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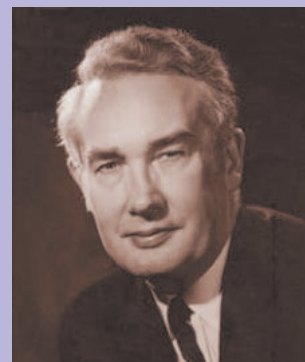
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Derek Harold Richard Barton

Maker of conformational analysis an essential part of organic chemistry

Derek Harold Richard Barton



(1918-1998)

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Fulcrum of Development



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Most of the advances won by women's movements have benefitted white middle class women more than others in the rest of the world. Such an inequity, and there are more, is ignored in most forums. Our culture seems to establish and reinforce this and awareness alone will therefore not be adequate to commence altering the system. (Sex is biological and given by genetics while gender is what society constructs and a lot more complex.) I am convinced that you can be empowered to think more carefully and analyse critically with a gender lens.

Indian women had no voice till a few decades back. Most had no access to higher education and neither could they own property. They were viewed as frail and delicate for any hard assignment or intellectual work. Dowry, marriage and other social customs ensured their lower status. Views, even of women, will require more time to change. Family serials on most entertainment television channels reinforce the stereotypical roles. There are major changes necessary before men, women and children can live more humane and fulfilling lives.

You talk to your friend about gender equity and as a result she changes her perception. A teacher can influence her students to evaluate their course and syllabus differently. A person may seek to influence his employer to make more gender sensitive work environment. Information through interpersonal communication is important and effective. It helps to form opinions and attitudes that will change behaviour.

There is a growing fascination (not only

in teenagers) in improving communication with members of the 'opposite' sex. However, this does not translate into improving relationships or altering views about the status of women. It often reinforces the traditional views about sexuality and gender roles. Are men and women fundamentally different? Perhaps there are many similarities between the sexes and yet experience, heredity, orientation, class and education have given rise to gender disparities.

While traditional value systems are not comfortable in the urban middle class, we are not yet convinced about the alternate views. The rural community is more orthodox and faces an even bigger barrier to change. This causes frustration in the community and at the same time heightened interest in the keen observer.

Gender, culture and communication are interlinked. We cannot address one without impacting on the others. Perplexing questions need to be addressed by communicators when designing a mass communication campaign. This is even more complex when the subject is gender inequality. The exercise will be worthwhile if it is effective. We celebrate International Women's Day this month and issues of women's health and nutrition have been identified as areas of focus.

Regardless of whether you are privileged or oppressed by society, this editorial may be unsettling. You might find it helpful to begin by taking positive action and that would have served the objective of this page. I believe that change is needed in the way we view and enact gender development.

There is woefully inadequate research in the area of science communication in general and gender communication in particular. A lot of empiricism is witnessed in the few field campaigns that have been launched. One's own class, education, sex, etc., influences how such campaigns and the communication material are used.

Communication will be at the heart of any social change. Only this can challenge views that constrain individuals and create inequities. Public discourse will be the key objective of any communication strategy and this should guide our collective efforts. Communicating issues of gender development and the underlying concepts of science will form the core of the programmes supported by Vigyan Prasar.

The posters, books, films and radio programmes that are under preparation will help the community to initiate dialogue and begin the process of orientation of views and attitudes. Stereotypes are not easy to overcome but the challenge has to be addressed. Increased understanding of the core messages will be a significant achievement. This will encourage more critical thinking on development agendas of governments and the attitudes of the individuals.

□ **Anuj Sinha**

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Editor: Er Anuj Sinha

Derek Harold Richard Barton

Maker of conformational analysis an essential part of organic chemistry

"One of the fundamental conditions for life on the Earth is the ability of carbon atoms to bind each other to a practically unlimited extent. They form chains, often very branched, but also rings and networks. The number of carbon compounds is thus very large — some years ago I saw the number two million — and many new ones are discovered or prepared every day. It is obvious that a multitude of different substances are required to build up a living organism and make it function."

Derek Harold R. Barton

"Conformational analysis may be described as the correlation of the preferred shapes or conformations of organic molecules with their chemical and physical properties. Frequently it is possible to assume a preferred conformation from the molecule and thus to deduce something of its chemical and physical properties."

Derek Harold R. Barton

"Barton's first paper, published in 1943, described the volatile excretion of ethylquinone from flour beetles when under stress. Clearly, even the beetles knew that they had to respond to the steely gaze of the young man and consequently (as they died) they exuded chemicals with interesting properties. That aside, this began his lifelong interest in natural products even though some of his later years were largely dedicated to inventing chemical reactions."

Steven V. Ley in *Biographical Memoirs of the Fellow of Royal Society* (2002)

Derek Harold Richard Barton (mostly known as DHRB among his friends, colleagues and students) played an instrumental role in making conformational analysis or the study of three-dimensional geometric structure of molecules as an essential part of organic chemistry. In 1950, Barton published a brief research paper entitled "The Conformation of the Steroid Nucleus" in a journal called *Experimentia*. In this paper Barton showed that organic molecules in general and steroid molecules in particular assume a preferred conformation. Barton reached to such a conclusion by analysing results accumulated by chemical physicists, particularly by Norwegian chemist Odd Hassel (1897-1981). Barton's paper introduced the field of conformational analysis and its significance was soon realised by fellow organic chemists. It revolutionised organic chemistry. Barton's paper was hailed as the first real advance in stereochemistry since the theory of Jacobus Henricus van't Hoff (1852-1911) and Joseph Achille le Bel (1847-1930). Barton was awarded the Nobel Prize in chemistry in 1969 jointly with the Norwegian chemist Odd Hassel (1897-1981) for "contributions to the development of the concept of conformation and its application



Derek Harold Richard Barton

in chemistry".

Barton's work on oxyradicals and his predictions about their behaviour in reactions helped in the development of a simple method for synthesising the hormone aldosterone. Barton's contribution to radical chemistry is very significant. A student of organic chemistry will find Barton's name associated with a number of reactions such as the Barton reaction, the Barton



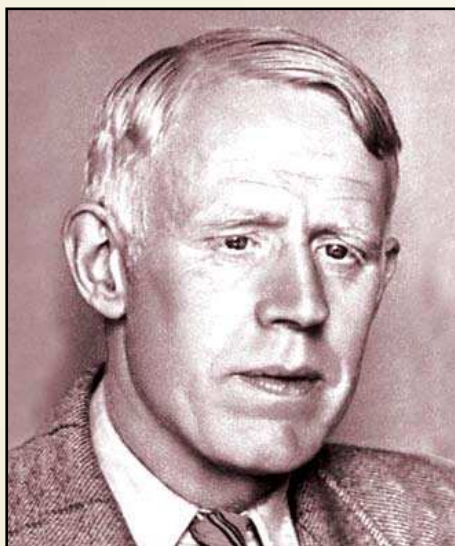
Dr. Subodh Mahanti

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decarboxylation, and the Barton-McCombie deoxygenation. Barton published more than 1,000 research papers.

Barton was born on 8 September 1918 in Gravesend, Kent, England to William Thomas and Maude Henrietta Barton. He attended a number of schools, viz., Gravesend County School for Boys (1926-29), King's School in Rochester (1929-32), and Tonbridge School (1932-35). Finally he had to leave school without getting any qualifications because of his father's sudden death in 1935. He had to help his family. He worked as an apprentice in the timber trade. In spite of adverse circumstances Barton harboured firm determination to excel in his life, to do something great in life. In 1937, he joined the Medway Technical College in Gillingham. He joined the Imperial College of London, London University in 1938 from where he graduated in 1940. He not only obtained a first class honours degree but also won the prestigious undergraduate prize, the Hoffman Prize. He obtained his PhD degree in 1943. His doctoral adviser was Ian Heilbron, a Fellow of the Royal Society of London.

Like all others Barton had to join the War efforts and worked for the government during 1942 to 1944 at a military intelligence unit at Baker Street in London. The work in which he was involved did not interest him much and undertook research work at night in the laboratories of the Imperial College. At the end of the war he worked for Albright and Wilson Ltd. in Birmingham as research chemist. He got involved in the synthesis of organophosphorus compounds. Industrially the work was important but it failed to provide enough intellectual stimulus to Barton. And so after a year Barton joined the Department of Chemistry at Imperial College London, first as Assistant Lecturer and then as ICI Research Fellow. The ICI Fellowship enabled him to develop an interest in the structure and synthesis of terpenes and steroids, which eventually led



Odd Hassel

him to conformational analysis. In 1949, Barton joined Harvard University in USA as Visiting Lecture in Chemistry of Natural Products at the invitation of Louis Fieser. It was at Harvard that Barton formulated his ideas on conformational analysis.

In 1950, Barton joined the Birbeck College in London first as Reader and later he became a Professor. In 1955, Barton joined Glasgow University as the Regius Professor of Chemistry. At Glasgow, jointly with J Monteath Robertson, Barton worked on the X-ray structure determination of complex natural products and explored new lines of research like organic photochemistry and oxidative coupling of phenols. In 1957, he came back to his alma mater, Imperial College London, as Professor of Organic Chemistry and stayed there till 1978. While serving the Imperial College London he visited a number of US universities as Visiting Professor. In 1958, he went to Massachusetts Institute of Technology as Arthur D. Little Visiting Professor and then in 1959 as Karl Folkers Visiting Professor at the Universities of Illinois and Wisconsin. In 1960, Barton was Visiting Professor at the University of California at Berkeley where he spent most of his time with the group headed by W. H. Dauben. In 1978, Barton became the Director of the Institut de Chimie des Substances Naturelles (ICSN), a government funded research institute at Gir-sur-Yvette in France. In 1986, he became Distinguished Professor at the A&M University, Texas, USA where he stayed till his death.

To understand the significance

of Barton's work on conformational analysis it would be in order to discuss about conformations. The structure of organic compounds are governed by three principles — constitution, configuration and conformation. Constitution indicates the order in which the constituent atoms of a compound are linked together, or in other words one can say that constitution represents the ground plan. The principle of configuration comes into play when there is a centre of asymmetry in a molecule. For asymmetrical molecule there will be a right form and a left form. A saturated carbon atom attached to four different groups is an example of asymmetrical molecule. In 1874, J. H. van't Hoff had observed that for a molecular entity having n centres of asymmetry there will be 2^n isomers or 2^n stable molecular entities having the same constitution but differing in configuration. In later years it was proved that van't Hoff was correct in his assertion. Conformation refers to any of the large number of possible shapes of a molecule resulting from rotation of one part of the molecule about a single bond. As early as in 1936, researches in chemical physics revealed that that restricted rotation about single bond is present in all organic compounds. Theoretically large numbers of conformations are possible. However, certain arrangements of bonded atoms and groups are preferred. The preferred conformations are those in which the arrangements of atoms and groups are in such a way that crowding and strain can be avoided and they also take



Ian Heilbron



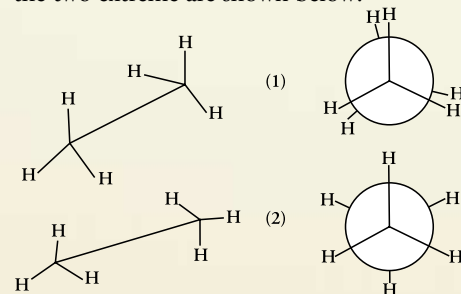
J. H. van't Hoff

into account of the fact that certain groups may attract or repel each other.

Some important examples of conformational isomerism are indicated below:

1. Linear alkanes (ethane, butane, etc.).
2. Ring conformation — cyclohexane, carbohydrates.
3. Optical isomerism resulting from restricted rotation about carbon-carbon bond (atropisomerism). Such isomerism is especially prevalent in biphenylic system; for example, binaphthol.
4. Folding of molecules, as seen in proteins.

In case of ethane (C_2H_6), an alkane, the two extreme are shown below:



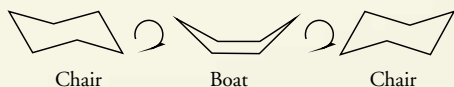
In arrangement like I (eclipsed conformation) the hydrogen atoms exactly oppose each other but in arrangement II they are perfectly staggered. In between the two extreme arrangements there may be an infinite number of intermediate arrangements which are called skew conformations. All possible structures are freely inter-convertible. There is an energy barrier (3 kcal/mol) between the two extreme arrangements. The staggered



J. A. Le Bel

conformation has the minimum potential energy, which increases with rotation and reaches a maximum at the eclipsed conformation. However, as the energy barrier is too small the rotation about the carbon-carbon bond may be considered as free rotation for all practical purposes. In fact at room temperature the rotation about C-C bond in ethane occurs about 10^9 - 10^{10} times per second.

A ring of six carbon atoms for example cyclohexane can have two conformations known as the chair and boat conformations as shown below:

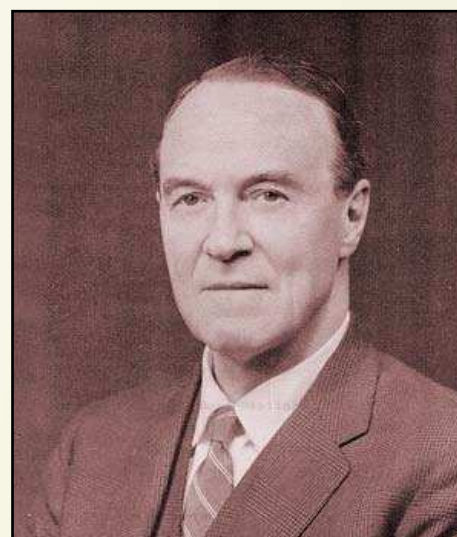


The other important conformational shapes of cyclohexane are half-chair, envelope, twist-boat or twist. These forms have two positions for the hydrogen atoms — axial and equatorial. It may be noted that cyclohexane conformations are classical examples of conformational isomerism and have noticeable effect on the physical and chemical properties; as result they have been extensively studied. The chair form is the most stable one. Certain substituents might favour one of the two chair forms. Molecules with networks of several rings such as steroids are often more rigid and so they are more likely to assume a preferred conformation.

After the publication of his seminal research paper Barton confirmed his ideas on conformational analysis with further work on the stability and reactivity of steroids and terpenes. He could show that

biological activities of natural products are determined by the shapes of their molecules and the positions and orientations of key functional groups. The basic assumption in conformational analysis is that preferred conformation of a molecule can be related to its physical and chemical properties. Conformational analysis proved to be a valuable tool for working out the configuration, in planning organic synthesis and in analysis of reaction mechanisms. Depending on the type of conformation the reactive groups may be easily accessible or they may be blocked by other groups. This means the knowledge of conformation of a molecule may help explain or predict the course of its reaction. Barton himself used conformational analysis to determine the geometry of many natural products.

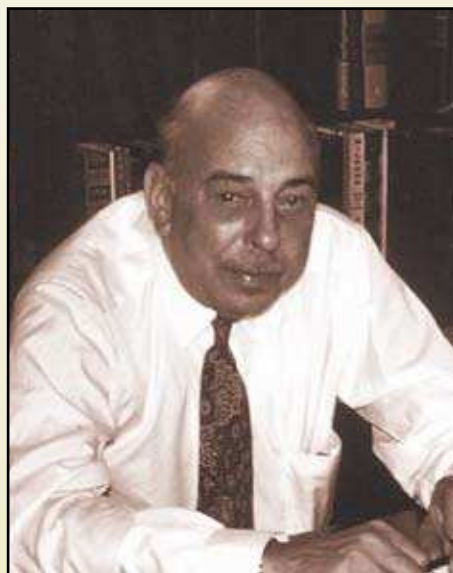
Commenting on the personality traits of Barton, Gordon W. Kirby wrote: "Derek Barton early acquired the reputation of being hard and uncompromising, a reputation that grew as much from anecdotes as first-hand knowledge. True, he could deal harshly with fools and the lazy, but anyone demonstrating a serious attitude to work and chemistry soon gained his respect. To these, especially the young and inexperienced, he showed a patient willingness to help and guide. At question time after colloquia the sight of Barton in the audience could unsettle even confident speakers. His ability to detect flaws in an argument and to reveal publicly gaps in a speaker's knowledge of chemistry was legendary, and woe betide the pretentious or those who tried evasion as a form of



J Monteath Robertson

self-defence! His academic staff learned to be alert before, as well as during and after, colloquia. Occasionally, with advance warning of seconds rather than minutes, he would invite a young colleague to introduce the speaker, with an encouraging remark such as 'Of course you know all about Dr. X's published work.'

Besides the Nobel Prize, Barton received numerous awards for his outstanding contributions in chemistry. In 1954, Barton was elected Fellow of the Royal Society of London. He was knighted in 1972. His numerous other awards included Harrison Memorial Prize of the Chemical Society of London (1948), First Corday-Morgan Medal of the Chemical Society of London (1951), Fritzsche Medal of the American Chemical Society (1956), First Roger Adams Medal of the American Chemical Society (1959), Davy Medal of the Royal Society of London (1961), First award in Natural Product of the Chemical Society of London (1971), Medal of the Union of Scientific Workers of Bulgaria (1978), Medal of the University of Sofia, Bulgaria (1978), Medal of the Academy of Sciences of Bulgaria (1978), Copley Medal of the Royal Society of London (1980), Hanbury Memorial Medal, the Pharmaceutical Society of Great Britain (1981), American Chemical Society Award for Creativity in Organic Syntheses (1989), Chemical Pioneers Award, the American Institute of Chemistry (1993), and Priestley Medal of the American Chemical Society



Louis Fieser

Continued on page 37

Trans-Neptunian objects and their importance



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After Pluto was relegated to a dwarf planet status, the small bodies lying beyond the orbit of Neptune caught special attention of astronomers. These objects are the most distant celestial bodies of the solar system accessible to ground based observations. These small bodies are collectively termed as 'Trans-Neptunian Objects' or TNOs. In fact, after the discovery of one of this kind, viz. 1992 QB1, about twenty years ago, planetary scientists focused their attention to TNOs and several more objects of this type were detected in the early years of the present century. Till now, more than 1,400 TNOs have been detected which differ with respect to their sizes, orbits, and various other features.

Classification of TNOs

Depending on their distances from the Sun and orbital characteristics, TNOs have been classified into four groups, viz., classical objects, resonant objects, scattering objects, and detached objects. Classical and resonant objects are together called 'Kuiper Belt Objects'.

(a) Kuiper Belt Objects

The Kuiper Belt Objects (KBOs) are at an average distance of 30 to 55 astronomical units (AU) where 1 AU is the mean distance of the Earth from the Sun and is equal to nearly 150 million kilometres. The eccentricities of the KBOs are low. They come from a region of space known as Kuiper Belt (see Box 1). Classical KBOs are called 'cubewanos'. A typical example of cubewano is 1992 QB1 which was discovered by Jane Luu and David Jewitt in the year 1992 with Keck telescope of Mauna Kea in Hawaii islands. [The name cubewano is derived from the first trans-Neptunian object (TNO) found after Pluto and Charon, which was called 1992 QB1. Later similar objects were called "QB1-o's", or 'cubewanos'.]

(b) Resonant objects

Resonant objects are locked in a mean motion ratio with Neptune. This means that

the orbital periods of Neptune and these resonant objects are related by a small ratio. This type of orbital resonance between two celestial bodies occurs when they influence

Box 1: Kuiper Belt

After the discovery of Pluto in 1930, American astrophysicist Frederick C. Leonard (1896 – 1960) suspected the existence of more celestial bodies of this type beyond the orbit of Neptune and believed that those objects might be detected in future. Afterwards, in 1943, Irish astronomer Kenneth Edgeworth (1880 – 1972) made an assumption regarding the existence of a large number of small bodies, rather failed planets, beyond Neptune. According to him:

"...the outer region of solar system, beyond the orbits of the planets, is occupied by a very large number of comparatively small bodies". Subsequently, Dutch astronomer Gerard Kuiper (1905 – 1973) made a similar assumption regarding the existence of a belt-like region at the outskirts of the solar system during its formation period. This belt-like region is known as 'Edgeworth-Kuiper Belt' or simply 'Kuiper Belt'. However, Kuiper believed that at the present stage bodies have been driven out towards the 'Oort Cloud', a spherical reservoir of comets lying far away at the farthest corner of the solar system.

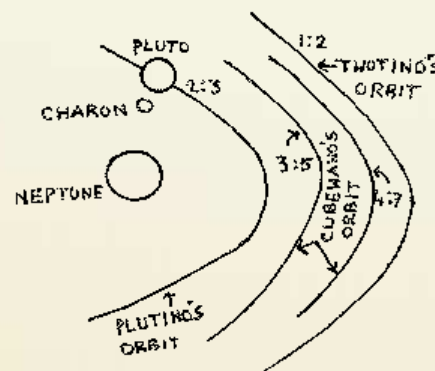
each other gravitationally. For instance, there is a 2:3 resonance between Pluto and Neptune, which means that Pluto completes two revolutions around the Sun by the time Neptune makes three such orbital revolutions. TNOs which are locked in 2:3 resonances with Neptune are called 'Plutinos' while 1:2 resonance TNOs are called 'Twotinos'.

The mean motion resonance is also seen in celestial bodies other than TNOs. For instance, 2:1 resonance exists between the moons of Saturn Dione and Enceladus as well as between Tethys and Mimus, while Hyperion and Titan are locked in 4:3 ratios. Jupiter's three Galilean satellites Io, Europa and Ganymede are trapped in a mean motion ratio of 1:2:4. So far, this is the only instance of resonance motion among three celestial bodies. However, if we move out

of the solar system, then we find that in each of the stellar systems around the stars HD 128311, HD 82493, HD 73526, and Gliese 876 contains a pair of planets which are locked in 2:1 resonance. Resonances of 4:1 and 5:1 ratios are found between the planets around the stars HD 108874 and HD 202206.

(c) Scattered objects

Unlike the classical KBOs and resonant objects, the scattered (or scattering) disc objects (SDOs) follow a large eccentric path (maximum orbital eccentricity can be up to 0.8) and their perihelions lie near the orbit of Neptune. The perihelion distances of SDOs could be 30 to 35 AU while their aphelion distances can be as large as 100 AU. The inclinations of their orbits are also very large and can be up to 40°. This means that the innermost ring of the scattered disc merges with the Kuiper belt while its outer rim lies far away from the orbit of Neptune. Most astronomers believe that



the SDOs were driven out beyond the orbit of Neptune by the gravitational influence of the four gas giants, Jupiter, Saturn, Uranus, and Neptune and are still perturbed by Neptune. The first scattered disc object to be recognised as such was (15874) 1996 TL₆₆, originally identified in 1996 by astronomers

based at Mauna Kea in Hawaii. Until 2009, more than a hundred SDOs had been identified, the largest of them being 136199 Eris which was discovered on 5 January 2005. Eris was earlier known as Xena.

(d) Detached objects

Detached objects, the fourth group of TNOs, differ from the other three types in the sense that they are not perturbed by the gravitational influence of Neptune due to their huge perihelion distance. For this reason, these celestial bodies are termed as 'detached' objects (also known as 'extended SDOs', 'distant detached objects', etc.). A typical example of detached object is '90377 Sedna' whose perihelion and aphelion distances are 76 AU and 927 AU respectively. The orbits of the detached objects have high eccentricity and large semi-major axes (up to few hundred AU). Till now at least nine confirmed detached objects have been detected.

TNOs of special interest

Some TNOs have special status with respect to their discovery, number of satellites or

5. Pluto is the second largest dwarf planet and TNO. It has three known satellites, viz., Charon, Nix, and Hydra.
6. The first retrograde TNO has been temporarily designated by 2008 KV42 (nickname 'Drac').
7. At present the dwarf planets Eris, Pluto, Makemake, and Haumea have been given a special status as 'Plutoid'. According to International Astronomical Union's announcement of 11 June 2008, a plutoid is defined as a celestial body in orbit around the Sun, with a semi-major axis greater than that of Neptune, which has sufficient mass to assume nearly spherical shape and has not cleared the neighbourhood of its orbit. Satellites of plutoids are not considered as plutoids. But, a section of the scientists are not satisfied with the term 'plutoid'. According to them, this very term itself again signifies a special status for Pluto. A list of some large dwarf planets has been given in Table 1. A glance at the table reveals

Secondly, until recently it was thought that periodic comets come from two regions, viz., Kuiper belt and Oort cloud. But, recent investigations shows that scattered disc may be a possible reservoir of periodic comets because SDOs are among "the most distant and cold objects in the Solar System". It may be mentioned here that the aphelion of the detached object Sedna is 960 AU; that is, it is about 32 times more distant than Neptune from the Sun. Till now it is the most distant known object of the solar system. So, investigations of the TNOs have already changed some of the old scientific views about the solar system.

Waiting for the future

For studying the surface features of the TNOs, astronomers of the European Southern Observatory (ESO) have taken up an intensive programme using their Very Large Telescope (VLT) situated at Paranal, La Silla in Chile. Forty selected objects have been studied and some preliminary results have been obtained. These results show that the surface compositions of largest TNOs (including dwarf planets) are different from

Table 1

Dwarf planets	Plutoids discovery	Date of	Diameter (km)	Number of satellites	Names of satellites
Eris (Xena)	Eris	21.10. 2003	2400	1	Dysnomia
Pluto	Pluto	18. 02. 1930	2300	3	Charon, Nix, Hydra
Haumea	Haumea	28. 12. 2004	2000	2	Hi'aka, Namaka
Makemake	Makemake	31. 03. 2005	1600	None	-----
Sedna	-----	14. 11. 2003	1800	None	-----
Quaoar	-----	04. 06. 2002	1290	1	Weywot
Orcus	-----	17. 02. 2004	1100	1	Vanth

something else. Some of these objects are listed below.

1. 1992 QB1 is the first KBO discovered after Pluto (discovered in 1930) and Charon (discovered in 1978) although at the time of discovery, Pluto was considered a planet.
2. (15874) 1996 TL₆₆ is the first object to be categorised as a SDO.
3. 20000 Varuna and 50000 Quaoar are large cubewanos.
4. The largest dwarf planet Eris is at present the largest TNO; it has one known satellite Dysnomia.

that all plutoids are dwarf planets but the converse is not true.

Why do we study TNOs?

TNOs contain primordial material of the solar nebula out of which the solar system was formed. They were driven far away during the formation of the Sun and the planets. Hence their material is least processed. So, a close examination of these bodies may reveal the nature of the material which formed the solar system. This is very important because till now our knowledge regarding the solar system formation is very limited.

that of other objects. Water ice has been detected on more than 50% of the largest objects. Moreover, methane is found on Eris, Pluto, Sedna and Quaoar. Spectral study of Pluto and Eris has revealed that the methane ice may be dissolved in nitrogen. Crystalline water ice has been spotted on the surface of Orcus. It is not possible to discuss all the results in detail here. However, it can be said that many new findings have already come up and more are due to come in near future. Thus, we find that the study of TNOs can reveal many unknown features that may open up new vistas in planetary science.

(1995). He was awarded honorary doctorate degrees from over 30 countries. He was member of many scientific academies and learned societies. Barton died on 16 March 1998 at College Station, Texas, USA.

Barton believed that the most important quality in academic research is originality, a quality which one can achieve with intelligence, integrity, hard work and sometimes serendipity. Our young chemists should remember Barton's advice to younger scientists: "In the academic world if you know how to do a reaction, you should not do it. You should only work on potentially important reactions that you do not know how to do."

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



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Gujarati	Ahmedabad	Gujarat	Ahmedabad, Bhuj, Rajkot, Godhra	(Mon) 9.30-10.00 PM
Kashmiri	Srinagar	J&K	Srinagar	(Tue) 9.30-10.00 PM
Kannada	Bangalore	Karnataka	Bangalore, Bhadravati, Mysore, Dharwad, Gulbarga	(Sun) 08.35-9.05 AM
Malayalam	Thiruvananthapuram	Kerala	Calicut (Kozhikode), Trichur, Trivandrum	(Wed) 08.00 -8.30 PM
Marathi	Pune	Maharashtra	Nagpur, Ahmednagar, Aurangabad, Pune, Jalgaon, Kolhapur, Sangli, Mumbai-A Ratnagiri, Parbani	(Sun) 07.25-7.55 AM
Manipuri	Imphal	Manipur	Imphal	(Sun) 06.40-07.10 AM
Khasi	Shillong	Meghalaya	Shillong	(Sun) 09.10-9.40 AM
Mizo	Aizawl	Mizoram	Aizawl	(Sat) 8.35-09.05 AM
Nagamese	Kohima	Nagaland	Kohima	(Tue) 12.30 N-1.00 PM
Oriya	Cuttack	Orissa	Cuttack, Sambalpur, Behrampur, Jeypore Bhawanipatna, Rourkela, Baripada	(Sun) 8.30-9.00 AM
Punjabi	Jalandhar	Punjab	Bhatinda, Jalandhar, Patiala	(Sun) 10.00 -10.30AM
Nepali	Gangtok	Sikkim W.B.	Gangtok Kurseong	(Sat) 9.30-10.00 PM
Tamil	Madurai	T.N. Pondicherry	Chennai-A, Combatore, Madurai, Tiruchirapalli, Tirunelveli, Karaikal Pondicherry	(Sat) 08.00-8.30 PM
Bengali	Kolkata	Tripura W.B. Assam	Agartala, Kailashahar Kolkata-A, Murshidabad, Siliguri Silchar	(Sun) 11.00-11.30 AM

(For details see the website www.vigyanprasar.gov.in)

Film as a medium has great potential:

Seema Murlidhara

A renowned science film maker, social journalist, scholar of FTII, Pune, and Director-Producer of Beacon Television, Mumbai Ms. Seema Murlidhara was awarded by 'Golden Beaver Award' at the first "Rashtriya Vigyan Chalchitra Mela and Competition 2011". The country's first science film festival and competition was organised by Vigyan Prasas during the 98th Indian Science Congress at SRM University, Chennai from 4 to 7 January 2011. Prominent film director Dr Adoor Gopalakrishnan presented the award to Ms. Murlidhara for her film 'Bahari Duniya ke Ajab Sanket' under the category 'Popular science programme' in a grand award presentation ceremony on 7 January 2011.

Recipient of many National Awards, Ms. Murlidhara was also felicitated for Best Video Programme for 'FLYER: the History of Flight' at the 16th All India Video Festival, NCERT (2010) held in New Delhi in January, 2011. She is a winner of the 'National Award for Science Popularisation through the Electronic Media 2006' given by Rashtriya Vigyan Evam Prodyogiki Sanchar Parishad (RVSPS, DST). The former President of India, Dr. A.P.J. Abdul Kalam had appreciated her effort in this direction. She has also worked as Senior Producer in Zee TV where she produced many popular shows of Science and Current Affairs including "Hum Zameen", an award-winning wildlife and environment magazine programme. She has produced TV science programme for Vigyan Prasas, DST; Family Planning Association of India; ISRO' NCSM; Nehru Science Centre, Mumbai; DD Bharati and many other organisations.

During the Rashtriya Vigyan Chalchitra Mela and Competition 2011 award ceremony Er. Anuj Sinha, Director, Vigyan Prasas and Consultant, Department of Science & Technology, Govt. of India interacted with Ms Seema Muralidhara on current trends and challenges in

science TV programming. Here are excerpts of the interview.

Er Anuj Sinha: Congratulations for the Golden Beaver Award! How does it feel



Ms Seema Murlidhara

to be honoured and feted? Did you expect this film to bring such recognition?

Ms Seema Murlidhara: Thank you. The Golden Beaver Award was a very pleasant and delightful surprise. It felt truly wonderful because awards like these are a huge encouragement, a positive push to keep striving for more, to keep improving. Film making is a creative process by which we strive to reach more and more audiences. Awards tell us that we are doing our job well. The icing on the cake, of course is the fact that we love what we do!



Ms Murlidharan received National Award for Science Popularization 2006 by Shri Kapil Sibal

No, to be honest! One can never really say that any film in particular would bring recognition or awards. This film had turned out really well considering it was a difficult and specialised subject.

AS: Another of your work has been recognized recently. What was this film about?

SM: 'FLYER-the History of Flight' bagged the Best Video Programme Award in the Secondary & Senior Secondary Section at the recently concluded 16th All India Educational Video Festival organised by NCERT-CIET in New Delhi. This film was made by us for the Visveswaraya Industrial and Technological Museum, Bangalore. The Museum has a scale model of the Wright Flyer. The brief given to us was to showcase it for the visitors to the gallery. It was a challenging assignment and we decided to weave the story of flight around it. It was a great opportunity to present the 'scientific process' how the Wright Brothers built the 'Flyer' and record the many failures that lead to the final success. The film also explained the aerodynamic forces in a simple manner.

AS: You and Shri Muralidhara have worked as a team for several years. How do you divide your responsibilities considering that this is such a creative field?

SM: Murali and I have been working together for the last 15 years with our production house Beacon TV. The fact that we are also a couple does not change anything. Like any creative team, we fight and argue and then decide on what works the best. Very often we edit or shoot sequences in more ways than one (his way and mine) and then decide!

Over the years we have learnt to respect each other's strengths! His is the technical mind and has come to enjoy hands-on editing. All the programmes done by us are edited by him. I, on the other hand, am the 'talker'. I love to write concepts and present them, deal with people, research

and devise the story line. I am also responsible for scripting. We divide the responsibility of directing shoots between us.

We have learnt to give each other 'creative space' and also to keep egos aside. Working together is enjoyable and enriching.

In fact, I give him full credit for teaching me how to write TV scripts in Hindi. He belongs to the South of India and his knowledge of Hindi is limited. So we have this process. I always read all our scripts to him and anything that he does not understand is changed (Our in-house secret to keep the scripts 'simple' and 'understandable').

AS: Does this professional division reflect within your family also?

SM: No, we try and leave work in office. In fact, we have always been a couple and there have been no divisions in housework. We are both hands-on homemakers and parents. We are a nuclear family and have single-handedly juggled home and work. We have always shared chores like cooking, dusting, cleaning, buying groceries, etc. When I am away for work, he is the mother too and when he is away, I step in.

Now our kids are grown up, but there was a time when they were little and Murali used to be home changing diapers and feeding kids when it was my turn to step out for work.

AS: You have done science films for Vigyan Prasar, TV Channels and other promoters. What has been your best experience and why?

SM: 'Aisa Hi Hota Hai' is the first thing that comes to my head. It was a weekly serial and our first 'science for children' show. I was learning the ropes with deadlines. I don't think I have studied that much even in my school and college years. It was an adrenaline pumping experience that I thoroughly enjoyed. The research and the weekly shoots with children, the working models and the analogies, the tight edit schedules and then the high of a 'great response' both from the viewers and the producer. It was a wonderful experience working with DECU-ISRO and Vigyan Prasar. It was a series that taught me much and truly opened the doors of S&T films for Murali and I.

One huge achievement of 'Aisa Hi Hota Hai' was the fact that it proved to us all over again that there is a viewership for such programmes!

AS: In your opinion how could Vigyan Prasar make the process of producing interesting programmes for TV more efficient?

SM: In my view, the timeline of production has to be tighter. The long period taken to produce just 5-6 films raises the costs and a certain amount of creative fatigue sets in. Moreover, there is a multiplicity of experts. VP has its own set of experts and the Directors, their own. Very often, our experts become redundant.

About the interesting bit, one point we would like to make is that the information load in each film needs to be eased. The

content should be lighter and allowed to flow. Very often, we end up putting in too much information.

Last but not the least, though one understands why programming is being done in blocks and divided among different producers, we can't help but say that this causes such a mix of very different styles and treatments that the series does not get a character. Just the shared montage and packaging cannot give a series its character.

AS: Every film maker struggles to attract and retain a talented technical team. How have you succeeded with your crew since there are lean times for science film makers?

About Beacon Television

We are a husband-wife team of H. B. Muralidhara and Seema Muralidhara. Having trained from the FTII as TV News Correspondents and after working with Doordarshan News and Zee TV for a few years, we decided to become our own bosses and grow in a niche field. Information based programming was our forte and we were inclined towards issue based programmes. Beacon Television was set up by us about 15 years ago.

Having started out with programmes for Zee TV (Hum Zameen, Environment & Wildlife), Humare PM ji (Prime Ministerial Politics) and Adarniya Pradhan Mantri (a rights based programme that gave the common man a voice), we soon expanded our client base to Hindujas, Chakra Channel, Star TV, UTV, Doordarshan, and a number of NGOs. Health, Environment and Wildlife, Children's Programmes, Women's Issues, HIV & AIDS became our genre and specialisation.



Tarron Kee Sair followed. Several films for the National Council of Science Museums, ranging from electronics to fun science and bio-technology were produced. There has been no looking back ever since.

Several awards including the National Award for Science Popularisation by RVPS, DST for the year 2006, and the Bronze Tree in Vatavaran have kept us motivated and enthused.

We pride ourselves for the quality of our work. We love what we do and we do it with love!

(as told by Ms. Seema Muralidhara)



SM: We have been lucky. Both, Murali and I are multi-tasking (the only way to control quality and costs)! Between the two of us we manage research and recce, script, editing and even narration. Moreover, we have succeeded in forging long-term professional relationships with cinematographers, directors, experts, researchers, animators and graphic artists. They work with us on a freelance project basis. I think its our discipline and mutual respect as well as the uniqueness of our work that attracts and keeps our team together and interested.

Yes, there are lean times as science film makers but we have come to enjoy these and accept them as time for pursuing reading, hobbies and other interests.

AS: How do you view the talent and spirit of the new generation of film makers from Mass Communication Institutes? Some talent that you have spotted and would like us to follow?

SM: I'm afraid that our interaction with the new generation of film makers from Mass Communication Institutes is fairly limited. I am not in a position to comment on their talent and spirit. I however do watch work by youngsters and while I enjoy their creativity and artistry, I also feel sad that very often they are so caught up with the technique that the content is missing.

Also, there are very few youngsters who are passionate about S & T. The field is relatively 'new' and 'boring', as it has been largely shunned by popular broadcasters. Hopefully, things will change!

AS: The soul of any film is a good script. How are you scouting for talented writers for science and development films?

SM: I'm afraid the answer is a negative. We have not had the need to scout for writers for our science and development films. We both started out as journalists and a journalist always writes one's own reports. We belong to the school of thought that for any good film the director has to know the script and the script writer has to know the subject so the package becomes one. I do hands-on research and script for every film done by us. Being from a non-science academic background, this is the part I enjoy most as it gives me the opportunity to learn and understand. I also feel that being a lay person helps. I am able to break down things to a very simple level and the audience therefore enjoys it!

About the Film : Bahari Duniya Ke Ajab Sanket

The Film 'Bahari Duniya Ke Ajab Sanket' was a part of the Series 'Taarron Kee Sair' produced by Vigyan Prasas during the International Year of Astronomy 2009. It was the fourth of our set of 5 films dedicated to the 'Birth and Life of Stars'. It was a challenging brief largely because we had never tackled astronomy before and were quite ignorant about the subject. In this film we were to talk about neutron stars and pulsars. Our target audience was the lay person and not somebody with an inherent interest and knowledge of astronomy.



We targeted the average Indian family and set out to craft a visual treat that demystified and informed as it entertained. As always, the first task was to understand these spectacular bodies ourselves. We looked for information and high points in research. This done, we realised the potential and decided to give it a sense of drama by heightening the mystery around these astral bodies. The mysterious signals caught by the first ever radio telescopes as well as the ancient Chinese records of the then unknown supernova explosion became dramatic beginnings.

We especially enjoyed making the models for this film. Once IUCAA showed us the model of a shock wave with a bucket and rubber tubing, we used the camera and lighting to create a spectacular

shot. The smoke rings moving out of the bucket illustrating the shock wave was lit up dramatically to enhance the impact.

We also decided to create a visual model for the pulsar. The switched on torch on the turntable that seemed to turn off as it moved away from the camera was devised. It was a simple shot that effectively demonstrated why the neutron star pulsed!

We experimented and innovated in treatment and technique and enjoyed the process of making this film. The award was a welcome endorsement that our hard work and effort was successful!

(as told by Ms. Seema Murlidhara)



AS: Given a generous patron, what would be the subject and treatment of your dream project?

SM: Its a tall wish! :) It would be an anti-superstition and myth busting show. Most definitely that!

This is how I dream about it! A weekly interactive show in a popular slot that is dynamic, hard hitting, investigative, bold, and above all scientific. It would have a mix of health, technology, myth busting and

superstition-exposure. It would need to be a long-running show that gets the time to build up an identity. Topical, rational, ethical and scientific would describe its characteristics not in a preachy way but in a dynamic and entertaining way. People would write in/ phone in. All kinds of questions would be answered. Here facts would not be doled out but things would be explained in a fun and interactive manner.

eg. A baba dips children in 'boiling oil'



Dr Adoor Gopalakrishnan felicitated Ms. Seema Murlidhara with Golden Beaver Award 2011

to cure them and yet people throng to the scamster. He makes money and the child is deprived of medical care. An exposure of the conman would lead to facts about 'boiling' and 'heat energy'. This would lead to how medicine would cure the child and above all expose the 'boiling oil'. How it is not boiling but bubbling due to the addition of lime juice.

This show would promote rational thinking and create a healthier society.

Only I know how it angers me to see that newborns continue to die because their parents think it is healthy to apply cow dung on their umbilical stubs. It is a shame to see large populations thronging to sadhus and babas for a male offspring. It is horrible to see diabetics fasting in the name of religion and women ruining their lungs on polluting chulhas.

It would not be an atheist show but a show with the firm belief that 'Science matters' and 'Faith in self is better than mindless dogma'.

AS: The progress of our society is burdened with large semi-literate and illiterate segments. How do you view the role of the film medium in accelerating the shift to a more aware society?

SM: Film as a medium has great potential with the semi-literate and illiterate sections. It is the visual world the medium that is at their doorstep, inside their homes! It enjoys a credibility and amazing reach.

But this medium can only change mindsets if it becomes more entertaining, lighter and simpler. It needs to address the needs of this population, speak their language: one-to-one.

But film makers like us have to change the challenge posed by the entertainment and the 'TRP' hungry segment head-on. We have to open our eyes to the fact that we are competing with the appealing genre of soaps and sensationalism! So why can we not entertain as we educate?

Moreover, the progress of our society is not just burdened by large 'semi literate' and 'illiterate' segments but also those 'literate' sections that continue to be trapped in dogmas! We need to become more visible and 'lighter'! We need to Infotain without compromising the content!

AS: The developments in ICT will impact on the film medium. How are you preparing for the changes?

SM: We understand that 'change' is the only constant! In fact, our field has been impacted greatly by changing technology! From cameras and post-production facilities to the broadcast platforms, everything has been changing. We keep ourselves in the know of things and are trying to change and adapt. We are also exploring web-based programming as a conscious decision keeping in mind the current scenario.

AS: Thank you for your time and sharing your insights with the readers.

Letters to the Editor

A query about miscarriage

I have been reading the articles by Dr. Yatish Agarwal on medical topics and preserving them as my basic reference. Of course, I have noted the disclaimer at the end of the articles. In the article 'When the Pregnancy Goes Wrong – Tiding Over the Woes of Miscarriage' (Dream 2047, February 2011), you have mentioned, "An early miscarriage often happens around the time that you would have expected to have a period, with bleeding and a similar sort of aching pain."

Is there a possibility of this going completely unnoticed in absence of any other symptom?

Vaidya D V

Ablesoft Computers,
3, Vedanta Gad, 36, Meghana Society,
Sahakar Nagar No. 2,
Pune 411 009.

Educative articles

The biography of Justus Von Liebig is (Dream 2047, November 2010) was excellent and educative. The article on dinosaur dung and evolution of grass was also very informative. I congratulate the editorial team.

Basanta Kumar Das,
B-113, Sector-I,
Damanjodi-763 008
Dist. – Koraput, Odisha.

A worthy publication

I am a new reader of Dream 2047. I find it is really a worthy publication which has established a strong link between the current science and the common reader.

Rupesh Kumar,
Purani Bazar,
Chainpur, Siwan,
Bihar – 841 203.

Complications in Pregnancy

Recognizing the emergency is half the battle won

"Ah, Hope! what would life be, stripped of thy encouraging smiles, that teach us to look behind the dark clouds of to-day, for the golden beams that are to gild the morrow."

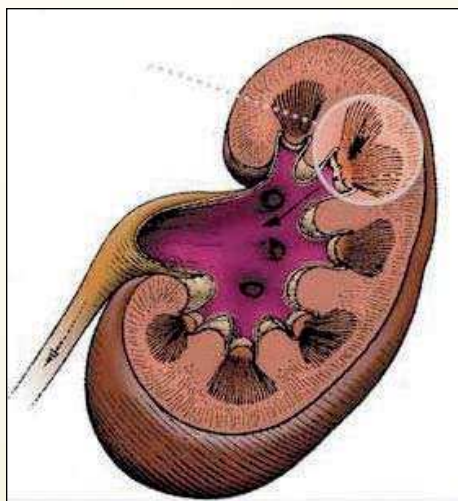
-Susanna Moodie in *Life in the Clearing*



Dr Yatish Agarwal
e-mail: dryatish@yahoo.com

Urinary tract infections

Infections of the urinary bladder, and in the ureter and kidneys, are common during pregnancy. These infections could occur at any time, but are more common after the 20th week of pregnancy.



What makes you vulnerable?

Urinary tract infections are more common during pregnancy because of two factors. One, the enlarged uterus puts pressure on the ureter and this slows the outflow of urine. And two, the pregnancy hormone (progesterone) causes a dilatation of the ureters. This allows the bacteria to travel more easily to the kidneys. Once the bacteria find feet into the urinary bladder, the infection is quick to spread into a full-blown urinary tract infection.

What to do

You must be quick to recognise the first symptoms. If you feel burning or stinging as you pass urine, need to frequently visit the bathroom, suffer discomfort in the lower abdomen, and develop fever with chills, think that you could be having a urinary tract infection. See the doctor.

The doctor will ask you to go for a urine test before starting the antibiotic treatment. You would need lots of fluids and a complete bed rest. Mostly, the results begin to show within 48-72 hours. The fever comes down. The burning also stops. You must, however, continue the treatment for the prescribed period. Stopping the medicine without completing its course can lead to recurrence and a more difficult situation. The treatment usually lasts two weeks.

Toxaemia and eclampsia

Toxaemia of pregnancy or pre-eclampsia is a potentially serious complication of late pregnancy. The condition is marked by a sudden rise in blood pressure, rapid gain in weight from retention of fluid, swelling over the body and loss of protein in the urine. Its onset may be so quiet that it could catch you unawares.

Tell tale signs

You could develop a severe headache, pain in the chest or upper abdomen, vomiting, drowsiness, dimness of vision and sudden

swelling over the ankles, legs, tummy, face, fingers and vulva.

In its more acute form, the onset is more dramatic and it rapidly passes into eclampsia. The mother has convulsions and she may go into coma. Her life is at serious risk and the baby may also die. In some instances, a premature labour may also set in.

Risk factors

Toxaemia is most common in first pregnancies. First-time mothers who are either less than 20 years old or over 35 years are the most likely sufferers. A mother who has suffered similarly during a previous pregnancy or has a mother or sister who suffered toxaemia is also at higher risk. The risk is also higher if there is a previous history of high blood pressure or kidney disease. A twin pregnancy and small-stature women also carry a higher than average risk.

Prevention

The best prevention against toxaemia is to be regular about the antenatal check ups. This way the condition can be diagnosed early. You must have a complete examination with weight and blood pressure and urine assessment done on each visit.

What to do

There is immediate need for specialist medical care. The mother must be admitted to a hospital immediately and put under close monitoring. She will need various forms of medication to control her symptoms. If this does not work, decision is taken to deliver the infant. This can save the situation many times and protect the life of both mother and child. The labour is either induced with the help of a intravenous drip or an emergency Caesarean section is done. If active treatment is not given, the condition carries a very high risk for the mother and baby.



Ectopic Pregnancy

Sometimes a pregnancy goes wrong at the very beginning. After conception, the fertilised egg, instead of moving into the womb, gets stuck in the fallopian tube and begins to grow there. Much less commonly, the fertilisation occurs in the ovary or the egg reaches the cervical canal.

On rare occasions the egg is either fertilised outside the tube or discharged from the free end of the tube after fertilisation; it then gets implanted within the abdominal cavity, establishes a blood supply, and continues to develop. Such pregnancies usually do not survive, although in extremely rare cases they actually go to term. All of them are given the name of an ectopic (out of place) pregnancy.

Causes

A common cause of an ectopic pregnancy is a blockage or an infection in the fallopian tube. For example, the tube may have been damaged by an infection. This produces structural distortion of the tubes. The sperms can move up to the free end of the tube, near the ovary where fertilisation occurs, but the passage is too narrow to permit the fertilised egg to make its way into the womb cavity. There may be number of other factors also. These include a history of a previous ectopic pregnancy, a Caesarean section, pelvic surgery, failed tubal ligation, pelvic tumours, and induced and spontaneous abortion or use of fertility drugs or post-coital oestrogen contraceptives (the morning-after pill) or an existing endometriosis.

Symptoms

Signs of an ectopic pregnancy usually occur after a missed period. The signs are a severe pain on one side—low down in the abdomen, vaginal bleeding, and sometimes feeling faint. If you get a strong one-sided pain and it is possible that you may be pregnant, do not delay. Contact the doctor immediately. There is a serious risk that the bleeding may become so severe that it may lead to shock.

Diagnosis

When all of the signs and symptoms of ruptured ectopic pregnancy are present, the

doctor can diagnose the condition rather comfortably. However, an early diagnosis, prior to rupture, is difficult. Before the pregnancy achieves a certain size, it may be difficult or even impossible for the physician to feel. Further, similar symptoms can occur in a number of conditions. These include pelvic inflammatory disease, endometriosis, rupture or twisting of an ovarian cyst, and spontaneous miscarriage.

The way to an early diagnosis is through the ultrasound and hormonal pregnancy tests. These tests, however, are not totally infallible. That is why doctors sometimes do culdocentesis. In this procedure a hollow



needle is inserted into the lower pelvic cavity through the upper vagina. If there is internal bleeding, blood will be aspirated from this space; and this would support the possibility of an ectopic pregnancy. In some cases however, it becomes necessary to perform an immediate laparoscopic examination. Using a slender, tubular endoscope inserted through an incision in the abdominal wall, the surgeon examines the pelvic cavity in detail.

Treatment

The treatment for ectopic pregnancy depends on the site it has implanted and on the patient's condition. Needless to say, it calls for an immediate hospitalisation, blood transfusions and surgery. Most surgeons prefer a conservative approach whenever possible, particularly if the patient is childless, has fertility problems, or is quite young. It is increasingly common, when the pregnancy has not yet ruptured, for the doctor to open the tube surgically, remove the pregnancy, and close the tube, leaving it in place.

In the past when a woman had to have both tubes removed, the uterus was usually removed as well, since there was no longer a possibility of her becoming pregnant. But with the development of in vitro fertilisation techniques this, of course, is no longer the case, and physicians therefore, preserve the uterus.

Birth of a handicapped baby

The birth of a handicapped baby is an extremely difficult situation. Most parents find it very hard to cope with, even though—because of ultrasound—you may know in advance that you are going to have, or are likely to have, a handicapped baby. Sometimes you may come to know only some months after, when the baby does not show optimum progress in his development.

Many parents, and mothers in particular, have to cope with feelings of guilt and the idea that in some way they have caused their baby's problem. This feeling of guilt is almost always unjustified, but that does not make it less real. It will take time, and the right people around you, and probably a lot of talking, before you can feel better. It is certainly not the time to point accusing fingers at each other.

What to do

It is a responsibility you have been given, and it is your duty to do your best. The need is to get as much support and information as you possibly can. Your treating obstetrician and baby's paediatrician, and your GP may be able to help in this regard.

You would have to look for and find what best help is available in your neighbourhood for your baby, and what treatment opportunities exist. Many children with a handicap do better than able-bodied people given proper support and surroundings. The idea should be to find the best possible treatment for them and not think of them as a burden or punishment. A positive and caring attitude can see the baby grow well and happily.

It may also be a good idea to see a genetic counsellor who has special knowledge about the reasons why such handicap occurred and what would be the chances for the defect to recur when you have a subsequent child.

Recent developments in science and technology

World's largest neutrino observatory completed

Culminating a decade of planning, innovation and testing, construction of the world's largest neutrino observatory was successfully completed in December last year near South Pole. The final string of optical sensors was installed in the IceCube Neutrino Observatory, which contains 5,160 optical sensors on 86 strings embedded in a billion tons of ice, almost two-and-a-half kilometres below the Amundsen-Scott South Pole Station of US National Science Foundation. The detector is a massive ice-bound telescope that fills a cubic kilometre of deep Antarctic ice. The largest part of the IceCube detector is the ice itself. At these depths, it is dark and optically ultra-transparent, allowing the sensors to record the traces of particles from tiny flashes of blue light – called Cherenkov radiation – emitted after a high-energy neutrino strikes one of the water atoms in the ice.

After photons, neutrinos are the most common particle in the universe. A neutrino is an elementary particle that usually travels close to the speed of light, is electrically neutral, and is able to pass through ordinary matter almost undisturbed. This makes neutrinos extremely difficult to detect. Neutrinos have a very small, but non-zero rest mass. As neutrinos have mass, they interact gravitationally with other massive particles, but very weakly.

Neutrinos are created as a result of certain types of radioactive decay or nuclear reactions such as those that take place in the Sun, in nuclear reactors, or when cosmic rays hit atoms. Most neutrinos passing through the Earth emanate from the Sun. Others come from cosmic rays interacting with the Earth's atmosphere, and dramatic astronomical sources such as exploding stars in the Milky Way and distant galaxies. Ever since neutrinos were discovered in 1956, scientists have hoped to decipher the information these astronomical messengers carry about distant



The last sensor is lowered down a hole in the ice as part of the IceCube Neutrino Observatory. (Credit: NSF/B. Gudbjartsson)

cosmic events, but they rarely interact with regular matter. Every second, in the region of the Earth, about 65 billion (6.5×10^{10}) solar neutrinos pass through every square centimetre perpendicular to the direction of the Sun.

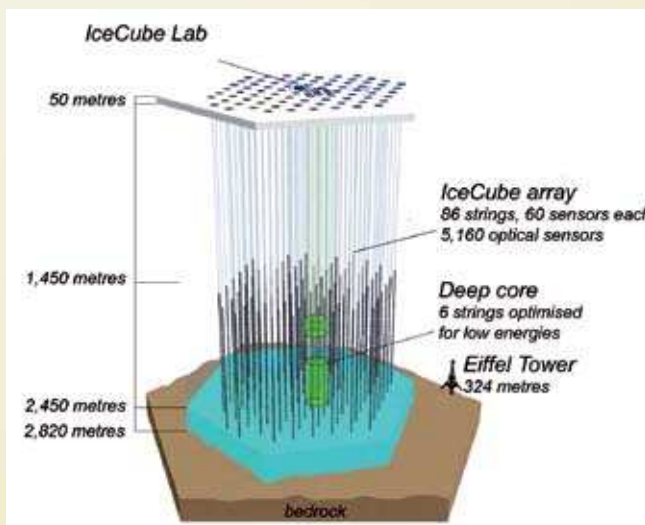
One way to find neutrinos is to wait for the extremely rare occasions when they collide with intact atoms, producing a shower of charged particles. When a charged

particle moves through a very transparent medium, such as clear ice, it fills it with a blue light called Cherenkov radiation. Because the particle goes faster than the light (in the transparent medium), it forms a bow wave like a speedboat in water. From that bow wave, scientists can map the direction of the original particle. The IceCube Neutrino Observatory is designed to detect these occasional flashes of blue light as proofs of the passage of neutrinos.

The main task of the IceCube is to watch for energetic neutrinos emanating from violent cosmic events such as supernovae and gamma-ray bursts. According to scientists of University of Wisconsin-Madison, USA, who are remotely operating the detector, IceCube should provide new insight into the highest-energy processes in the universe. For instance, catching the trace of neutrinos from core-collapse supernovae, some of which emit more than 99 percent of their energy in neutrino form, would allow astrophysicists a clearer look into the mechanism by which stars die. IceCube might also help to reveal the nature of dark matter, an invisible component of the Universe that may consist of one or more types of weakly interacting particles (WIMPs).

The mystery of Sun's hot corona solved

From Earth the Sun appears as a dazzlingly bright disc. But when the bright disc is fully covered by the Moon, as happens during a total solar eclipse, a faint halo can be seen around the darkened solar disc. This is the outermost layer of the Sun's atmosphere called the 'corona', which becomes visible only during a total solar eclipse. The most unusual thing about the solar corona is its extremely high temperature. It has a temperature of millions of degrees Kelvin. This is quite puzzling

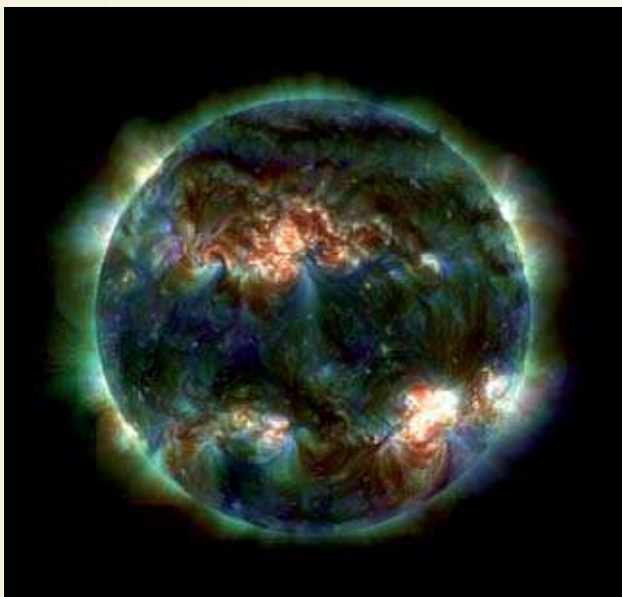


Schematic diagram of the IceCube neutrino detector.



Biman Basu

e-mail: bimanbasu@gmail.com



A false-colour image showing the solar corona: the blue, green, and red channels show plasma at temperatures of 1, 1.5, and 2 million degrees, respectively. The image shows the corona for a moderately active Sun, with some (red) hot active regions in both hemispheres, surrounded by the (blue/green) cooler plasma of the quiet-Sun corona. (Credit: NASA)

because the visible surface of the Sun – the photosphere – has a temperature of only about 6,000 degrees Kelvin, and there is no other source of heat, either internal or external, that can provide the heat to raise the temperature of the corona to millions of degrees Kelvin.

For several decades the extremely high temperature of the corona was thought to be associated with effects of the solar magnetic field, which can store and transport energy from lower regions of the Sun to the corona. However, the details of how this heating took place fully understood. Now observations from a new generation of Sun-observing spacecraft – NASA's *Solar Dynamics Observatory* and the Japanese *Hinode* spacecraft – are indicating a different mechanism, one that could provide the corona with a significant portion of its heat by continually delivering hot ionised gas, or plasma, to the upper atmosphere. The team of researchers led by Bart De Pontieu at the Lockheed Martin Solar and Astrophysics Laboratory in California, USA, have found that short-lived fountains of plasma known as spicules, shooting up from the Sun's chromosphere – a relatively thin layer separating the photosphere and corona – appear to play a role in heating the corona to searing temperatures at millions of degrees

Kelvin (*Science*, 7 January 2011).

After analysing coronal data from the two satellites, the team found that the vast majority of the spicule plasma is only heated to between 0.02–0.1 million degrees Kelvin and sinks back down into the chromosphere. However, the key finding is that a small but significant portion of the plasma is heated beyond 1 million degrees Kelvin and uplifted into the corona. The researchers found this process to be ubiquitous across the Sun.

Although the spicule theory offers a satisfactory and plausible explanation of coronal heating, it does provide a definitive answer. In order to pinpoint the exact role of spicules in coronal heating and to understand

what drives and heats them in the first place, De Pontieu hopes to exploit an upcoming NASA mission – the *Interface Region Imaging Spectrograph (IRIS)*, which is due for launch in December 2012. *IRIS* is designed to focus on the physics of the region between the solar surface and corona, which could provide vital clues for solving the mystery.

Dark matter galaxy detected

Our Milky Way galaxy may have a small companion made entirely of invisible dark matter that is supposed to make up almost 80 percent of the universe. But dark matter does not interact with light and cannot be seen through a telescope like normal matter – it is known only because it exerts gravitational forces on matter we can see. The presence of a galaxy containing dark matter, dubbed 'Galaxy X' was revealed using a new mathematical technique developed by Sukanya Chakrabarti, a post-doctoral fellow and theoretical astronomer at the University of California, Berkeley, USA. The technique is used to analyse the ripples of gas in spiral galaxies.

Chakrabarti and her

colleagues exploited dark matter's indirect effects to solve the conundrum, by using radio telescopes to carefully analyse disturbances in the vast clouds of hydrogen gas at the farthest reaches of the Milky Way. A dark matter-dominated galaxy passing through the gas should leave ripples in the dust that are an indication of not only where the galaxy is, but how big it is. Using the method, Chakrabarti and her team found a set of ripples that indicate a comparatively huge satellite galaxy, 260,000 light-years from the centre of the Galaxy.

The dark galaxy was detected using a technique similar to that used 160 years ago to predict the existence of Neptune. Neptune's gravitational effect on Uranus was seen long before it was viewed through a telescope. The gravitational effects of the invisible dark galaxy on the outer edges of the Milky Way galaxy were similarly used to detect the presence of the dark matter galaxy, which emits no light. The details and findings of these analyses were presented at the 217th meeting of the American Astronomical Society held in Seattle, Washington, USA, from 9 to 13 January 2011. [Paper available at arXiv:1101.0815v1 [astro-ph.CO] 4 Jan 2011]

According to Chakrabarti, who devised the new technique, this is basically a new method to render dark galaxies visible. Chakrabarti's technique is capable of detecting dim dwarf galaxies as small as a thousandth the mass of the Milky Way, and she believes confirming the existence of Galaxy X could lead to the discovery of more nearby dark matter galaxies. In fact,



The Milky Way galaxy beyond which a galaxy made of dark matter has been discovered. (Credit: NASA)

Chakrabarti thinks dark matter galaxies could be lurking in great numbers just outside the Milky Way. With an estimated mass equal to only one hundredth the mass of the Milky Way, Galaxy X is the third largest of the Milky Way's satellite galaxies. The two Magellanic clouds are each about ten times larger. However, being made of dark matter, even a satellite galaxy one-thousandth the mass of the Milky Way would still exert a large enough gravitational effect to cause ripples in the disk of our galaxy, which can be detected from Earth. Chakrabarti has also calculated that the predicted galaxy is in a parabolic orbit around the Milky Way, now at a distance of about 300,000 light-years from the galactic centre. The galactic radius is about 50,000 light-years.

When viewed from Earth, Galaxy X currently sits across the Milky Way somewhere in the constellations of Norma or Circinus, just west of the galactic centre in Sagittarius. According to Chakrabarti, Galaxy X is not likely to be composed entirely of dark matter. It should also have a sprinkling of dim stars, which should provide enough light for astronomers to see it, now that they know where to look.

The reason the dark matter galaxy has not yet been seen is mainly because it lies in the same plane as the disc of Milky Way. Clouds of gas and dust standing between us and Galaxy X, make it difficult to observe through telescopes. Although presence of a satellite galaxy made of dark matter is indicated by the results of the study, now all that remains is to confirm it. That will have to wait until Chakrabarti's collaborators are granted time to use the *Spitzer Space Telescope*. If Galaxy X's existence is confirmed, it would be a major step in verifying our understanding of how the universe condensed from primordial matter and energy after the Big Bang.

Birds use plastic to warn intruders

What is considered garbage by most people is the perfect nest decoration for some birds, and with a specific purpose. Three Spanish researchers led by Fabrizio Sergio, a biologist at the Doñana Biological Station



Black kite (Milvus migrans)

in Spain, have discovered a peculiar trait in birds aimed at keeping predators at bay by using pieces of white plastic in their nests. In a study with the common black kite (*Milvus migrans*), found across Europe, Asia, Africa, and Australia, the researchers found that the birds use scraps of white plastic to signal territorial dominance. These plastic scraps warn off rivals not to challenge the nest owner or attack the nest. Many other

mates. None was known to be specifically aimed at defending territory.

For the study, Sergio and his team catalogued and quantified the nest decorations of 127 nests in Doñana National Park, monitoring the survival of the nest owners and their young for that season to determine whether nest decorators were the fittest of the flock. They kept watch on black kites that had been banded and followed for years in the national park in southwestern Spain.

The researchers also walked along nearby roadsides to find out what garbage was available and compared that with what the birds actually placed in their nests. In one experiment, Sergio's team set out green, transparent, or white, 20-centimeter-square sheets of plastic to determine which ones the birds preferred. The birds completely ignored green and transparent pieces of plastic and went for the bright white stuff that could be seen from far away.

During the study, the researchers found that several weeks before females laid eggs, the birds festooned their nests with pieces of white plastic, the amount of which depended on the fitness of the birds. The fitter birds, which survived better and produced the most young, tended to put up the most decorations (most amounts of white plastic scrap), whereas birds with poorer territories had none. Very old and very young birds also had plain nests.

Thus, nest decorations could be correlated with how fit the birds were. And potential intruders took notice. Birds interested in stealing food or commandeering a nest almost never bothered the nests with most plastic scraps, but plain nests could undergo up to six raids per hour, Sergio and his collaborators reported in their paper. According to Sergio, the plastic appears to be a convenient way of codifying and announcing strength, saving kites from indiscriminate or ill-chosen battles.

This behaviour of the black kite was something totally new. According to Sergio, the results suggest that animal-built structures may serve as signalling devices much more frequently than currently recognised. ■



A black kite nest littered with white plastic scrap. Three eggs can also be seen. (Credit: F. Sergio)

bird species have been known to use human-made objects such as colourful ribbons, trinkets, beads, and even colourful plastic cloth pegs to decorate their nests, but most of were considered to be aimed at attracting

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: “Will a complete ban on plastic carry bags and sachets help prevent pollution of the environment?”

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* March 2011” should be clearly written on the envelope.



Vigyan Prasar

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Winners of “Your Opinion” contest for December 2010

Topic: “In spite of stringent anti-pollution laws and crores of rupees spent on pollution control programmes, why do our rivers and air remain highly polluted?”

Kuldeep Bauddh
Research Scholar (SRF)
Department of Environmental Science
Babasaheb Bhimrao ambedkar University
Raibareilly Road, Lucknow-226025
E-mail: kuldeepenvir0811@gmail.com



The anti-pollution laws and our government alone cannot do anything until and unless every citizen is aware of environmental pollution and its effects. Corruption and politics are mainly responsible for the failure to implement any anti-pollution law or policy. There must be proper planning and control measures and the government should take the initiative to create mass awareness to save environment. It should not be mere political propaganda but should be an integral part of our educational programs. People should understand that if we are degrading our environment we are harming ourselves. Any government at its own level cannot achieve the goals of sustainable development until people play a more proactive role.

Mrs. Jyothi Shrinivas Kadkol,
Muktangan Exploratory Science Centre,
Bharatiya Vidya Bhavan Chowk,
Senapati Bapat Road,
Pune- 411 016, Maharashtra



The anti-pollution laws are stringent but they are not disseminated at all levels effectively. The laws need to be strictly enforced and monitored at all levels without compromise. Corruption and the tendency to compromise have been acting as negative catalysts for the enforcement of the laws. In many cities, sewage treatment units are too few and many do not work efficiently. As a result, sewage goes

directly into the rivers, damaging aquatic life forms and turning rivers into garbage dumps. Similarly, polluting gases such as carbon monoxide, oxides of sulphur and nitrogen continue to poison the air, posing risk to human health. Laws checking vehicular emissions need to be implemented more stringently. Industries need to control the emission of harmful gases. Above all, there is need for greater awareness at all levels.

Mrs. Ch. Kanaka Durga,
Teacher, J.D.A.V. High School, V.S.P. Township,
Madharam, Khammam district – 507 122
A.P.



Ever increasing air pollution can be attributed mainly to lack of an efficient public transport system in most cities. The gap is filled by individual vehicles, causing higher levels of pollution. Spread of concrete jungles has led to destruction of forest lands, further magnifying the problem. Availability of clean fuels like CNG (compressed natural gas) or bio fuels in select cities has been able to tackle the problem of air pollution, but only to a small extent.

Water pollution is mainly the result of untreated waste let into water bodies by various industries. In India people perform many traditional customs in or on the bank a river which adds loads of organic wastes, boost the growth of decomposers leading to foul smell and turbidity. It is time people realise that salvation comes only when man is able to exist on Earth. Crores of rupees spent on pollution control programmes can produce results only when awareness among people increases. Involvement of the masses in these programmes is need of the hour.

'Rashtriya Vigyan Chalchitra Mela and Competition (RVCM) – 2011'



Dr Arvind Ranade briefing about RVCM at opening ceremony



Opening Remark by Er Anuj Sinha, Director, VP, at opening ceremony

During the 98th Indian Science Congress, Vigyan Prasar organised the India's First Science Film Festival at SRM University, Chennai. The festival was held from 4 to 7 January 2011. It was organised to facilitate, nurture, recognise and encourage outstanding Indian science film producers. Jahangirabad Media Institute, Barabanki, UP and Tamil Nadu Science Forum, Chennai were the partners who provided technical and event support respectively. The competition had the three categories; (a) Popular science films (duration more than 20 mts), (b) Short films on science and technology (duration less than 20 mts), and (c) Animation and graphic film/video on science and technology.

This competition attracted outstanding science and technology video film producers

different categories. Out of these, 11 entries in the 'Popular science films' category; nine in the 'Short film on science and technology' category; and two in the 'Animation and graphics film on science and technology' were shortlisted.

During the first three days, the shortlisted science films were screened, which were well received by the viewers. The films under different categories for awards were selected by a national jury comprising well known and prominent personalities of science communication. The jury was lead by Mr Kiran Karnik while Er Gauhar Raza, Mr Amar Kanwar, Mr U. Radhakrishnan, and Mrs Saba Dewan were the other members of the jury.



Dr P. V. Sunil Kumar discussing with film producers & Directors

in the country and set new bench marks for excellence. There were 58 entries received in



Winners of RVCM with Er Gauhar Raza (on chair left), Dr Adoor Gopalakrishnan (on chair centre) and Er Anuj Sinha (on chair right)



Team members of RVCM from VP, Jahangirabad Media Institute, and Tamil Nadu Science Forum with Adoor Gopalakrishnan

The award winners

Category: 'Popular science films'

'Golden Beaver Award'

Film Title : 'Bahari duniya ke ajab shanket'

Film Director : Mrs. Seema Muralidhara,
Beacon Television, Mumbai



'Silver Beaver Award'

Film Title : 'Doorbin ke 400 saal'

Film Director : Sri Rakesh Andania, Credence Media,
New Delhi



'Bronze Beaver Award'

Film Title : 'Butterflies'

Film Producer : Dr Babu Sabastian, State Institute
of Education Technology,
Thiruvananthapuram

Film Director : Sri Suresh Elamon



Category: 'Short films on science & technology'

'Golden Beaver Award'

Film Title : 'Action reaction'

Film Director : Mrs. Anita Gupta, Central Institute of
Educational Technology, NCERT,
New Delhi



'Silver Beaver Award'

Film Title : 'Ants all around us'

Film Producer : Dr Babu Sebastian, State Institute
of Education Technology,
Thiruvananthapuram

Film Director : Sri Suresh Elamon



'Bronze Beaver Award'

Film Title : 'Beyond bicycle'

Film Producer & Director: Sri Matiur Raheman, Television
Programme Company, New Delhi



Category: 'Animation and graphics films on science & technology'

'Golden Beaver Award'

Film Title : 'Pupi-2'

Film Director : Mr. K. S. Madhu, Hibiscus Digital
Media, Thiruvananthapuram



There were no winners for the Silver and Bronze Beaver awards in this category.

The Science Film Festival was inaugurated on 4 January 2011 by Er Gauhar Raza, Eminent Science Film Maker, and Scientist and Jury Member. Er Anuj Sinha, Director, Vigyan Prasar, gave the opening remarks and welcomed the participants. The festival was well attended by enthusiast film makers, producers, delegates, and science communicators.

The award presentation ceremony was held at T. Ganesan Auditorium Hall No. 1 within the campus of SRM University. The Guest of Honour was the prominent film maker Dr Adoor Gopalakrishnan and the Chief Guest was Prof. K. C. Pandey, General President of 98th ISC. The awards were presented by the Dr Adoor Gopalakrishnan and Er Gauhar Raza, member of the national Jury.

'Certificates of Merit'

To encourage the science films makers, Vigayn Prasar honoured the following short listed films by presenting them with 'Certificates of Merit':

- Tahamina Begum from Doordarshan Kendra, Kolkata for the film 'Telescope and Galileo'.
- Sri Bharat Shitole from BHU Entertainment, Mumbai for the film 'Baate Raaj Ki'
- Dr P V Sunil Kumar from Vikram Sarabhai Space Center, Thiruvananthapuram for the film 'Touching the lives'
- Moasunep Kichu, and Subha Das Mollick from EMMRC, St.Xavier College, Kolkata for the film 'History of Sound Recording'
- Producer – National Council of Science Museums, Kolkata for the film 'Aachrya Jagdish Chandra Bose'
- Sri Satish Pandye from Lucrative Eye, New Delhi for the film 'Engineering Marvels- the signature bridge'
- Mrs. Mohuya Chaudhuri from International Aids Vaccine Initiative, New Delhi for 'Quest for an AIDS Vaccine'

Radio Science Serial Review meeting-cum-workshop

Vigyan Prasar, in association with All India Radio, has been producing and broadcasting radio serials on science topics in 19 Indian languages through 117 radio stations spread across the country. For reviewing and assessing the progress and decide ways to enhance the reach of

on the recently concluded serial 'Science in Modern India.' The review brought out the rich variety of innovative formats used by the various groups. In this session it was agreed by all the groups that next 13-episode serial on 'Bio-diversity' may be started from 13 February, 2011.

there was discussion on briefs developed for the serial on 'Chemistry' by Vigyan Prasar. This session was conducted by Shri Kapil Tripathi. Several points in terms of content, format and production were discussed. Participants urged that VP should incorporate important message in all briefs



Session on "S&T for Women Empowerment" at Chandigarh



Participants at Chandigarh Workshop

the serials, two regional meeting-cum-workshops were organised at Chandigarh on 30-31 January, 2011 and at Tirupati on 7-8 February, 2011.

The first workshop in Chandigarh was organised by Vigyan Prasar jointly with, Bharat Gyan Vigyan Samithi, Chandigarh. It covered the languages Hindi, English, Punjabi, Kashmiri and Gujarati. In his keynote address on the first day of the workshop, Dr. T V Venkateswaran underlined the role of radio in communicating the method of science and scientific temper to the masses. In this session Mrs. Kinkini Dasgupta Mishra spoke on Gender Communication. Shri Kapil Tripathi briefed the participants about the purpose of the two-day review meeting-cum-workshop. After a round of introductions, representative from All India Radio and resource groups explained the status of the project and discussed feedback

In afternoon session, there was a detailed discussion on proposed serial on 'S&T for women empowerment'. The session was conducted by Mrs. Kinkini Dasgupta Mishra. Lots of suggestions came out from the participants during the discussions which will be incorporated in briefs to be given to writers for the development of scripts.

On next day, i.e. 31 January 2011,

to help the script writers.

The second workshop was organised at Tirupati on 7 and 8 February 2011. It was organised in association with Jan Vigyan Vedika, Andhra Pradesh. The languages covered were Telugu, Tamil, Malayalam, Kannada, Marathi and Konkani.

In this workshop also, all the issues related to the serial on 'S&T in Modern India', 'Biodiversity', 'S&T for women empowerment', and 'Chemistry' were discussed in similar manner as was done at Chandigarh. All the participants actively participated in each session and suggested important points which may be incorporated in the briefs developed by Vigyan Prasar. Issues related to content, format, strategies, and deadlines of all proposed serials were discussed. Dr. T V Venkateswaran conducted the session on 'S&T for women empowerment' and Shri Nimish Kapoor took a session on



A view of Radio Workshop at Tirupati



Participants at Tirupati Workshop

'Chemistry'. Participants were of the view that the serial on 'Chemistry' should be of 26 episodes, instead of 13 episodes, because all major issues of chemistry cannot be covered

in the proposed 13-episode serial. Seventeen more topics for the serial on 'Chemistry' and the experts to develop briefs on these subjects were also discussed. Shri Kapil Tripathi presented an overview of radio programmes of Vigyan Prasar.

In both the meetings it emerged the VP's radio serials are well received in majority of languages and there is a need for strong publicity

for reaching a larger audience. A regional workshop for North East and Eastern region will be organised in the month of March 2011 at Kolkata.

Science Expo-2011 organised in Lucknow

'Science Expo-2011' was organised during 19-23 January 2011 in Regional Science City, Lucknow in which about 22 scientific research institutes from different parts of the country and Lucknow participated. Publications of Vigyan Prasar were displayed at the Expo.

The State Minister for Science, Abdul Mannan inaugurated the Science Expo. He said that such kind of events can help in the dissemination of science in the society. Some

of major participants of this Expo were Biotech Park, Lucknow; Birbal Sahni Institute of Palaeobotany, Lucknow; Central Drug Research Institute, Lucknow; Science and Technology Council, Uttar Pradesh; DRDO; INSA, Lucknow Chapter; and Lucknow University. Nimish Kapoor, Manish Mohan Gore and Manbir Makhloga represented Vigyan Prasar in this event.

In the discussion session with children, Nimish Kapoor, Scientist, Vigyan Prasar briefed the children about the making and activities of VIPNET clubs (Vigyan Prasar Network of Science Clubs) and answered questions regarding such clubs.



Chronicle-Vigyan Prasar Science Quiz Programme



Vigyan Prasar and Chronicle has decided to publish a Science Quiz every month starting from February, 2011 for the period of one year in Civil Service Chronicle Magazine both in Hindi and English. This magazine is published by Chronicle, Noida. This programme will be as a part of International Year of Chemistry 2011 (IYC). The objective of the quiz programme would be to create interest, awareness towards this subject among youth so that they would be able to know about the importance of Chemistry in day to day life. Vigyan Prasar will prepare a questionnaire every month both in Hindi and English and will select five winners from Hindi and English quiz for the prizes. These prizes will be given by Vigyan Prasar in terms of its publication.

Scientific Awareness Conference



A Scientific Awareness Conference was organised by Vigyan Jagarukta Samiti on 2 December 2010 in a suburban town named Barhalganj in Gorakhpur district of eastern Uttar Pradesh. On this occasion the renowned Indian molecular biologist Dr. Lalji Singh encouraged the children to do science and to become scientists. Vigyan Prasar also participated in this conference.