Vedas, the historic treatises of Maharshi Charaka and Sushruta also include description of Indian natural history.



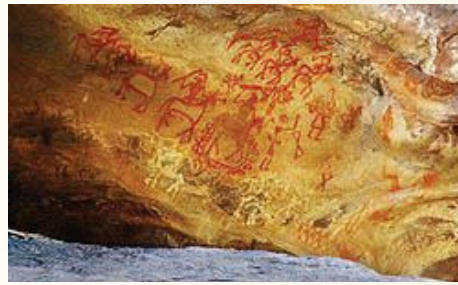
Carolus Linnaeus (1707-1778)

The treatise named Gajashastra, written in the Pali script about 200 years ago, contains information about catching of elephants, caring for them and giving them training. About the same time, information about classification of land into five different kinds of ecosystems is contained in the Tamil literature of the Sangam period, which also clearly mentions about various plants and rice fields.

The Indus Valley Civilisation, which flourished in northwest India around 1700 BC, has had an important role in the development of natural history in India. Archeologists, paleontologists and naturalists have carried out studies on about 1,000 sites of Indus Valley Civilisation. In the course of these studies, bones of many animals like hare, spotted deer (chital), rhinoceros, elephant, and jackal have been unearthed. In addition, from some habitats of Indus Valley situated in western India, seeds of many wild plants have been recovered during excavation although these plants have now become extinct from these areas. The engravings of plant and animal forms on the earthen pots and stones recovered during excavation of Indus Valley sites are excellent examples of natural history of that period. From excavation at Harappa dating back to 3,000 BC, a seal with engraving of a tiger on it was recovered. The first evidence of the taming of elephants has been obtained from the study of Harappan civilisation.



Picture depicting natural history



Engravings depicting wild life on the caverns of Bhimbetka

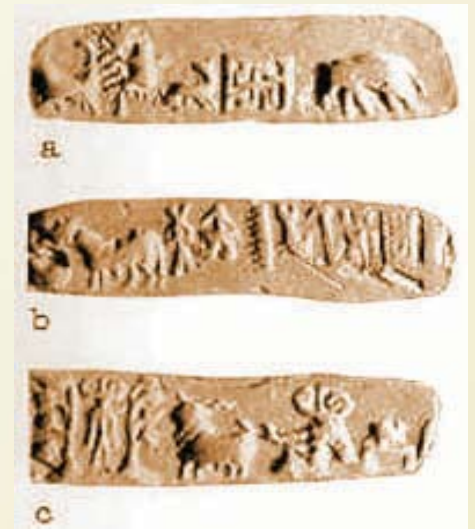
The natural history in India acquired a new dimension during the Mauryan reign. During the fourth and third century B C, Mauryans had ruled India. These rulers took many significant steps for protection of animals. The Mauryan rulers were the first to regard forests as resources and they used to treat elephants as the most important boon of forests. This was because at that time the military power, besides men and horses, was also dependent on elephants. In the Arthashastra of Kautilya, clear mention has been made about special responsibilities of the protectors of those forests which were homes to elephants. During the Mauryan reign, proper arrangement was made for the protection of forests which used to provide timber for building construction. In this period, important steps were taken for the protection of plants and animals; therefore, in the annals of Indian natural history this period is considered as most significant. The tribal people dwelling in forests in that period were assigned the duties as food-gatherers (aranyaca) or guards and their help was also taken in the catching of animals.

The great Mauryan emperor Ashoka (304-232 BC) had taken many steps for protection of animals and birds, so much so that he himself gave up hunting. In the annals of Indian natural history, Ashoka was probably the first ruler who had seriously advocated the cause of protection of wild animals. For this the king's orders were inscribed on pillars. Many kings later followed these policies of Ashoka. The edict on one of these pillars states - Our king killed very few animals.

In the Chalukya period, the Sanskrit treatise Manasolasa may be regarded as an excellent work in the annals of natural history, which focuses on the hunting of wild animals. The kings of Chalukya dynasty ruled India during the 12th and 13th century. During that period yet another treatise related to natural history was

written. The name of this treatise was Mriga Pakshi Sashtra. Written in the 13th century by the Jain poet Hamsadeva, this treatise contains detailed descriptions of mammals and birds. Although many naturalists today question the subject matter of this treatise, endeavours during that period were certainly remarkable.

After the Chalukya period, the role of Mughal emperors in the annals of natural history in India has been quite significant. Besides leading a lavish life style and raising spectacular buildings, the Mughal emperors made much contribution towards protection of plants and wild life, and in the field of art and literature. The animals were given protection in the gardens of Mughal emperors. Artists were instructed to make



Animals in stone engravings recovered from an Harappan site

paintings of plants and animals. These paintings kept in our museums are witness to the legacy of our natural history. Hunting and eagle keeping were the special hobbies of Mughal emperors. The observations on the Indian animals and birds made by Mughal emperors were written down by the scribes called vakianavis.

Zahir-ud-din Muhammad Babur (1483-1530), who laid the foundation of the Mughal Sultanate, in his autobiography Baburnama has described nature in all his earnestness apart from description of social, economic and political conditions of his times. Babur was a highly educated Muslim ruler and has presented a vivid description of plants, animals and birds in Baburnama.

In the 17th century, there was a painter called Mansur, in the court of the



Painting showing Babur hunting wild animals

Mughal emperor Jahangir, who was an expert in depicting plants and animals in his paintings. Actually, Jahangir had a special affinity towards natural history. That is why he got the depiction of nature done with the help of Mansur and set up a private museum of those paintings. Mansur used to make paintings during the reign of Jahangir's father Akbar as well, but he made fabulous paintings only during Jahangir's time. He acquired name and fame as *ustad Mansur*. Jahangir gave him the title *Nadir-ul-asra*, which means best personality of the era.

Mansur had mastery in carrying out the scientific documentation of plants and animals. There is so much of artful vividness found in his paintings that they are unique in themselves. The documents prepared by him focusing on the annals of the Indian natural history have scientific accuracy inherent in them. Many of his paintings even today are accepted in their original form in the scientific world.

When Mansur accompanied Jahangir in his natural expeditions, he was entrusted with the job of making paintings related to plant and animal life. Jahangir has recorded at one place in his memoir that during the expedition to the Kashmir valley, Mansur made live sketches of around 100 flowers.

Unfortunately, Mansur did not put his signature on the majority of the paintings made by him. He is credited with just a single painting made by him during the Kashmir valley expedition as he had put his signature only on that painting.

Mansur was the first to make paintings of the Siberian Crane and the Dodo bird. Dodo, a flightless bird found in Mauritius, fell prey to the reckless huntings by European explorers and finally became extinct from Earth in 1681. The painting of Dodo made by Mansur is of great significance for modern science. During the period 1626-1628, Ronald Saveri, an artist from Amsterdam, Holland, also made a painting of Dodo which was an amateurish effort of lesser significance, while Mansur made his painting watching a live Dodo. This Dodo was brought to Jahangir's court via Goa, which was then a Portuguese controlled territory. Created by Mansur, this rare painting was rediscovered during the middle of the 20th century from the collection of the Institute of Oriental studies of the Russian Academy of Sciences. The replicas of paintings made by *ustad Mansur* have been kept for display in the Indian Museum (Kolkata), National Museum (Delhi), Maharaja Sawai Mansingh-II Museum (Jaipur) and Chhatrapati Shivaji Vastu Sangrahalaya (Mumbai).



The unique painting of Dodo made by Mansur

In the latter half of the 18th century, after the establishment of the monopoly of the East India Company in India, the company and the English rulers made a lot of efforts for protecting the plants, birds and animals of India. They were actively engaged in recording information related to natural history. The first museum of natural history was established during this period itself and the collections of living specimens in this museum kept increasing with time. During the British rule, the Britishers brought a number of rare plant species and planted them in India. During this period, most of the English officers joining the ranks of the Indian Civil Service were naturalists, who in every possible way enriched the legacy of Indian natural history. During this period, the contribution of Thomas Hardwick (1755-1835) is worth mentioning. At that time Hardwick was engaged as a military officer in India and he gave salaries to the local artists for making innumerable paintings of the birds and animals of India. Treading the footsteps of Hardwick, another British officer John Edward Grey (1800-1875) published a book titled *Illustrations of Indian Zoology*. Grey selected 202 colour illustrations out of the pictures of the animals prepared under Hardwick's direction and got them published in the book.

On 15th September 1883 eight persons pledged to establish a society for the development of natural history in India. Of these eight people, six were foreigners while two were Indians. They named this society as the Bombay Natural History Society (BNHS). Actually, the establishment of the Bombay Natural History Society is considered a milestone in the annals of the Indian natural history. This society has preserved the heritage of the natural history of India. One can have a look at the rich biodiversity of India in the natural history museum of the society. This unique museum of the Indian natural history houses 30,000 specimens of birds, 20,000 specimens of mammals, 8,000 specimens of reptiles and amphibians and 60,000 specimens of insects which all look alive. The earlier dedicated members of the BNHS documented the information regarding the animal kingdom of India and the neighbouring countries during the British period, which have today become the valuable legacy of this museum.

The great Indian ornithologist and naturalist Salim Ali (1896-1987) played an



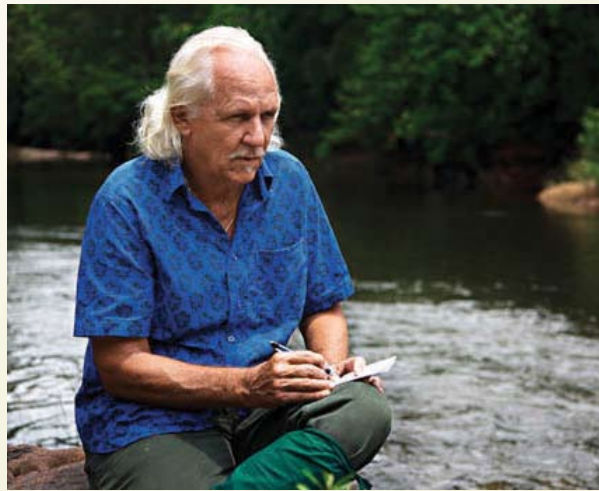
Salim Ali (1896-1987)

incredible role in the development of the Bombay Natural History Society. He was involved with this society for 78 years and was its first Indian honorary secretary and President. Salim Ali has authored many books on Indian birds in popular style. He had also worked in the elite company of the world renowned American naturalists like Sydney Dillon Ripley and Walter Norman Coleage.

Bird watching, that is, observation of birds is a topic of natural history in which the interest of people is growing steadily. In the Indian context, the credit for this goes mainly to Salim Ali. The books authored and the research done by him on the study of

Indian bird life made him an international expert on Indian birds. The Book of Indian Birds, Handbook of the Birds of India and Pakistan, The Birds of Kutch, Indian Hill Birds, Birds of Kerala, The Birds of Sikkim etc. are some of the famous books of Salim Ali.

Edward Hamilton Aitken (1851-1909), through his English articles written in popular style, brought home the information of natural history to common Indian readers. He used to write articles in the name of 'Eha' which are the first letters of his first, middle and surname. The book of the Indian novelist Rudyard Kipling (1865-1936) titled The Jungle Book gained immense popularity not only in India but also worldwide. It created interest in natural history in the common man including children.



Romulus Whitaker (1943-)

After India's independence, the Zoological Survey of India, under the leadership of Biswamoy Biswas carried out significant survey work related to natural history. In free India, many Indian naturalists contributed towards enriching natural history. Notable among them are M. S. Mani and B. K. Tikader (entomologists); Sunder Lal Hora, C. V. Kulkarni and S. B. Setna (fishery scientists); and C. R. Narayan Rao, Romulus Whitaker, and G. C. Daniel (herpetologists).

Some other Indian scientists have also contributed to the development of natural history. Amongst them, a leading name is J. B. S. Haldane. Born in England in 1892, Haldane is one of the founders of the population genetics. Besides being a successful scientist, he was a famous science populariser too. He always laid emphasis on

the responsibilities of science towards the society at large. Haldane believed that the main responsibility of a scientist is to make science acceptable to the common man. He translated his idea into practice in his own life. He wrote many popular articles and books on science with a view to making science understandable to common man. He also wrote extensively on natural history. Haldane wrote 24 books and more than 400 research papers and popular articles on science. Animal Biology, Science and Life Ethics, Enzyme, My Friend: Mr. Leakey, Science and Everyday Life, Preface and Notes to Dialectics of Nature etc. are some of the main works of Haldane.

For creating awareness about natural history and conservation of plants and animals through mass communication media in India, the names of M. Krishnan and T. N. Perumal (wild-life photographers), Prof. K. K. Neelkantan (wild life lover), Harry Miller and Ruskin Bond are also noteworthy.

In India, the development of natural history has remained by and large diversified. While in the past, we have mixed accounts of hunting and protection of animals, looking at the present endeavour for the conservation of animals and plants one can hope for a happy future of co-existence of wild animals, plants and man on Earth.

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(Translated by: Abhas Mukherjee)



Edward Hamilton Aitken (1851-1909)

The Dark Shadows

Spirits, Witchcraft and Black Magic

Superstition, bigotry and prejudice, ghosts though they are, cling tenaciously to life; they are shades armed with tooth and claw. They must be grappled with unceasingly, for it is a fateful part of human destiny that it is condemned to wage perpetual war against ghosts.

Victor Hugo, *Les Misérables*

Ever since the human beings decided to form communes, set up a social order, fight diseases, they have also sought refuge under the dark shadows of the irrational. Witchcraft, shamanism, and other forms of miracle healing probably stem from the failure in finding remedies for diseases and disorders beyond comprehension. But even after an astounding, though admittedly still incomplete, progress in unravelling the mental illnesses men and women in large parts of the world continue to live under the spell. Here are four case studies, which reflect the mechanisms of witchcraft and shamanism. We will then discuss why these old world ghosts continue to survive in the modern world and why people fail to emerge from the shadows.

As the crow flies, some 160 kilometres from Delhi, off the highway, there is a small village. The headman is Surendra Chaudhari. Today, all village streets are leading to his home. A big crowd has assembled to witness the evil spirit that has overpowered the headman's daughter-in-law. Meera is possessed. Her body is swaying, face livid, hair wild and eyes red shot. She is gibbering, ranting, raving in frenzy, totally out of control. A village elder solemnly asks her to tell who she is, why has she possessed Meera, and what was her desire. As if the question amuses her, the spirit shrieks a loud laugh and says: 'So, you want to know who I am? I am Ratna, Meera's friend.' A hush falls over the crowd. Ratna is dead. She had drowned herself, jumping into a well seven months ago. The elder asks again, 'What makes you come?' The spirit of Ratna smiles, and says, 'I have come to take Meera's husband. The man is evil. He beats my friend and treats her like an animal. He has no soul. He must die.'

This rattles the crowd. A few whispers punctuate the stony silence. The spirit goes on, 'Go, get my friend's mother-in-law. She

is a curse. It is she, who instigates my friend's husband to behave like a Satan. I must pull out her nasty tongue.' The whispers get louder. There are women in the crowd, who have a score to settle with Meera's mother-in-law. They secretly wish the spirit to do what it is saying. The elder man is however more sensible. He says, 'If you kill the husband and the mother-in-law, your friend will be left all alone. Surely, you don't want that! We will see to it that they do not ill-treat your friend henceforth. If they do not change, you may do as you please. Give them a chance.' The



spirit relents, 'You promise?' 'Yes', many in the crowd join in with the elder this time.

The spirit leaves. Meera falls down, unconscious. Two elderly women sprinkle cold water on her. Another one ties a sacred thread around her arm. Meera slowly opens her eyes. She appears bewildered to notice a crowd gathered around her. She whispers, 'What has happened? Where am I?' She has



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sweat all over her and feels very thirsty. The women attend on her. Gradually, colour returns to Meera's drained face. The event is over. The crowd melts away.

The spirit of Ratna is a subject of hot debate in the village. Many people empathise with Meera, and the village elders meet and take a decision to call and counsel Meera's husband and parents.

RS is a 45-year-old businessman. He has a wonderful family: an aged mother, a caring wife and two children. His trade is flourishing and he is a popular man. He regularly visits the temple, gives alms to the poor, and commands respect in the community. Yet, for the last two months, he has slowly gone into a shell. He no longer wishes to go to his work, does not like to interact with anybody, and is always deep in melancholy. He weeps for no reason, has become apathetic towards his needs and duties, and complains of aches and pains, and extreme tiredness even after rest. The family doctor checked him but could not find any physical cause for his symptoms. When laboratory tests also drew a blank, the goodly woman next door suggested to his wife, 'Somebody must have cast a spell on your poor husband. You must seek a tantrik's help.' The bewildered wife has no choice. She engages a tantrik, who promises to nullify the spell. The tantrik visits their house, carries out some rituals, and then tells everybody to wait. He goes to the backyard with a shovel and returns triumphant with a wooden doll in his hand. He breaks the doll in their midst, takes his fees and leaves, promising that RS would soon be normal.

The family of RS waits in eagerness for signs of improvement, but his condition progressively becomes worse. The family waits. Will they ever see RS smile again?

Up in the hills of Uttaranchal, the town of Rudraprayag is blessed with a public hospital. Dr. Raj has just joined here as a child specialist. He rings the bell for the attendant to send the next child. A woman,

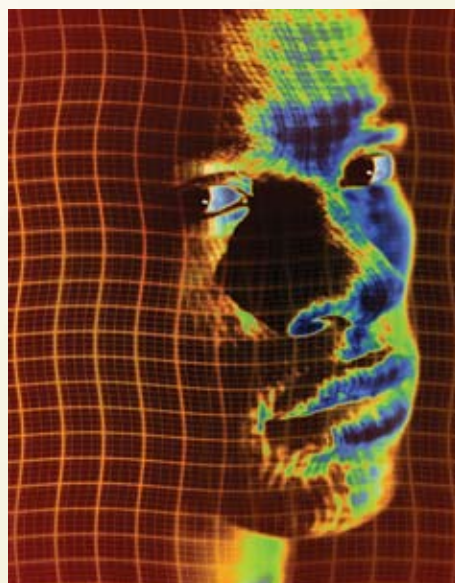
her eyes welling with tears, silently beseeches him and sits down on the stool with her child. The child is running high fever. Raj takes him to the examination couch and uncovers the child. He is aghast. The child's abdomen wears marks of recent burns. He looks questioningly at the mother. She begins to cry. The father tells the story. Mohan, his son, was afflicted with fits. The village healer had treated him with a red-hot iron. There was no relief. 'Doctor sahib, save him', he cries and falls at Raj's feet.

I am at work in my hospital, a large public care facility in New Delhi at the end of my duty in the busy outpatients. At the stroke of lunch, after I have seen off scores of patients a young man enters my chamber hesitantly. His face is ashen. 'Doctor, can you give me a private moment? I need your help.' I ask him to sit, smile at him reassuringly and wait. He pours out, 'Doctor, I am in a sorry state. I have lost my manhood. During the night, when I am fast asleep, I am possessed by a lecherous woman's spirit. She mates with me and has made me lose my vitality. Yet, my family has fixed my marriage. They do not know the truth. How would I ever satisfy my wife? Do you have a pill that can set things right for me?' The young man was half in tears. I ask him, 'How do you know that you have lost your manhood?' His face turns red. He is silent for a minute. Then perhaps making an inner resolve, he begins, 'Some four weeks ago, on the advise of a friend I visited a woman for a first time experience. She was good looking, she excited me, and she was also patient, yet, I simply did not come on. I stayed limp. I tried and tried, but it just did not happen. I thought it was just a chance. I consulted my friend again. He took me to a tantrik. The tantrik did some incantation and found that a young woman's spirit had taken possession of me. The night emissions were because of her. She does not want me to marry. The tantrik worked a spell for me, but it hasn't helped. Now, you are my only hope.'

Such incidents are commonplace throughout the world. Charms and amulets, spirits, black magic, and exorcism are practices that have been a part of human society for centuries. Community studies have found that people often take recourse to prayer, invocation, faith healing, and tantrism to find relief from disorders and illness of the mind. While these practices are most prevalent in the developing societies,

they are also practised in the industrialised world. One in five families in the western hemisphere takes recourse to this option. Obviously, the poor, because of illiteracy, are more gullible and thus relatively easy prey, but the educated also succumb to it. The lack of proper healthcare facilities and the dissatisfying performance of the facilities that do exist also push the people towards primitive practices.

Before we probe these practices, let us, for a while, return to the individuals, whose lives we have just visited. Let us analyse their cases. If you think a little more about Meera, you would realise that she was under no possession. Rather, she was experiencing a spell of dissociative somatisation disorder. Her mind was wrought by her difficult situation.



She had been the darling of her parents, the only daughter, but soon after her marriage her parents had passed away. Though an accomplished girl, Meera never got a chance to prove her abilities and was subjected to severe mental trauma by her husband and mother-in-law, and she felt helpless. One day she learnt of her friend Ratna's demise. With or without knowledge of why she did so, she took on Ratna's identity to give vent to her bottled up feelings, and in the bargain, she found help from unexpected quarters. The village elders, who had turned a blind eye to her sufferings, now had a reason to pursue her case with her in-laws. The entire operation had occurred at another level, and her conscious mind did not appear to be even aware of what had transpired. This is one setting where the socio-cultural beliefs

of a community had come to the rescue of a young woman in distress.

The outcome in most cases, however, is not that fortunate. The distress that such practices often cause reflects amply in the three other lives. The behavioural change that RS was overcome with was no evil work of a tantrik. RS was suffering from depression. The signs were classical, and if his family had taken him to a physician suitably trained in mental health, the doctor would have taken little time in diagnosing the condition. And, with antidepressants, RS would have taken just two or three weeks to begin his recovery.

The poor child in Rudraprayag simply needed treatment for high fever. It was the abnormal rise in body temperature, which had led to convulsions. Such fever-induced convulsions, or febrile seizures, are common in children. The best safeguard against such fits is to quickly take suitable steps to lower the body temperature. Suitable fever-relieving medicines, such as paracetamol, and sponging with wet cloth can quickly bring the situation under control. Yet, most people are so perplexed by the uncontrolled movements of the body in convulsion that they only see a curse of the supernatural in it.

And finally, the young man who visited me in 1982. He is now a happily married man, and has two school-going children. His problem was as much a product of wrong social beliefs as of ignorance of biological functions. His mind had been wrought with anxiety and that was his undoing. The belief that nocturnal emissions, a normal process in men, were the evil effects of a spirit had warped his mind. He only needed anxiety-relieving medication and simple counselling to be normal again.

Beliefs, practices, and effects

Down the ages, in all societies and civilisations, simple sorcery—such as setting out offerings to helpful spirits or using charms—has been a common feature of human life. It is a wherewithal to force results that cannot be achieved in normal course. From a sociological perspective, this practice reinforces and consolidates common beliefs about the supernatural world, and in turn strengthens the social bonding. Psychologically, this serves as a sense of control over nature, mitigating the anxieties caused by uncertain seasons, natural disasters and disease. When such

eventualities occur, people tend to interpret them in terms of diabolical witchcraft or black magic. The function of the so-called witch doctor, or medicine man, has been to counter the power of evil through good magic, and 'identify' the alleged culprits who may then be sought out and driven away.

Exorcism also has a similar notion underlying it. The shamans, or special priests, perform rituals to expel demons or evil spirits from people or places that are possessed, or are in danger of possession. They retrieve the lost or stolen soul, and invoke the gods and helping spirits.

Witch doctors, tantriks, ojhas and the like also prey on people's minds by performing complex negative rituals. They would bury a clay or wax image with nails driven into it, chant incantations and summon the evil spirit. You pay them to harm or destroy a rival you fear.

The notion that spirits exist has percolated down the ages. It is not difficult to theorise how this thought might have emerged. At the passing away of a loved one, human emotions run wild. In an acute grief, one may see a vision or hear the voice of the deceased. Memories can play tricks on the grieving mind. Such hallucinations might lead to the belief that a part of person lives on even after death, as a spirit. And just as people can be good or bad, the spirits can



also act friendly or foul!

The bogey, or the evil and mischievous spirit, also finds a sympathetic ally in the odd and bizarre state of a diseased human mind. In almost all major illnesses, especially of the mind, a person may report that he or she has seen visions and heard voices that nobody else can perceive. The media, cinema, even Harry Potters and Vaitals and Elves and Hobbits continue to bombard our minds

into believing the inexplicable.

Witch doctors, faith healers and shamans all resort to intricate rites, invocations and incantations to heal the mentally ill. Many of them with keen observation and study of human behaviour develop an understanding of mental illnesses. They are also able to provide relief in some situations when the illness is minor and strong suggestion can work. Their witchery sometimes also succeeds, because the illness is self-limiting, or the suffering mind finds solace in the attention and care that it receives. Where this fails, they find an easy alibi in imagined planetary configurations, influences and destiny. Some smart faith healers motivate the patient to seek help in a modern-day hospital using the ploy that he or she is destined to benefit from that particular place. The suggestion, even if given deviously, may help the sufferer.

Many times, however, when the self-proclaimed healers resort to inhuman means to prove their theories or to control the mentally ill, a tragedy unfolds. Many religious places which specialise in 'treating' the mentally ill, use physical violence, chaining or beating. Sometimes the tragedy gets compounded. Some years ago, ten mentally ill people, chained and confined in a tiny room in a town in Tamil Nadu, were burnt to death when suddenly a fire broke out.



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Recent Developments in Science and Technology

Planck reveals early universe

European Space Agency's Planck mission has released its first full-sky map, which shows the cosmic microwave background (CMB) in higher resolution than ever before and it may help cosmologists to develop a much clearer picture of the early universe. The CMB was first observed in 1965 by Arno Penzias and Robert Wilson at the Bell Telephone Laboratories in Murray Hill, New Jersey, USA. Penzias and Wilson shared the 1978 Nobel Prize in physics for their discovery.

The study of the CMB in the 1990s using NASA's Cosmic Background Explorer (COBE) satellite won George Smoot and John Mather the 2006 Nobel Prize in Physics. Later, in 2003 the first full-sky survey of the CMB was produced by NASA's Wilkinson Microwave Anisotropy Probe (WMAP). But the Planck mission is expected to surpass WMAP

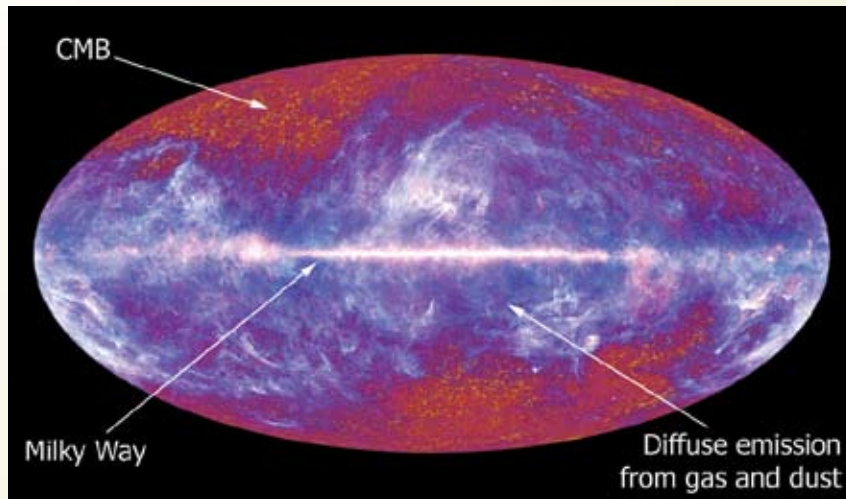
by detecting a so-far unobserved type of polarisation of ancient microwave photons, which are believed to date back to the period of inflation and are determined by the density of primordial gravitational waves.

One of the main objectives of the Planck mission is to map the primordial radiation created about 375,000 years after the Big Bang. Slight variations in the temperature of the CMB are believed to reflect fluctuations in the early universe from which large structures such as galaxies would later evolve.

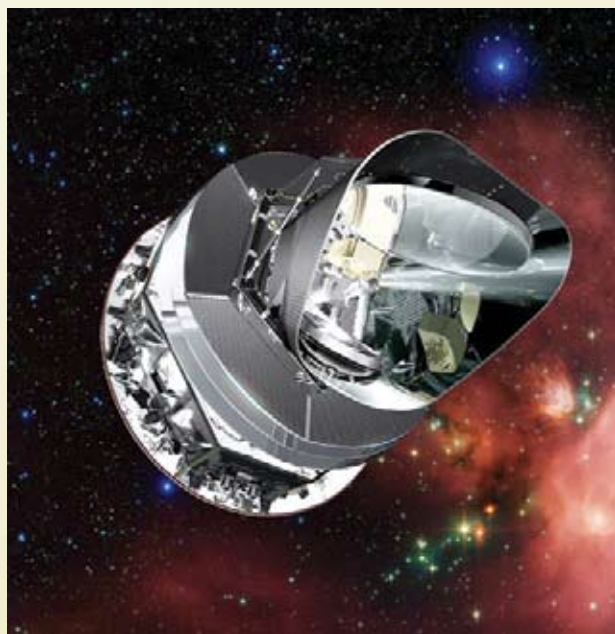
Planck was launched in 2009, and now orbits a distant point, called the second Lagrange point of our Earth-Sun system, about 1.5 million kilometres away. The satellite is designed to make the most precise measurements to date of tiny variations in the CMB and is

expected to refine our estimates of the size, mass, age, composition, geometry and fate of the universe – whether it will collapse in on itself, or expand forever.

Planck is equipped with both the Low Frequency Instrument and the High Frequency Instrument. Together, the two



A sharper view of the early universe than any other image has captured so far. Planck's map depicts subtle variations in the universe's temperature at different points in the sky, reflecting the distribution of matter when the universe was 380 million years old. The bright streak across the middle of the picture is our own galaxy, the Milky Way, viewed edge-on. The intense light comes not from stars but from the radiation released by the dust and gas clouds that stretch between them. [Credit: ESA, HFI & LFI consortia]



The Planck spacecraft.



Biman Basu

[e-mail: bimanbasu@gmail.com](mailto:bimanbasu@gmail.com)

instruments scan the universe in nine frequency channels, with a sensitivity that is 10 times better than that of the earlier probes.

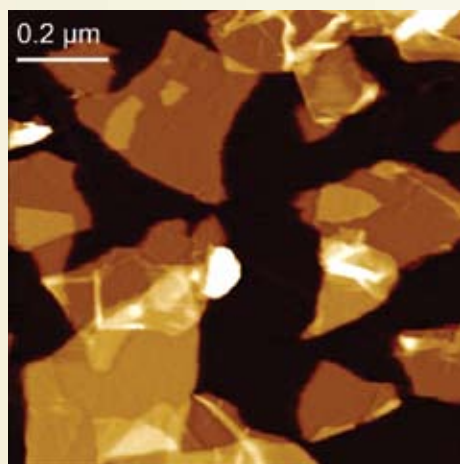
Planck will help provide answers to some of the most important questions in modern science: how did the Universe begin, how did it evolve to the state we observe today, and how will it continue to evolve in the future? The results could reveal how stars like the Sun are forming in our own galaxy today, how the galaxies grew and evolved over cosmic time, and how planetary systems can develop from the dust and gas around young stars.

In the latest all-sky image produced from Planck data, while the

Milky Way shows us what the local universe looks like now, the microwave background radiation show us what the universe looked like close to its time of creation, before there were stars or galaxies. The main objective of the Planck mission is to decode from the pattern of the cosmic microwave background radiation what happened in that primordial universe. The first full data release of the CMB is planned for 2012.

Graphene removes arsenic from water

Graphene is a two-dimensional allotrope of carbon which was discovered in 2004. Graphene is a two-dimensional, giant, flat sheet of carbon atoms with the thickness of an atom. The planar, hexagonal arrangement of carbon



Graphene flakes

atoms in graphene can be considered as nothing but a single layer peeled off from the three-dimensional graphite crystal. The single-layered honeycomb structure of graphene makes it the “mother” of all carbon-based systems: the graphite we find in our pencils is simply a stack of graphene layers; carbon nanotubes are made of rolled up sheets of graphene; and fullerene molecules, or buckyballs are nanometre-size spheres of wrapped-up graphene.

Because of its unique properties, graphene has already found applications in many fields, especially in electronics where its exceptionally high electrical conductance is a big advantage. Now, researchers have found yet another use for this wonder material. A team of scientists from Pohang University of Science and Technology in South Korea used a composite material made from reduced graphene oxide (RGO) and magnetite to effectively remove arsenic from drinking water (ACS Nano, 16 June 2010 | doi: 10.1021/nn1008897).

Graphene is a sheet of carbon just one atom thick that also exists as an oxide. Reduced graphene oxide is a chemical state of the material that has gained electrons. The researchers dispersed a magnetite-RGO composite in water containing arsenic. The RGO composite soaked up the arsenic from water and was removed by using a permanent magnet.

Arsenic is one of the most carcinogenic elements known and is toxic above 10 parts per billion (ppb) and arsenic contamination is quite widespread in some states of India. Drinking water contaminated with the element can lead to chronic illness and

death. The arsenic mainly comes from naturally occurring arsenic-rich rocks through which the water has filtered but it may occur in areas where arsenic is mined as well. Scientists also suspect that changes in agricultural practices, such as using too much groundwater rather than surface water sources like rivers and ponds for irrigation, may also be to blame.

Arsenic can be removed from drinking water by using activated carbon or precipitating it out with iron minerals, such as iron oxides – for example, magnetite (Fe_3O_4) nanocrystals. However, such particles cannot be used in rivers, or other environments with flowing water, because of



Magnetite-RGO composite dispersed water solution (left) and magnetic separation. [Credit: ACS Nano]

their small size and because magnetite rapidly oxidises when exposed to the atmosphere. Researchers have recently overcome the latter problem by combining iron oxides with carbon nanotubes, and graphene-based materials such as graphene oxide.

The researchers at Pohang University of Science and Technology created a new type of magnetite composite based on reduced graphene oxide. The hybrid material, which is super paramagnetic at room temperature, can remove over 99.9% of arsenic in a sample and reduce its concentration to below 1 ppb. The composite is better for removing arsenic compared with bare magnetite because the presence of the graphene flakes among the magnetite particles increases the number of arsenic adsorption sites. The reduced graphene oxide also increases the stability of magnetite so that it can be used in continuous-flow systems for longer periods.

High heels are dangerous

High heeled shoes have always been in fashion among women. Even though many women admit that high heels are usually uncomfortable and painful, they continue to wear them to look thinner, taller, and more stylish. However, physicians have found that high heels force the body into an unnatural and stressful position. As a result, many short-term and long-term health problems, especially with the legs, can develop.

When a woman wears high heels, the foot is pointed downward; this causes an unbalanced distribution of weight. Therefore, the foot and toes experience much more stress than they are designed to support. Another possible consequence of wearing high heels is Achilles tendonitis, or inflammation of the Achilles tendon. The Achilles tendon is a tendon that connects the calf muscles to the heel. When high heels are worn too frequently, the slanting of the foot causes tension in the heel, and the tendon shortens. As a result, the heel only feels comfortable when the foot is kept in a pointed position; any attempt to stand the foot flat or wear a flat shoe becomes extremely painful.

Till now the reason for this change was not known, but now scientists have evidence of the changes occurring the leg muscles that bring about the difference. In a study, Marco Narici from Manchester Metropolitan University, UK, and Robert Csapo,



Women who spend most of their time moving around in high heels cause damage to their muscles.

from the University of Vienna, Austria, compared two groups of women – one regular high-heel wearers and another who did not. Using MRI and ultrasound technology the researchers compared the calf muscles and Achilles tendons of women who frequently wore high heels with those of women who mainly wore flat shoes. They have found that the muscle fibres of the calves of women who wear high heels on a regular basis are 13% shorter than those of women who habitually wear flat shoes. According to the researchers, by shortening the fibres, the muscles would have to contract more to shorten by the same length. And if this was the case the calf muscles of women wearing high heels could no longer function optimally and thus would produce less force than the flat shoe wearer's calf muscles.

The tendons of high-heels wearers, although no different in length, were found to be about 20% less flexible than the tendons of flat-shoe wearers. Thus, over time, walking in heels causes calf muscles to become shorter and weaker. When the wearer switches to flats, the muscles are suddenly stretched into a position they are not used to, causing pain and discomfort (Journal of Experimental Biology, 16 July 2010 | doi: 0.1242/jeb.048454).

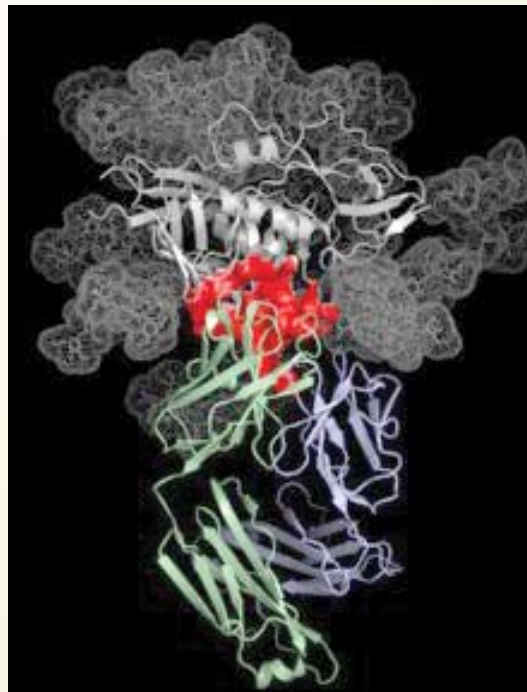
The feet and toes are not the only body parts that suffer from high heeled shoes. For example, in order to balance out the forward shift in body weight, the lower back tends to bend slightly in the opposite direction. This bend then pinches the nerves in the back in a condition known as sciatica. Patients suffering from sciatica can feel pain and numbness from the lower back all the way to the feet. The forward slanted position of the foot also prevents the knee, hip, and lower back from relaxing properly. Therefore, the risk of stiffness, pain, and injury increase as well.

Another common problem that stems from high heels is knee osteoarthritis. The bones in the knee are separated by a cushiony material called cartilage. In order for the cartilage to remain strong and protective, it must absorb nutrients from fluid in the knee. However, when women wear heels regularly, the stress felt by the knees can increase up to 26%. This stress makes it more difficult for cartilage to absorb the nutrients it needs. Eventually, the cartilage becomes damaged, and knee osteoarthritis results. Individuals

with this condition suffer from chronic pain due to the deterioration of their joints.

Antibodies to fight HIV discovered

One of the main problems with dealing with the Human Immunodeficiency Virus (HIV) has been the ability of the virus to continuously change its surface proteins to evade recognition by the immune system



Atomic structure of the antibody VRC01 (blue and green) binding to HIV (grey and red). [Credit: NIAID VRC]

of the body, and today an enormous number of HIV variants exist worldwide. As a consequence, research efforts to find individual antibodies that can neutralise HIV strains have been almost impossible.



The Human Deficiency Virus (HIV)

However, there are a few surface areas on the virus that remain nearly constant across all variants of HIV. One of the few such identified areas is called CD4 binding site. It is located on the surface spikes used by HIV to attach to immune system cells and infect them.

Scientists have recently discovered two potent human antibodies that can stop more than 90 percent of known global HIV strains from infecting human cells in the laboratory by attaching to the CD4 binding site and preventing the virus from latching onto immune cells. According to the scientists, the antibodies attach to a virtually unchanging part of the virus, and this explains why they can neutralise such an extraordinary range of HIV strains. They have also demonstrated how one of these disease-fighting proteins accomplishes this feat.

Led by a team from the National Institute of Allergy and Infectious Diseases (NIAID) Vaccine Research Center (VRC) in USA, the scientists found the two naturally occurring antibodies called VRC01 and VRC02 in an HIV infected individual's blood using a novel molecular device. The device is an HIV protein that the scientists had modified so it would react only with antibodies specific to the site where the virus binds to cells it infects (Science 9 July 2010). The scientists found that VRC01 and VRC02 could neutralise more HIV strains with greater overall effectiveness than previously known antibodies could do.

According to the scientists, these antibodies could be used to design improved HIV vaccines, or could be further developed to prevent or treat HIV infection. The method used to find these antibodies could be applied to isolate therapeutic antibodies for other infectious diseases as well.

The researchers also determined the atomic-level structure of VRC01 when it is attaching to HIV. This has made it possible to define how the antibody works and to precisely locate where it attaches to the virus. With this knowledge, they have begun to design components of a candidate vaccine that could induce the human immune system to make antibodies similar to VRC01 that might prevent infection by the vast majority of HIV strains worldwide. Scientists believe the new discovery could lead to new vaccine for AIDS. ■

Your Opinion

Dream 2047 has been inviting your opinion on a specific topic every month. The reader sending the best comments will receive a popular science book published by VP. Selected comments received will also be published in Dream 2047. The comments should be limited to 400 words.

This month's topic: "Is it worthwhile to plan for human settlements in space, to escape disasters on Earth in future?"

Response should contain full name; postal address with pincode and email ID, if any; and should be accompanied by a recent passport size photograph. Response may be sent by email (opinion@vigyanprasar.gov.in) or by post to the address given below. If sent by post, "Response: Dream 2047 September 2010" should be clearly written on the envelope.



Vigyan Prasar

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Winners of "Your Opinion" contest for June 2010

Topic: "If rainwater is harvested on a large scale will it affect the flow of the rivers?"

Aman Arora

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Rainwater harvesting on a large scale can surely increase the flow of rivers. Rainwater is believed to be the purest form of water available for us.

In spite of abundant rainfall, India remains a "thirsty" land, as 75 to 90 percent of rainfall is concentrated over four months of June to September. During these four months, rainfall is generally heavy. But a significantly large part of this water runs off into seas and oceans and goes waste. One of the most useful effects of rainwater harvesting is that it can control floods, as the excess water will be stored and not allowed to overflow. It will also recharge the groundwater and thus, increase the water table leading to sustainability. The excess water can be stored and channelised to water thirsty or drought affected areas through irrigation canals.

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Rainwater harvesting is a simple solution to a big problem. Flow of river primarily depends on groundwater level which is largely dependent on rain. In last fifty to sixty years, there is a rapid growth of urbanisation, industrialisation, and deforestation. The use of



river water and groundwater has increased unexpectedly, which has in turn reduced the groundwater recharge and water flow in rivers. More than 80 percent of rainwater is drained to sea without recharging the groundwater. As a result floods and water scarcity are observed during different seasons of year. If rainwater harvesting is done on a large scale then it will improve the ground water level, ensure healthy flow of river, and also reduce floods.

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Rainwater harvesting essentially means collecting rainwater from the roofs of building and storing it underground for later use. Not only does this recharging arrest groundwater depletion, it also raises the declining water table and can help augment water supply. There are numerous positive benefits of harvesting rainwater. The technology is low cost, highly decentralized, empowering individuals and communities to manage their water. It has been used to improve access to water and sanitation at the local level. Rainwater harvesting on a large scale can supplement the flow of rivers positively and ensure that they remain recharged throughout the year and thus can mitigate the ill-effects of floods and drought.



Workshop to promote reading habits among children

Vigyan Prasar organised a one-day workshop to promote reading habits among the children at Cambridge School, Noida (UP) on 26 July 2010. This workshop was part of "Celebration of Book week" of Cambridge School. The workshop started with inaugural session. In this session Mrs Rajni Jauhari, Principal, Cambridge School, Dr Madhu Pant, Former Director, Bal Bhawan, Dr Subodh Mahanti, Scientist 'F', Mr Zia Ahemed, Science communicator, Shri Kapil Tripathi, Scientist'D' and co-ordinator of the programme, and Ms Chavi Ghosh, librarian, Cambridge School were present. In her speech the Principal briefly described the efforts made by the school in promoting reading habits among the students.

After the inaugural session Dr Subodh Mahanti interacted with the children and spoke about the importance of reading, life and work of scientists and



Dr S. Mahanti, Scientist 'F' interacting with the children



A view of Vigyan Prasar Book exhibition

their association with books and some important facts related to books. Dr Madhu Pant spoke on simple techniques for writing story and poems. She demonstrated with example how a simple story can be written. She also recited poems from the book Hum Nanane Vagayi Hai published by Vigyan Prasar. The children also took part in recitation.

Mr. Zia Ahmed demonstrated activities related to science behind miracles. These activities were based on a book Seeing is not Always Believing – a Vigyan Prasar publication. Children not only asked a number of questions but they also answered questions asked by the speakers. Ms Chavi Ghosh said that the school library is playing active role in promoting reading habits and the school has developed a number of innovative schemes for the same. Vigyan Prasar organised an exhibition of its publications during the workshop.

Inviting Entries

Vigyan Prasar

A national institute for science and technology communication is proud to announce

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- These can also be downloaded from website <http://www.vigyanprasar.gov.in>
- Last date for receipt of entries is **30 September 2010**.



Director, Vigyan Prasar
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Dream 2047 is sent free of cost to its subscribers. It is being sent to about 50,000 subscribers. We are in the process of updating our mailing list and improving the contents of *Dream 2047*. We therefore request you to spare a few minutes to fill up the questionnaire and mail it to us.

Please note, unless we hear from you, we may discontinue sending *Dream 2047*. So please ensure that your response reaches us before 30 September 2010.

Your suggestions are valuable. Kindly give your considered opinion on the recent issues of *Dream-2047* to enable us to improve the quality of the magazine.

You may also submit your comments online (www.vigyanprasar.gov.in for online submission).

– Editor

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| <input type="checkbox"/> Hindi | <input type="checkbox"/> English |
|--------------------------------|----------------------------------|

11. We are also sending email version of *Dream 2047*. If you wish to receive only email version, please write your email ID

12. What rating would you like to give about *Dream 2047* in a scale of 1 (poor) to 10 (Excellent).

13. Please give your suggestions on how can we make *Dream-2047* more readable and attractive.

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.....

(Use separate sheet if necessary)

Date: _____

Signature

Name:.....

