



# Bringing up our Sisters



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Women are heading an increasing number of households due to several factors including widowhood, divorces, separation and abandonment (the causes for which are to be found in civil unrest, social and cultural factors and environmental upheavals.) Women work not to supplement income but in about 30% cases (perhaps the current census will yield a more robust estimate) they are the main and often only the support for the family.

Community development efforts must specifically address women's needs of food and shelter. In male-headed households these needs are neglected and women remain the poorest member within a poor family and generally are not in the forefront when aid is distributed or benefits of development reach a family. In women-headed homes these issues are often magnified and distorted due to problems of ownership and rights. Such strategic needs require urgent attention of planners and workers.

Some scientists and engineers have joined social workers and development officers in accelerating the pace of development. Technology based solutions have resulted in generating higher incomes and improving livelihoods. A key factor of every such project is sustaining the income at the completion of the intervention and withdrawal of external agents. The approaches of development agencies have evolved through the last few decades from

'welfare' to 'participatory development' in most societies. Successful models need to be widely replicated.

An intervention based on a technological solution requires adaptation and innovation in the laboratory and rework at the field through several iterations till it is adopted by the community. The researcher has to be skilled and talented in addition to being committed to the cause for such sustainable development. Most of us are trained to specialise in narrow disciplines and are not very alert to the context including seemingly unrelated factors that can result in aborting an intervention.

This column has skimmed over several interesting facets of the process of development including theoretical constructs and the necessity to delve deeper into current gender debates. Interested readers can be guided to books, theses, authoritative references and seminal research papers on the subject.

Issues of technology communication will be the focus now. What are the factors inhibiting the transfer of appropriate technology to the people who will use it? Can the process of technology diffusion and extension for empowering women be made more efficient? Have we utilised lessons from other interventions – successes or failures – to reduce the length of the learning curve? Has feedback and independent analysis been dispassionately documented and studied? Are there

enough case studies documented to guide the current generation of development workers? Are the challenges and rewards of field work attractive to the young generation of engineers and technologists?

Science and technology communicators, it is hypothesised, are neglecting a wide range of development issues in their current pursuits. Working with print or electronic mass media, or the new digital formats many of them have the necessary competence and several opportunities to engage in some aspects of the process of technology extension and development. From profiling such researchers to features on field work there can be a wide spectrum of opening for them. Analysis even within the constraints of development journalism can be a vital independent input for development agencies.

A dialogue organised in Delhi some weeks back has revealed areas of neglect in technology communication for gender empowerment and recommended moves that can foster and nurture it. These range from immediate action by Vigyan Prasar as well as by other laboratories, universities and field groups (a brief report is elsewhere in this issue). The process needs support, consultation and constructive criticism. This facet of communication has to be strengthened and within a reasonable time period.

□ **Anuj Sinha**

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**Editor: Er Anuj Sinha**

# Amedeo Avogadro

## Founder of the Atomic-Molecular Theory



Subodh Mahanti

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“Most important, at the outset, the birth (or rather, rebirth) of atomic theory enabled Dalton, Avogadro and those who followed to begin to make sense out of the rules of chemistry—how substances reacted and bounded with each other—as well as the properties of gases.”

Ray Spangenburg and Diane K. Moser in *The History of Science in the Nineteenth Century* (1999)

“Avogadro’s Law shows that simple gases hydrogen and oxygen are diatomic ( $H_2$  and  $O_2$ ) and that water is  $H_2O$  (and not  $HO$  as Dalton believed). However, the law was largely rejected or ignored for 50 years (although Ampere accepted it) until Cannizzaro in 1860 convinced a Chemical Congress at Karlsruhe of its value.”

*The Cambridge Dictionary of Scientists* (2002)

“Avogadro’s work provided the essential link between Gay-Lussac’s law of combining volumes and Dalton’s atomic theory. This was not, however, realized at the time and, as a consequence, the determination of a self-consistent set of atomic weights was delayed for 50 years. The French physicist Andre Ampere was one of the few who accepted the theory and for many years it was taken to be Ampere’s own.”

*A Dictionary of Scientists*, Oxford University Press, 1999

Lorenzo Romano Amedeo Carlo Avogadro di Quaregna e di Cerreto, Count of Quaregna commonly known as Amedeo Avogadro is one of the founders of the atomic-molecular theory. Avogadro’s hypothesis proposing that equal volumes of gases contain equal number of particles (molecules) is one of the most fundamental concepts of chemistry. The hypothesis later became known as Avogadro’s Law. As we know, in science when a theory is proposed without any experimental verification it is called hypothesis, and when such theory is proved by experiments it becomes a law. Avogadro’s hypothesis was not given its due importance in his lifetime, but when it was finally accepted it changed the very face of chemistry. Avogadro was the first to use the word ‘molecule’ and made a clear distinction between ‘atoms’ and ‘molecules’. Avogadro proposed that gases were composed of molecules, which in turn were composed of atoms. It was a great leap in scientific thought that Avogadro caused. He made it clear that a single atom was not necessarily the basic building block of gases. It should be noted that Avogadro did not use the word ‘atom’. In those days the words ‘atom’ and

‘molecule’ were used almost synonymously. Avogadro believed that there were three kinds of molecules—‘integral molecule’ that



Amedeo Avogadro

is a molecule of a compound; ‘constituent molecule’ that is the molecule of an element which could consist of more than one particle; and ‘elementary molecule’, which was actually the atom that we know today.

He also used the term ‘molecule’ in general sense meaning both atom and molecule.

Avogadro was a religious man and he led a simple life. He never sought honours for his work. Unlike many of his contemporaries he also did not take part in any debate over the priority of his work.

We do not have much information on Avogadro’s private life. Amedeo Avogadro was born in Turin, Italy, on 9 August 1776 in a noble family. His parents were Count Filippo Avogadro and Anna Maria Vercellor. Avogadro’s father was a very influential person. Besides being a count, he was a distinguished lawyer, senator, advocate-general and president of the senate.

Following his father’s example, Avogadro decided to pursue a legal career. In 1792, he became a bachelor of jurisprudence and then after four years he obtained a doctorate degree in ecclesiastical law. While pursuing a successful legal career Avogadro became interested in physical science (or in natural philosophy, as it was called in those days). In 1800, Avogadro started studying mathematics and physics privately. By 1803 Avogadro started studying electricity. His interest in electricity was inspired by the pioneering work in electricity by Alessandro Volta (1744-1824) who was also an Italian. Avogadro’s brother also joined him in his study on electricity. Together they carried out a number of experiments on electricity which were responsible for their nomination to the Royal Academy of Sciences in Turin.

In 1806, Avogadro took up the post of demonstrator at the Academy of Turin. In 1809, he was appointed as a professor of natural philosophy at the College of Vercelli. He was selected for Italy’s First Chair of Mathematical Physics created at the University of Turin in 1820. However, by July 1822 he became jobless. This was because Avogadro was thought to be associated with the movement against the King of Sardinia. Avogadro was reappointed



*Alessandro Volta*

at the Turin University in 1833 and worked there for another twenty years.

In 1809, the French chemist Joseph Louis Gay-Lussac (1778-1850) demonstrated that all gases expand to the same extent if subjected to an equal rise in temperature. While trying to explain Gay-Lussac's observation, Avogadro formulated his famous hypothesis (1811) which states that equal volumes of all gases contain equal numbers of particles (molecules) at the same temperature and pressure. The hypothesis later became known as Avogadro's Law.

Avogadro's hypothesis was presented in his paper titled "Essay on Determining the Relative Masses of the Elementary Molecules of Bodies and the Proportions by which They Enter these Combinations". The paper was written in French (not Italian) and it was published in a French journal—De Lametheries Journal of Physics, Chemistry and Natural History. It may be noted here that in those days Italy was under the rule of the French Emperor Napoleon Bonaparte. Avogadro in his paper wrote "M. Gay-Lussac has shown in an interesting memoir...that gases always unite in a very simple proportion by volume, and that when the result of the union is a gas, its volume is very simply related to those of its components. But the quantitative proportions of substances in compounds seem only to depend on the relative number of composite molecules, which combine, and on the number of composite molecules, which result. It must be then admitted that very simple relations also exist between the volumes of gaseous substances and the

numbers of simple or compound molecules, which form them. The first hypothesis to present itself in this connection, and apparently even the only admissible one, is the supposition that the number of integral molecules in any gas is always the same for equal volumes, or always proportional to the volumes."

He further wrote "...we suppose... that the constituent molecular of any simple gas whatever...are not formed of a solitary elementary molecule, but are made up of a certain number of these molecular united by attraction to form a single one."

Avogadro's hypothesis made a distinction between molecules and atoms. Molecules of a gas were defined as smallest entities which could exist independently with same properties as those of the gas and molecules were composed of atoms. Molecules could be made up of two atoms (diatomic), three atoms (triatomic), four atoms (tetraatomic), and so on.

According to Avogadro's hypothesis at a given temperature and pressure equal volumes of gases contain same number of particles or molecules. So, from the ratio of the weight of equal volumes of two gases we can get relative weights of the two particles and this relative weight of a gas relative to a standard gas may be defined as its molecular weight.

The volume of one mole of any gas at 0°C and one atmosphere pressure is 24.42 litres. Now as per Avogadro's hypothesis equal volumes of gases contain equal number of particles or molecules and so the number of particles in one mole of any gas would



*Joseph Louis Gay-Lussac*



*John Dalton*

be the same irrespective of temperature and pressure of the gas. This number is called Avogadro's number.

Avogadro's hypothesis raised serious controversy throughout the first half of the nineteenth century. In fact most of the well-known chemists and physicists of his time rejected Avogadro's ideas. In order to understand why Avogadro's idea was rejected in the beginning we need to realise the fact that when Avogadro published his hypothesis, chemistry was yet to become an exact science. It is true that the Law of Definite Proportions and the Law of Multiple Proportions had been accepted by chemists and the English chemist and physicist John Dalton (1766-1844) had published his New System of Chemical Philosophy elaborating his atomic theory. However, though Dalton had asserted that each element had a characteristic atomic weight and it was atoms which were the combining units in chemical reactions, he had no accurate method for determining atomic weights unambiguously. The result was that he made the incorrect assumption that in most common (or the simplest) compound formed of two elements, there was one atom of each. For example, he considered water (the most common compound of oxygen and hydrogen) as HO and not H<sub>2</sub>O. There was a deeply rooted conviction among chemists that chemical combination happened because of an affinity between unlike elements. After the pioneering works of the Italian physiologist and physicist Luigi Galvani (1737-1798) and Volta on electricity became known



Luigi Galvani

to the chemists, the affinity between two unlike elements was thought to be attraction between unlike electrical charges. So the idea proposed by Avogadro that two identical atoms of hydrogen might combine into molecular hydrogen was rejected on the assumption that like atoms would repel. In fact the Swedish chemist Jons Jakob Berzelius (1779-1848) was strongly advocating his "dualism" theory according to which one half of a compound substance had to have a positive charge and the other half a negative charge so that two halves are held together. And chemists of Avogadro's time found it difficult to comprehend how two atoms of oxygen or two atoms of hydrogen in one of Avogadro's "molecules" could have different charges.

There were other reasons for not accepting Avogadro's theory. In those days chemistry was purely an experimental science. Avogadro did not carry out any experiments; he arrived at his theory by purely rational arguments and chemists of his time were not prepared to believe in something which was not proved by experiments. Avogadro did not have much interaction with the prominent chemists of the day. He was a self-taught chemist.

The studies of Charles Frederic Gerhardt (1816-1856) and Auguste Laurent on organic compounds showed that Avogadro's law was indispensable in explaining why same quantities of molecules brought to vapour state attain the same volume. However, subsequent studies on inorganic compounds showed certain exceptions. Later the Italian chemist

Stanislo Cannizzaro (1826-1910) observed that such exceptions occurred because of molecular dissociation that took place at certain temperature. Cannizzaro forcefully restated the Avogadro's hypothesis at the first international chemical conference at Karlsruhe, Germany, where a total of 140 delegates from different parts of the world had gathered including many of the most prominent chemists of the day. Cannizzaro demonstrated that Avogadro's hypothesis was the key needed to unlock the problem of atomic and molecular weights. Besides his forceful speech in favour of Avogadro's theory he also circulated a pamphlet on the subject. Cannizzaro succeeded in making the chemists convinced about the significance of Avogadro's theory.

Avogadro's law gives a direct method of finding the molecular formula of a gas, which in turn gives the relative atomic masses of the elements present in it. The SI base unit of amount of substance is the mole, which is related to Avogadro's law. The standard 'unit' of the amount of substance or mole is taken as the relative formula mass of the substance in grams. Mol is the shortened form of mole or moles. The mole is usually defined as containing as many elementary entities, (usually atoms or molecules as the case may be) as there are atoms in 0.012 kg of carbon-12.

The number of particles in one mole number is called Avogadro constant (its symbol is  $N_A$ , sometimes  $L$  is also used as its symbol). The value of Avogadro's number is 602,000,000,000,000,000,000



Andre Ampere



Stanislo Cannizzaro

0,000 ( $6.02 \times 10^{23}$ ). It may be mentioned here that Avogadro constant replaced Avogadro's number when mole was introduced as a separate base unit in the International System of Units (SI) in 1971. The introduction of mole recognised the amount of substance as an independent dimension of measurement. The Avogadro constant is not just a pure number but it is physical quantity associated with a unit of measurement. The Avogadro constant is  $6.02 \times 10^{23} \text{ mol}^{-1}$ .

How big is the Avogadro number? If you have rupees equivalent to Avogadro's number then it cannot be spent at the rate of one billion rupees per day over a trillion years. The value of Avogadro's number was first calculated by Johann Josef Loschmidt in 1865. The symbol  $L$  for Avogadro's number indicates the connection of Loschmidt with Avogadro's number. The French physicist Jean Perrin in 1909 proposed naming the constant in honour of Avogadro.

The Avogadro constant enables chemists to determine the exact amount of substance produced in a given reaction. The Avogadro constant provides the link between the gas constant  $R$  and the Boltzmann constant  $k_b$  ( $R = k_b N_A$ ). Similarly it also links the Faraday constant  $F$  and the elementary charge  $e$  ( $F = N_A e$ ). The earliest accurate method to measure the value of the Avogadro constant was based on coulometry. This method used the equation  $F = N_A e$ , where  $F$  is the electric charge carried by one mole of electrons.

Avogadro died on 9 July 1856 at the age of 79.



J.J. Berzelius

King Victor Emmanuel III attended the meeting held at Turin in 1911 to commemorate the hundredth anniversary of the publication of Avogadro's classic 1811 paper. A lunar crater has been named after Avogadro.

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(The article is a popular presentation of the important points on the life and work of Amedeo Avogadro available in the existing literature. The idea is to persuade the younger generation to know more about Amedeo Avogadro. 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.)

## NOMINATION FORM FOR TRAINING PROGRAMME ON INNOVATIVE EXPERIMENTS IN PHYSICS

Vigyan Prasar is organizing six regional Training programmes in East, West, South, North, North-East, and Central India during August to October 2010. The objective of this training programme is to illustrate and demonstrate a series of novel activities that may help enhance interest in physics amongst students and teachers. Activities aim at conceptual understanding of Physical phenomena rather than verification of experiments described in a text book. The experiments were jointly developed by Department of Physics, Indian Institute of Technology, Kanpur and Vigyan Prasar.

If you are a physics teacher/science communicator and willing to attend this workshop, kindly send us information as per the details below.

### INNOVATIVE EXPERIMENTS WORKSHOP 2010

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6. PHONE : .....
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8. Have you developed any low cost or otherwise Innovative experiments/teaching aid in physics? If yes, brief description with photograph. Use additional page, if required.
9. Have you attended any workshop based on innovative experiments in Physics? If yes, specify date, organizer and your contribution, if any?
10. If you are a working teacher, kindly give your School address, with phone/fax number and your nomination should be endorsed by School Principal)

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*(The workshops will be organized in Chandigarh, Mumbai, Hyderabad, Kolkata, Shillong & Bhopal. After the selection, each nominee will be informed by Vigyan Prasar individually about the exact dates/venue etc.)*

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# “Youth must be ambitious”

## L. N. Jhunjhunwala

Shri L.N. Jhunjhunwala established his first industry of 12,000 spindles at Bhilwara in Rajasthan and today controls 470,000 spindles in Madhya Pradesh, Rajasthan, and Karnataka. He ventured into high-technology graphite electrode industry in 1979 and operates the largest plant in Asia today. He established the first Hydel power plant of 90 MW capacity in the private sector in a record period of two-and-a-half years in Himachal Pradesh is now constructing 11 power projects with a total generation capacity of 12,000 MW. The teachings of Gandhiji and Acharya Vinoba Bhave have deeply influenced Shri Jhunjhunwala, who is now leading the higher education work of Ramakrishna Mission. He is Chairman of the Indian Institute of Management, Indore.

Recently Er. Anuj Sinha, Director, Vigyan Prasar and Consultant, Department of Science & Technology interacted with Shri Jhunjhunwala on issues of science, technology and industrial development in India. Here are excerpts of the interaction.

*DREAM 2047:* You were fascinated with the study of advanced mathematics and inspired by Dr Satyendra Nath Bose. Please give us some glimpses of this personality.

*LNJ:* I was a student of Dr Satyen Bose in 1947 – the year in which India got its independence. If I remember correctly, we were not more than six students in post graduate pure mathematics. Dr Bose had a well-built stature – absolutely fair coloured, long head with snow-white hair. He used to be dressed in a white dhoti and a white kurta and looked like an ancient vedic rishi. He was so fond of me that he was very disappointed when I discontinued my study of mathematics to join business. Astronomy was my favourite hobby. This got further intensified during my occasional stays at Vinoba Bhave's Ashram in Wardha.

Dr Bose never mentioned to us about his great discoveries in the field of electromagnetic properties of the ionosphere, the theories of x-ray crystallography and

thermoluminescence, and unified field theory. Bose's inputs on Planck's law and the hypothesis of light quanta (1924) led Einstein to seek him out for collaboration. After Dr. Bose got success in some of his discoveries, he formulated a theory and called it Einstein-Bose Theory. But Einstein responded that Bose had a major contribution in the work and it would be called Bose-Einstein Theory.

*DREAM 2047:* How do you assess the learning and teaching of mathematics in high schools today and what can be done to improve the ground situation?

*LNJ:* My interest in mathematics continued because of my interest in

students. The sessions were very interesting and the students were absolutely absorbed. Dr. Singh was able to completely change the attitude of our students during his interactions on the last day. Recently Dr. Singh organised a one-week mathematical workshop for talented students from all parts of India on the study of astronomy at Jantar Mantar, New Delhi. A team of our students joined and the atmosphere was completely different with a lasting impression on the participants. I am in touch with so many educational institutions. Mathematics scares most of the students, if teachers are oriented by people like Dr. Singh, things would be different. Vigyan Prasar may continue encouraging such activities.

*DREAM 2047:* Astronomers in ancient India contributed enormously to our understanding of the Universe and they did not have sophisticated instruments. Over the centuries we have lost the rigour of observation, documentation, survey and research. There is high priority for work in this area with national research institutes at Bangalore and Nainital. How can modern astrophysics advance in our country?

*LNJ:* It is true that our ancient rishis were very keen observers. The world is grateful to our country for having given concepts of zero

and, around which the entire modern mathematical science has been developed. There are so many national institutes in the country today. I recall the year 1893 when Swami Vivekananda happened to be travelling from Japan to America. Jamshedji Tata was also travelling on the same ship. They had long discussions on higher education in India. After five years, in 1898, Swami Vivekananda got a letter from Jamshedji that he had earmarked a large sum of money for a research institute at Bangalore. He requested Swami Vivekananda to be the leader of the institute and implement the project. It is a long story that we will stop here. The proposal needed the approval of the British government that took seven years. This kind of deep involvement which



*Science Scholar & Industrialist Shri L.N. Jhunjhunwala (left) with Er Anuj Sinha*

astronomy where long calculations were involved. I noticed in my own high school complex in Bhilwara, run with the active assistance of Ramakrishna Mission, that students were scared of mathematics. In my time trigonometry, calculus, solid geometry, etc., were taught in the graduation course in the college. Today these are taught in high school or even earlier. Computers were not known in my times and now there cannot be a school without computers. Once I told the Director of Delhi University, South Campus Dr. Dinesh Singh that students are scared of mathematics. He was convinced that mathematics can be made very interesting and at my request he sent a team of two mathematicians to my educational complex in Bhilwara for a three-day presentation to

Jamshedji had and his faith on the monks helped in setting up this institute. The great CV Raman, who got the Nobel Prize in 1929, has been one of the early Directors of the institute. But people like Jamshedji and Swami Vivekananda are no more.

Your efforts in explaining the science of eclipses is commendable. We have in Delhi the Nehru Planetarium that I visited a few times. It is inspiring to be there and particularly when the director shows us the wonders of the sky. The long queues at midnight there to watch the comets through telescopes when they are visible show the keen interest of the students, but somehow the same excitement is not there in our universities. Advanced level studies need to be made more challenging with field trips and projects to attract talent and support interns of fellowship must be enhanced to retain such scholars in research.

*DREAM 2047:* We are among the last few regions in the world that have jute as a resource. The jute industry has witnessed high rates of growth and years of poor performance due to myriad reasons. Technology now is available for blending jute with a large variety of fibres to give specialised products for new uses. How do you envisage the future of this industry?

*LNJ:* Whatever I am today is because of my involvement in the jute industry. India had become free in 1947. We were so proud of the fact that India had the monopoly of jute even though partition of our sub-continent had broken this monopoly. Export of jute goods was controlled by a tight quota system. Exporting jute goods had become a highly profitable business due to quotas. There happened to be a jute mill in Nepal. I got a brilliant idea of exporting Nepali jute goods outside India. This was a good business strategy. Adequate research and development could have, I feel, given diversified products at lower costs.

*DREAM 2047:* From jute you moved into textiles and then a high-end industry-graphite electrodes. Was there a design in these strategic moves?

*LNJ:* After I had some money from jute, I was keen to enter some industry. I managed to get a license for a mill in Rajasthan. Although I did not have sufficient funds, I was able to form a group of four partners for implementing a textile project. Many hurdles came our way due to poor infrastructure and competition. All

these challenges made my resolution very firm. God has been kind and I succeeded in making my products the best in India, which were used by some of the traditional units in preference to their own products.

It was a challenge – getting a loan from Industrial Finance Corporation of India (IFCI). I met the Dy. Governor of Reserve bank of India (RBI) who used to be in-charge of IFCI. Some people complained to him that I was a smuggler. I tried to convince him that I had no interest in smuggling. I was surprised when he saw the lines of the palm of my hand and cleared my loan request.

I had established myself in the textile sector and I felt that I should take up a bigger challenge. I started exploring the possibilities of entering an area that would test my international management skills.

In 1969, I happened to meet Shri T.N. Chaturvedi who was heading the India Investment Centre in Delhi (and who later became the Election Commissioner). He had a hobby of reading books and when he used to come to Calcutta (now Kolkata), he used to stay with me and spend spare time in the second-hand book shops of College Square looking for rare books. He suggested to me to take up graphite electrodes. We started with a production of 5,000 tons 1979 and today we produce 60,000 tons out of which 50,000 tons are exported to South Korea, USA, Japan and other countries. We are the second largest producer in the world now.

*DREAM 2047:* I hope Reserve Bank now has decision makers who base their recommendations on better foundations. Sir, the Greenfield hydel power plants were to take more than 36 months to complete. Your company completed it in 30 months. What are the key lessons for the industry and the government?

*LNJ:* Graphite electrode success with all the challenges gave me lot of confidence nationally and internationally. The power sector was opened for the private sector in 1980. I knew nothing about power sector except that this was one area where India will have shortage for decades. I therefore, decided to take interest in MP and HP. HP government in 1984 was considering six projects. I trekked to the sites that needed trekking for 8 to 10 kilometres in unknown areas with no foot tracks or pathways. Nobody else had taken these troubles and I was selected and given two power projects – one at Malana for 100 MW and the other

at Allain Duhangan for 200 MW.

Canada produces the maximum hydel power in the world. One of my textile executives happened to be in Montreal those days for some negotiating collaboration. I suggested to him to meet executive of Hydro Quebec in Montreal to find out whether they can help us technically and/or financially in the hydel projects. They jumped in and showed great enthusiasm.

Hydel power is a capital-intensive project. Even though we had acquired a good stature, it was not enough for large capital investments like those required for hydel projects.

I had to go through tremendous difficulties, but ultimately I could line up everything and the construction work started on the site. The whole team was highly motivated. The normal schedule for a hydel project was 5-6 years those days, largely in the public sector, which involved a lot of delay in decision-making. I was deeply involved in the implementation of the project. I consulted my Canadian friends who made a detailed bar chart for me to complete the project in two years. To monitor this project we started a consultancy company in India in partnership with the Canadian company. There was day-to-day-follow up. Daily targets were fixed and in the last ten days hourly targets were fixed. Finally the project was completed in 2 ½ years a record time.

*DREAM 2047:* You have been a student of Gandhiji and a follower of Vinobaji and in many ways have followed their teachings in your professional and personal life. What is your message to the new entrepreneurs and the next generation of industrialists?

*LNJ:* I have been an intensive student of Mahatma Gandhi. I read every line of his biography by D.G. Tendulkar, which is about 4,000 pages. My admiration for Vinobaji and my stay in his ashram at Pawnar, sometimes for 20 days at a stretch, gave me an insight into their style of working at the grassroots.

Gandhiji was an extraordinary man. India has every reason to be proud of him. Industrialists have much to learn from the high standards Gandhiji set for himself. Ends did not justify wrong means. That is the lesson we need to internalise.

*DREAM 2047:* Sir, you have spent time on learning classical music from the best practitioners in the country. Are you able to find time to follow your passion on

vacations or free time? How do you propose to nurture this interest?

LNJ: Yes. I have been a student of classical music of the greatest dhrupad singer of my time Shri Aminuddin Dagar at Calcutta. After his death, I took lessons for Dagar's nephew. When he too passed away, I requested his son Vasef Ali Dagar to improve my skill. Time is a great constraint now, yet I enjoy listening to classical music and I get lost listening to it.

DREAM 2047: The management institutes and indeed all centres of learning have to prepare the skill sets of their graduates to be useful for the next three / four decades. How are you guiding IIM, Indore to remain relevant to the needs of the industry for the next thirty years?

LNJ: I have been the Chairman of IIM Indore for the last three years. This is an opportunity to be with the best academic people and they interact with the most talented students. I must admit that I am neither frustrated nor inspired by faculty. I possibly have too high expectations from them. I thought at least one will win a Noble Prize in economics.

DREAM 2047: You have a truly multi-dimensional personality. Besides your entrepreneurial acumen, you have done serious trekking, been a film maker, been a shishya of dhrupad with the best masters and authored important books. How did you evolve so many skills and perform at such high levels in such widely different sectors?

LNJ: I am flattered by such words. Yes, I have been involved in many activities. Business on one side, astronomy, trekking, Ramakrishna Mission, film making where I won India's highest award – the Golden Lotus. I wrote a book at the instance of Ramakrishna Mission on World Parliament of Religion that has been well received. The third edition has just come. Still I am not India's top entrepreneur like the Ambanis, Premji or Narayan Murthy. I study a lot, work hard and remain a humble learner. There is so much to be done still.

DREAM 2047: The educated youth today seems rudderless and ready to move in the direction of any breeze careers, lifestyle and goals. How can they find new role models who can be inspiring them to make the right choices and follow more fulfilling paths? What will be your message to them?

LNJ: Today's educated youth inspire me. They are often highly spiritual and highly motivated and working hard. But I do not find them ambitious enough. On the other side I also see several youth leading a lazy life. I wish they had the fire to see that India, which was once the glory of the world, reaches great heights again. One man of the stature of Ramakrishna, Vivekananda, Aurobindo, Raman Maharshi will be good enough to revive India.

DREAM 2047: Thank you for your time, and for sharing your ideas and wisdom with our readers.

## 2011-2012 Hubert H. Humphrey Fellowship Program

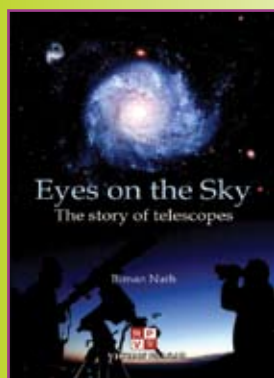
The Hubert H. Humphrey Fellowship Program, which is a Fulbright program, brings accomplished mid-level professionals from developing countries to the United States for ten months of non-degree graduate study and related practical professional experiences. The program is designed to meet the requirements of policy makers, planners, administrators, and managers in the government, public and private sectors, and non-governmental organizations, who have a public service commitment, demonstrated leadership potential, and commitment to their own country's development.

The fellowships are awarded inter alia in the fields of Agricultural and Rural Development; Communications/Journalism; Substance Abuse Education, Treatment and Prevention; Educational Administration, Planning and Policy; Higher Education Administration, HIV/AIDS Policy and Prevention; Human Resource Management; Natural Resources/Environmental Policy/Climate Change; Public Health Policy and Management; and Technology Policy and Management. Qualified women and candidates from minority and disadvantaged groups are encouraged to apply.

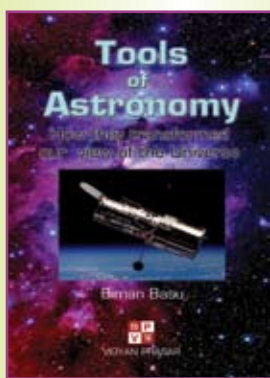
Candidates should demonstrate the required experience, skills, and commitment while also indicating how they can benefit from this program in ways that they have not experienced previously and are not likely to experience without the Humphrey program. Candidates should be proficient in both written and spoken English and will be required to take Internet-based Test (iBT) of the Test of English as a Foreign Language (TOEFL). Programs arranged for the Humphrey fellows will begin in August 2011. During their Humphrey year, fellows are expected to be resourceful, display initiative, and network with U.S. organizations and professionals. All fellows participate in a one-week workshop at Washington, D.C. in October, 2011.

**Application deadline:**  
**15 July 2010. For more details visit**  
[www.humphreyfellowship.org](http://www.humphreyfellowship.org)

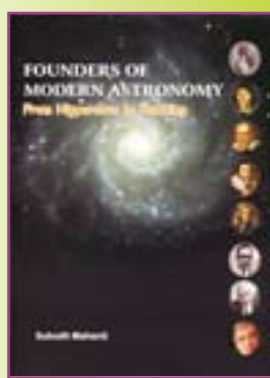
## New Arrivals of Vigyan Prasar



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# For want of a nail

## Keystone species and biodiversity



**T V Venkateswaran**  
email: [tvv@vigyanprasar.gov.in](mailto:tvv@vigyanprasar.gov.in)

True worth of shade is only realised when the Sun is beating down hot, so says an old Tamil adage. A French equivalent says, we know the true worth of a thing when we have lost it. What appear to be common place and trivial could actually be the keystone. Thus a poorly lowly star fish (*Pisaster ochraceus*) was found to be keystone species in its ecosystem.

Mukkaw Bay, was like any other rocky beach with its own unique ecosystem. As in most rocky coastal ecosystem, species such as mussels and barnacles, attaching themselves to rocks, thrive in the intertidal zone. During the high tide, waves reach out inshore and sea water level extends inland. During the low tide water recedes and even waves cannot reach too deep inshore. Changing tides expose many organisms living in the intertidal zone to varying amounts of water and direct sunlight.

The ballet of waves and waltz of tides create a variety of ecological niches in this intertidal zone. In the splash zone, algae, periwinkles, and other shelled animals fix themselves to rocks to withstand the awesome power of crashing waves. By some estimates, the pressure exerted by a pounding wave may be 16 tonnes per square metre of rock. In the intertidal zone, barnacles build limestone forts around themselves. They spend their lives lying on their backs kicking food into their mouths with their feet. Below the barnacles are the rockweeds, which need to be submerged at least an hour during each tide. Mussels live among the rockweeds, attaching themselves to rock by silken threads. These organisms close their shells when the tide is low and then open them to filter-feed when the tide is high.

Star fish make their homes in the sub-tidal zone and prey upon mussels and sea urchins. Their five-sided body structure consists of an exoskeleton of tiny spines and a mouth in the center of the ventral, or bottom, side. They use the suction of their tube

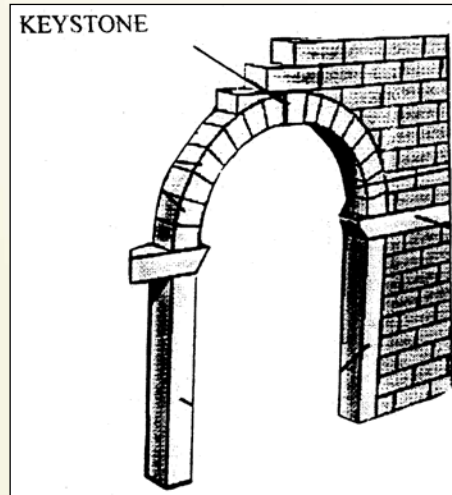


Figure 1: In architecture, keystone is the wedge-shaped piece at the crown of an arch that locks the other pieces in place. The term in ecology is used figuratively to a species whose very presence contributes to a diversity of life in a crucial way.

feet to open the shells of their prey. Lobsters also live in this zone, eating almost anything, alive or dead. The tides, currents, and waves stir up nutrients, delivering food to many organisms. Inside the mud and among the waving grasses, worms, clams, and bacteria digest dead organisms and recycle wastes. Noting is a waste in nature.

Mukkaw Bay is no exception. Just like any rocky beach, this rocky intertidal zone



Figure 2 Robert Paine deliberately removed *Pisaster star* fish to see its impact and identified it as a keystone

included a large number of species. Typically star fish (*P. ochraceus*) are present along with limpets, chitons, mussels and barnacles with no single species dominating the ecological space. Star fish were known to eat mussels as well as barnacles and other invertebrates, but they were relatively uncommon so no one thought them to be very important in the community.

Robert Paine, an American ecologists wanted to understand the importance of species in a ecosystem. If an ecosystem has number of species, what will happen if one of them is removed? He ventured to study what would result if *Pisaster* is removed from the ecosystem.

He chose a stretch of natural rocky shore in the Mukkaw Bay area. He demarked two regions one as experimental zone and other the control zone. From the experimental zone he removed manually each and every starfish *P. ochraceus* and recorded the changes in this zone. On the other hand, he left the control zone undisturbed. For more than three years he weeded out starfish from the experimental zone while retaining the control zone in its natural course and observed the relative changes.

Over a period of time, in the experimental zone, area where he had systematically removed the *Pisaster*, he observed that mussels, especially *Mytillus californianus* increased to monopolise all the space in the rock preventing other invertebrates and algae from being able to attach to the rocks. Thus it was obvious for him the removal of *Pisaster* has resulted in a pronounced decrease in biodiversity. Instead of usual 15 species found (in the control area) only eight species were found in the experimental area. Without a predator to control their numbers, the mussels soon took over the community and crowded out other species, greatly reducing the community's diversity.

The study showed that in absence of the predator, Pisaster, the mussels grew unchecked and edged out other species. Mussels *M. californianus* proved to be an ecologically dominating species that is able to compete for space effectively in the intertidal zone. In the control zone predation by Pisaster reduced the abundance of the mussel and opened up space on the rocks allowing other species to colonise and persist. However Pisaster is not able to eliminate mussels completely because *M. californianus* could grow too large to be eaten by the starfish. Thus the large adult *M. californianus* were safe from predation by starfish. Size limited predation provides a refuge for the prey species and these large mussels are able to produce large number of fertilised eggs. Thus a dynamic balance was being maintained in the control zone; whereas in the experimental zone without the predator starfish the balance was being lost.

A variety of species interlocked with each other in the food web was known. From his extensive field study, Paine evolved a new ecological concept – keystone species. In architecture, keystone is the wedge-shaped piece at the crown of an arch that locks the other pieces in place. The term in ecology is used figuratively to a species whose very presence contributes to a diversity of life and whose extinction would consequently lead to the extinction of other forms of life. Keystone species help to support the ecosystem (entire community of life) of which they are a part. It should be noted that keystone species may not be the relatively most abundant species in the ecosystem. But their impact on the community is greater than would be expected based on just relative abundance. They are, in short, keystone of the architecture of the web of species in a particular ecological space.

Species that are known to play this role, besides the starfish mentioned above, include the sea otter, the freshwater bass, and the predatory whelk *Concholepas* (a kind of elongated sea snail). By contrast, trees, giant kelp, prairie grasses, and reef-building corals all have impacts that are large but not disproportionate to their total biomass, and therefore they are not keystone species.

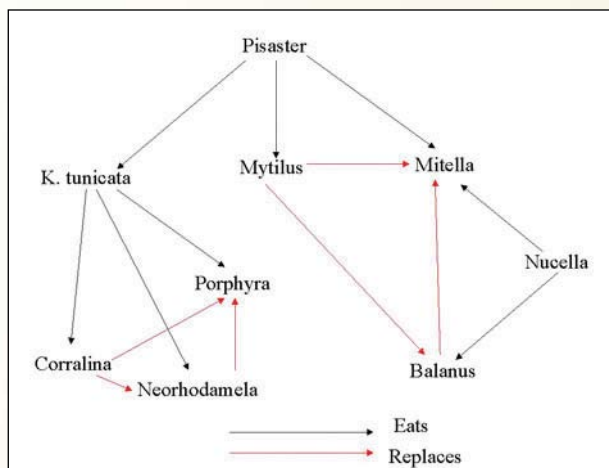


Figure 3 without pisaster, rocky shore ecosystem's food web collapses and many species are driven out. Biodiversity is lost.

Keystone species are usually noticed when they are removed or they disappear from an ecosystem, resulting in dramatic changes to the rest of the community. The phenomenon has been observed in a wide range of ecosystems and for a wide range of organisms. From rhododendrons in Sikkim Himalaya, sea otters to Cullenia tree in the Kalakkad rainforest, ecologists have identified a wide variety of keystone species. These keystone species are pillar of their community on which the stability of their entire system depends.

Looking at a keystone species one is reminded of an old proverb:-

- For want of a nail the shoe was lost.
- For want of a shoe the horse was lost.
- For want of a horse the battle was lost.

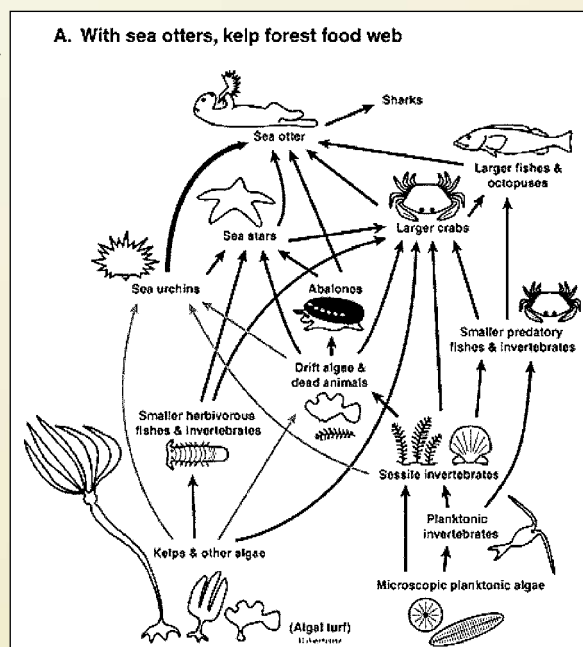


Figure 4 sea otters play a key role in the marine food web

For want of a battle the kingdom was lost.  
And all for the want of a horseshoe nail.

### All iz Not well

Sea otters, affectionately called teddy bears of ocean, were once in abundance from northern Mexico to Alaska all along the Pacific coast. Today it is rare to sight one. Unfortunately, their teddy-bear qualities were nearly their downfall; their pelts were especially thick and soft. Sea otters were hunted to almost extinction in the last 150 years for fur trade.

Sea otters have only thick fur for insulation in the cold waters of Pacific; one square centimetre of it contains more than 155,000 hairs 10 times as many hairs as on a human head. As they lacked other mechanisms like blubber to keep themselves warm, they ate like pigs. It is estimated that sea otters eat about 25 percent of its body weight every day. That is a 20-kilo child eating five kilos of food every day! Among otters delicacies are crabs, clams, mussels, shrimp and especially, sea urchins. All this eating helps make the sea otter a keystone predator.

Sea floor is usually forested by kelp plants. Kelp is a giant, yellow-brown, rubbery seaweed stretching from the sea floor to the surface. Kelp plants act like the tall trees of a forest. Beneath the kelp live algae, the shrubs of the underwater forest. Kelp plants also shelter fish, sea urchins, and other creatures. Sea urchins graze kelp. Sea otters gulp sea urchins.

As more and more sea otters were hunted for its fur, sea urchins multiplied in numbers. More and more sea urchins populated the sea and the kelp forests were decimated. They left behind desolate areas called urchin barrens. As the kelp was gone so was fish. Fishing industry in the Pacific declined. It was soon clear that sea otter was the keystone species – without which entire ecosystem can fall apart. Wherever sea otters have disappeared, kelp forests have suffered. Sea otters and starfish are predatory keystone species.

Finally in 1911 an international treaty was signed protecting sea otters from hunting. At that time there was just 13 colonies of sea otters in the whole

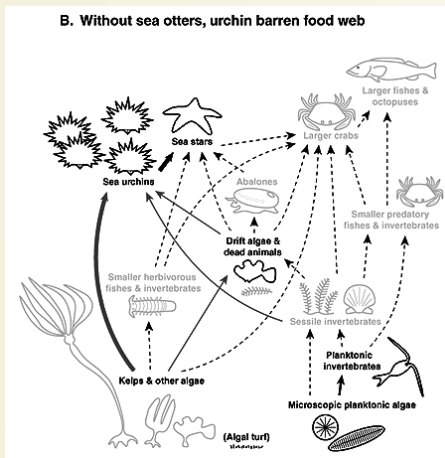


Figure 5: if the sea otters are removed many other organism also disappear as a consequence.

of Pacific Rim. Researchers soon found that when sea otters arrive in an area from which they have been absent, they begin snacking on urchins. Soon the kelp forest begins to grow back. Algae species that had been missing make an appearance, along with fish that like to hide out in the canopy. However the sea otters are not making a comeback as scientists had expected. Although their population has increased, it is getting sick more often than they used to. At places killer whales have started eating them. All iz NOT well – yet.

**Tree of life**

Cullenia exarillata or as the locals call it, VEDIPLA, is an abundant canopy tree. Ecologists are realising that it is not just an ordinary endemic Indian tree. But it is a keystone species that sustains biodiversity in the Kalakad Mundanthurai Tiger Reserve, in the Agasthyamalai Hills in the Western Ghats of southern India. This tree acts as a hot bed of activity when in flower and functions as a keystone resource for several species of arboreal mammals including the endangered primate Lion-tailed macaque (Macaca silenus). Insects are attracted to its fruits; birds in turn consume the insects; reptiles congregate to eat the insects; monkeys join the cacophony to eat insects, leaves and fruits. And tigers may lurk on the forest floor, hoping to eat the animals that ate the insects that ate the fruits!

This tree flowers usually from February to May, during the early dry season that coincides with the period of fruit scarcity in the forest. Flowers produce little nectar but the edible fleshy sepals compensate for this. About 9,000 flowers are produced by

the tree during the flowering season that last for about 50 days. Several species of arboreal mammals and birds consume the flowers during this fruit scarcity period. Ecologists suspect that flower eaters could be important in flower pollination. The overabundance of the flower crop and the timing of flowering may have evolved as a strategy to satiate predators and enable the flowers to be pollinated during the annual period of fruit scarcity in the forest. This in turn makes Cullenia exarillata a possible mutualist keystone species while the sea otter is a predatory keystone species.

**Engendering an ecosystem**

Mangrove crabs that live in burrows dug in mangrove mud are considered a keystone species. The crabs neither play the role of predator nor mutualist synergy to garner the status of keystone species, but they alter the structure and chemistry of the sediment in ways that affect wider range of mangrove organisms and play a key role in the biodiversity of the mangrove ecosystem.

Beneath the mangrove soil surface crabs tunnel complexes of burrows. Primarily these interconnected burrows are the habitats of mangrove crabs and provide them shelter from extreme environmental conditions and refuge from predators. However, these tunnels behave like conduits for carrying water, dissolved nutrients and air.

Mangrove crabs are predominantly herbivorous, feeding on fallen or fresh leaves and propagules. They take leaves into the burrows and the uneaten ones are thus buried in mangrove soil by the crabs. While part of it is decomposed by aerobic bacteria in the burrows, some are decomposed by sulphur and iron-reducing bacteria. The burrowing habit of crabs facilitates the decomposition and mineralisation and provision of nutrients to mangrove life.

The absence of the burrowing crabs from mangrove ecosystem would result in plant nutrient deficiency in mangrove soils and in turn mangrove primary productivity would be stunted. Reduced primary productivity would impact the life-supporting capacity of the mangrove ecosystem. By making burrows, these mangrove crabs act as “ecosystem engineers” who create new habitats and change the availability and quality of food, shelter and refuge for other constituent species in mangrove ecosystems.

**Letters to the Editor**

**Useful editorial**

The editorial “Every contact builds public relations” (DREAM 2047, June 2010) was extremely useful for institutions like Pushpa Gujral Science City. I have made copies of the article and sent to all the relevant staff members for their study and action. I can assure you that the practical suggestions given in the article will be implemented in PGSC.

**Dr. R. S. Khandpur**  
 Director General,  
 Pushpa Gujral Science City, Kapurthala  
 Head Office: SCO 60-91, 3rd Floor,  
 Sector 34-A, Chandigarh

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**Excellent article on Periodic Table of Elements**

The article on Dmitri Ivanovich Mendeleev (June 2010) was marvellous. After school days, I went through this type of article for the first time. It was very informative too. Kudos for Dr Subodh Mahanti. The article on Volcanoes was also an exclusive piece on the subject.

**Pramod Pandey**  
 Editorial Section, Dainik Jagran  
 PO- Ramna, Muzaffarpur (Bihar), Pin – 842002  
 e mail - pramodp@mzf.jagran.com

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**A handy tool of information**

Developments in Science & Technology takes place every moment and DREAM covers all those and makes it a handy tool of information. Truly, every time, the editorial of DREAM makes us to “think scientifically and act scientifically”. From month to month it publishes valuable articles on different branches of science and technology. It quenches the thirst for knowledge of every class of the learned society. I convey my best wishes to your entire team.

**Syed Akhtar Ali**  
 Assistant Teacher, F.U.H.S., Nanded (M S)

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**Amazing magazine**

I am grateful to my sir who gave me this wonderful magazine related to science. I am student of B.Sc. II (PCM). I have not seen such amazing magazine. I came to know about T.R. Sheshadri, who was unique chemist of India. I want to know more about science through this magazine. So I would request you to send me this magazine so that I may quench my thirst for knowledge.

**Ajeet Verma**  
 C/o Manoj Kumar  
 568Kha/3/24 Geetapalli, Alambagh  
 Lucknow-226 005

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**Thank you**

We gratefully acknowledge the copy of the May 2010 issue of DREAM 2047. I am sure, trainees, students and researchers to this Institute shall find this of great value.

**A.K. Ramchandani**  
 Asstt. Library Information Officer  
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# The Causes and Trigger Factors of Depression



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

“The attitude of unhappiness is not only painful, it is mean and ugly. What can be more base and unworthy than the pining, puling, mumping mood, no matter by what outward ills it may have been engendered? What is more injurious to others? What less helpful as a way out of the difficulty? It but fastens and perpetuates the trouble which occasioned it, and increases the total evil of the situation.”

—William James (U.S. psychologist)

Until a few years ago, researchers believed that depression could be of two kinds: endogenous, caused by inexplicable sense of gloom; and exogenous, caused by reverses in life. This theory is no longer accepted. The current scientific consensus is that only those people who suffer from certain biological and psychological vulnerabilities are prone to depression. Stressful life events only act as precipitating factors. This theory explains why some people become depressed even when things are going well with them, and why others take even the most adverse circumstance in their stride and are not affected by it.

## Biological factors

Clinical research indicates that depression may result from wide ranging defects in the biological system. Chemical aberrations may be the biggest culprit, but certain vitamin deficiencies, hormonal abnormalities, and genetic factors can also play the villain. Sometimes, psychological factors may act their part as a precipitant. Equally, however, the subject may not be faced with any distressing factor, and all may be seemingly well, yet the spirits are low and negative emotions harass the mind.

## The Chemical “locha” (aberration)

Functional imaging studies have shown that certain chemicals in the brain which act as transmitters in the brain circuit may play an important role in regulating human mood and emotions. The most significant of these are norepinephrine and serotonin.

## The norepinephrine link

There is now considerable experimental evidence that a deficiency of norepinephrine in certain brain circuits leads to depression, while its overabundance generates mania. A whole, intricate mechanism has been discovered explaining how it works. The circuits that feel either paucity or abundance of norepinephrine originate in the brain



stem, primarily in a region called the pigmented locus coeruleus. These circuits extend to many areas of the brain, including the limbic system, which play a significant part in regulating emotions.

## The mood-serotonin connection

Serotonin has taken the centre stage in research on the causative factors of depression, ever since the newer antidepressants that change serotonin levels have met with good therapeutic success. The view is that a deficiency of serotonin at the serotonin-using synaptic junctions in the brain circuit can upset the mood and emotions by promoting, or permitting, a fall in norepinephrine levels. The anatomical basis to this finding has also been outlined.

There may also be other mechanisms at work. Serotonin depletion might affect many brain regions that participate in depressive symptoms—including the amygdala (an area involved in emotions), the hypothalamus (involved in appetite, libido and sleep), and cortical areas that participate in cognition and other higher processes.

The most clinching evidence to the serotonin theory comes from medications, called the selective serotonin reuptake inhibitors (SSRIs), which have revolutionised the treatment. They are highly effective and produce milder side effects than older medications.

## Hormonal abnormalities

Depressed people have an imbalance of hormones, possibly fuelled by a chronic activation of the hypothalamic-pituitary-adrenal axis—the system that manages the body’s response to stress. They generally have higher than normal levels of corticotropin-releasing factor, ACTH, and cortisol, and this may affect the mood. In addition, depression has also been linked to both a deficient or overactive thyroid gland.

## Vitamin deficiencies and other organic disorders

A variety of organic conditions have a link with depression. Deficiencies of vitamin B6, vitamin B12, and folic acid; degenerative

neurological disorders, such as Alzheimer's disease and Huntington's chorea; strokes in the frontal part of the brain; and certain viral infections are some of them.

## Medications as the culprit

A variety of medications, which include those given for pain relief, some antibiotics and anti-fungal drugs, medicines which help lower the blood pressure, steroids, oral contraceptives, anti-ulcer drugs, and several others also may cause depression in some people.

## Genetic Factors

Both depression and bipolar disorder are known to run in families. The evidence for heredity is much stronger for bipolar illness than for unipolar depressive illness. If a parent has bipolar disorder, there is a 27 per cent chance that his or her child will have a mood disorder. The risk goes up to 50-to-75 per cent if both parents suffer from the illness.

The role of genetic factors in the genesis of depression also finds corroboration in twin-studies. Genetically identical twins, raised in the same environment, are likely to suffer from depression three times more than the non-identical twins who only have about half of the genes in common. Adoption studies also support this theory. These studies show that children of depressed parents are vulnerable to depression even when raised by adoptive parents. On the other hand, children of healthy parents fostered by depressed adoptive parents, need not suffer depression.

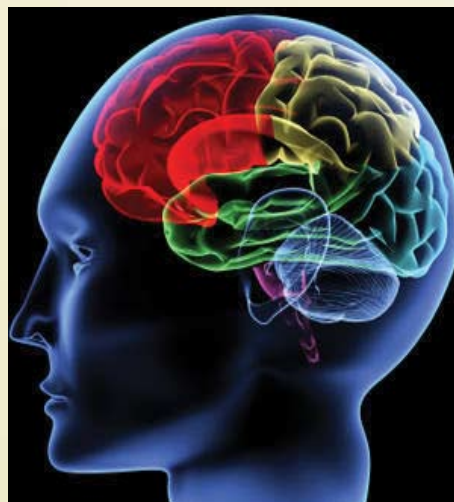
## Psychological Factors

### Stressful life events and depression

Stressful life experiences may play a significant role in the genesis of depression. According to reliable data, the loss of a parent before age 11 is the most significant event associated with the development of depression in later years. The loss of a spouse or some other loved one is also a common environmental stressor that may trigger depression. Other stressful experiences include divorce, pregnancy, the loss of a job, and even childbirth. Many women experience a postpartum depression, after delivering a baby.



The transition from one stage in life to the next, such as adolescence, adulthood, middle age and old age, also puts individuals at an increased risk of depression. Women in particular are at risk in middle life, when the children leave home to make their separate existences. Likewise, retirement is another such time, especially for people who derive satisfaction, status, or esteem from their jobs. Serious physical illnesses or disabilities can also be a real burden for some and lead to depression.



## Chinks in the personality

All humans, of whatever personality pattern, can and do get depressed, but people with depressive personality traits appear to be more vulnerable. Depressive personality traits include gloominess, pessimism, introversion, self-criticism, excessive scepticism and criticism of others, deep feelings of inadequacy, and excessive brooding and worrying. In addition, people who regularly behave in dependent, hostile, and impulsive ways also appear to run a greater risk of this illness.

## Psychoanalytic links

Sigmund Freud believed that depression was a psychological response to loss—either real loss, such as the death of a parent or spouse, or symbolic loss, such as the failure in achieving an important goal. Freud believed that a person's unconscious anger over such loss leads to a weakening of the ego and the loss of energy.

## The theory of 'learned helplessness'

When animals were exposed during experimental work to repeated electric shocks from which they could not escape, they soon developed an attitude of helpless resignation and made no attempt to escape from future shocks. Basing on these experiments, psychologists have proposed that human beings, when exposed to uncontrollable and inescapable events for long, also develop a similar attitude of 'learned helplessness'—that, one cannot control the outcome of events. This leads to apathy, pessimism, and loss of motivation—the characteristic symptoms of depression.

## Cognitive theory: the negative, self-defeating attitude

Some people habitually tend to focus only on the negative aspects of any given situation; they interpret facts in negative ways, and blame themselves for all misfortunes. This is a negative, self-defeating attitude which often takes roots in early childhood. It makes situations seem much worse than they really are and increases the risk of depression, especially in stressful situations.

# Recent Developments in Science and Technology

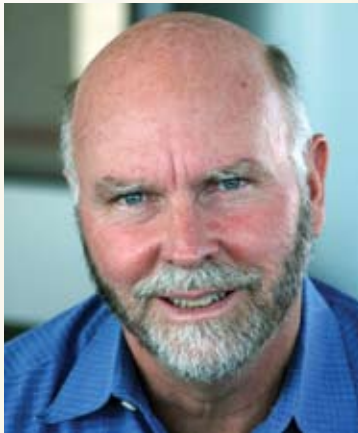
## First cell built with artificial genome

Ever since James Watson and Francis Crick unravelled the structure of DNA in 1953, genetics has become one of the fastest developing areas of science. The recent announcement of the creation of a cell with a completely synthetic genome by J. Craig Venter and his team at the J. Craig Venter Institute in USA is a landmark achievement in genetic engineering. For the first time not only has a complete genome been built from scratch but has also been expressed when introduced into the cell of another bacterium. What Venter and his team has achieved was to stitch together the entire genome of the bacterium *Mycoplasma mycoides* and put it into a different bacterium, *Mycoplasma capricolum*, which started behaving like the natural *M. mycoides*. But it was no easy task. It cost an estimated \$40 million and the effort of 20 scientists working for more than a decade to produce. The team included three Indians – Sanjay Vashee, Radha Krishnakumar, and Prashanth P Parmar.

The researchers synthesised the genome of *M. mycoides*, containing just over a million DNA base pairs using a method developed in 2008. After the synthetic genome was transplanted into *M. capricolum*, the recipient cells immediately began to carry out the instructions encoded within the synthetic genome. The cells manufactured only *M. mycoides* proteins, and within a few rounds of self-replication, all traces of the recipient species were gone (Science, 21 May 2010). Interestingly, to distinguish their synthetic genome from the naturally occurring version, the researchers encoded a series of watermarks into the genome sequence.

One difficulty the researchers faced was in stitching together the small sequences of the *M. mycoides* genome together. Because current machines can only assemble relatively short strings of DNA fragments at a time, the researchers used the

DNA repair machinery of yeast and *E. coli* bacteria to link these strings together and form full chromosomes. After three rounds of assembly involving transplanting between



J. Craig Venter

yeast and *E. coli*, the researchers were able to produce a complete genome over a million base pairs long.

Although the achievement has been described as creation of artificial life, it is not really so. The cells which expressed the synthetic genome were natural bacterial cells. Except the DNA the rest of the cell had all natural components. But that in no way makes the success less significant. Venter hopes that in the future, the synthetic genomic technology can be used to design and develop entirely new organisms, with wide-ranging practical applications. For example,



Cells of *Mycoplasma capricolum* with synthetic genome of *Mycoplasma mycoides* in it. (Credit: J. Craig Venter Institute)



Biman Basu

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by designing genomes and transplanting those into microorganisms special organisms could be created that produce vaccines, other pharmaceutical compounds and bio-fuels. Scientists at the Venter Institute are already working with the oil firm Exxon Mobil to create bacteria that take up carbon dioxide and convert it into clean fuel. Other applications include designer organisms that could convert wastewater into drinking water and clean up hazardous chemical spills.

Beyond practical applications, the researchers also hope that synthetic cells will help elucidate the basics workings of life, perhaps allowing researchers to decipher exactly what every component of a bacterial cell does. Although the genomes of countless organisms have now been sequenced, scientists do not fully understand how even the simplest life forms function. Study of cells with synthetic genomes in future could lead to better understanding of cellular systems. However, there are also apprehensions about the misuse of the new achievement. According to some scientists, the technique could also be abused to create the ultimate biological weapon.

## Mobile phone use not linked to cancer

The widespread use of mobile telephones in recent years has heightened public concern about possible adverse health effects. Mobile phones work on microwave frequencies and are known to emit low-level radiofrequency electromagnetic fields, which some people think can cause brain tumour. But any link between the use of mobile phone and brain tumour has always been controversial. Despite claims in support and against any link between the two, scientific studies have been few and far between. The largest study so far on mobile



*Mobile phones do not cause cancer.*

phones and cancer was a Danish study in 2006, which looked at over 420,000 people who had been using mobile phones for many years. It found no link between mobile phones and any type of cancer including brain cancers and leukaemia, but it was confined to only one country. A recent multinational study has also found no evidence for an association between tumour risk and mobile phone use. The latest study was carried out by an international collaboration called INTERPHONE, run by the International Agency for Research on Cancer in Lyon, France, part of World Health Organization the findings of which were published in the *International Journal of Epidemiology* (17 May 2010 | doi:10.1093/ije/dyq079).

The INTERPHONE study was aimed at establishing whether usage of mobile phones increased the risk of the two main types of brain tumour – glioma and meningioma. It involved 2,708 people with glioma, 2,409 with meningioma, and 7,658 matched controls without brain tumour. The subjects were drawn from 13 countries. According to the authors, no studies have included as many exposed cases, particularly long-term and heavy users of mobile phones, as the present study. Sixteen study centres from 13 countries (Australia, Canada, Denmark, Finland, France, Germany, Israel, Italy, Japan, New Zealand, Norway, Sweden and the UK) were included. To have the most representative samples, the INTERPHONE study focussed on tumours in people in the age group 30-59 years, as they were expected to have had the highest prevalence of mobile phone use in the previous 5-10 years, and on regions likely to have the longest and highest use of mobile phones – mainly large urban

areas. Detailed information on past mobile phone use was collected during face-to-face interviews with the study subjects.

According to the authors, this is the largest study of the risk of brain tumours in relation to mobile phone use conducted to date and it included substantial numbers of subjects who had used mobile phones for more than 10 years. The study found no increase in risk of either glioma or meningioma in association with use of mobile phones.

### Genome study shows interbreeding between modern humans and Neanderthals

Although Neanderthals (*Homo neanderthalensis*) and modern humans (*Homo sapiens*) had lived at the same time on Earth it was believed that they had never interbred. Neanderthals went extinct 30,000 years ago. But an international group of researchers currently sequencing Neanderthal DNA have found evidence that between 1% and 4% of the DNA of people today who live outside Africa came from Neanderthals, probably the result of interbreeding between Neanderthals and early modern humans. The team led by Svante Pääbo, a geneticist at the Max Planck



*Neanderthal man*

Institute for Evolutionary Anthropology in Leipzig, Germany, pieced together the first draft of the Neanderthal genome sequence – which represents about 60 percent of the entire genome – using DNA obtained from three Neanderthal bones that came from Vindija cave in Croatia and are between 38,000 and 44,000 years old. The partly sequenced Neanderthal genome was then compared to the genomes of five present-day humans from different parts of the world. The comparison showed that Neanderthals shared some genes with present-day humans in Eurasia and sub-Saharan Africa indicating interbreeding in the distant past (*Science*, 7 May 2010).

Countless fragments of degraded ancient DNA were extracted from the three pieces of bones, which were used to create libraries of sequences and then reassembled by computer into the draft Neanderthal genome comprising nearly two billion base-pairs. The researchers used the genomes of modern humans and the chimpanzee as references to get the sequence in the correct order.

The recent finding contrasts sharply with Pääbo's previous work of sequencing the first Neanderthal mitochondrial DNA, which he carried out in 1997. Mitochondria are the cell's energy-generating organelles with their own DNA, which is distinct from the much longer DNA sequence that resides in the cell's nucleus. This study had showed that Neanderthals had not made any contributions to mitochondrial DNA of modern humans. But since mitochondrial DNA represents only a tiny fraction of an individual's genetic makeup, it was still possible that study of Neanderthal nuclear DNA might tell a different story. However, later studies have typically led researchers to conclude that *Homo sapiens* arose in Africa and replaced the archaic humans including Neanderthals it encountered as it spread out from its birthplace without mingling with them. In addition to throwing light on how Neanderthals and modern humans interacted, the Neanderthal genome is helping researchers to figure out which parts of the modern human genome separate us from all other creatures.

### New clue to anti-matter mystery

Physicists at the Fermi National Accelerator Laboratory in USA have found a clue as to



The three bone fragments from Vindija cave from which Neanderthal DNA was sequenced. (Credit: AAAS).

why the world around us is composed of normal matter and not its counterpart, antimatter. According to the Big Bang theory of the origin of the universe, equal amounts of matter and antimatter should have been created in the beginning and they should have annihilated each other soon after, leaving behind nothing but energy. The universe could not have come into being if it were so. But the universe exists. In fact the existence of matter has been one of the biggest mysteries of cosmology.

Anti-matter can be found today, but not easily. It can be produced in particle accelerators, in nuclear reactions or by cosmic rays. The Fermilab team, known as the DZero collaboration, analysed data from collisions of protons and antiprotons at Fermilab's Tevatron, which until the Large Hadron Collider came up was the most powerful particle accelerator in the world. They found that the collisions produced pairs of the particles known as muons, which are sort of heavy electrons, slightly more often than they produced pairs of anti-muons. The results showed a 1% excess production of muon (matter) particles compared to anti-muon (anti-matter) particles in these high-energy collisions (Fermilab-Pub-10/114-E | arXiv:1005.2757v1).

It was Andrei Sakharov, the Russian physicist, who in 1967 first provided a recipe for how matter

could prevail over antimatter in the early universe. He postulated a slight difference in the properties of particles and antiparticles, known technically as CP violation, as a condition for matter to prevail. In other words, what he meant was that when the charges and spins of particles are reversed, they would behave slightly differently. Over the years, physicists have discovered a few examples of CP symmetry violation in rare reactions between subatomic particles that slightly favoured formation of matter over antimatter. But they were not enough to explain the existence of matter. CP symmetry (C = charge; P = parity) states that the laws of physics should be the same if a particle were interchanged with its antiparticle, but it is not always so.

According to the Fermilab team, the new finding is based on the behaviour of particularly strange particles called neutral B-mesons, which oscillate back and forth trillions of times a second between their regular state and their antimatter state. As it happens, the mesons, created in the proton-antiproton collisions, seem to go from their antimatter state to their matter state more rapidly than they go the other way around, leading to an eventual preponderance of matter over antimatter of about 1%, when they decay to muons. Researchers say the new findings show much more significant 'asymmetry' of matter and anti-matter – beyond what can be explained by the Standard Model, the current theory of fundamental

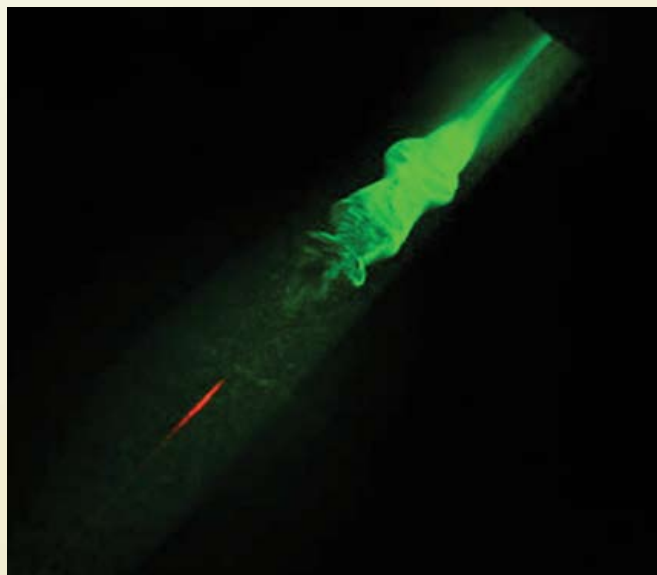
particles. The new discovery is also expected to lead to fundamental discoveries at the new Large Hadron Collider, as well as a possible explanation for our own existence.

### Making clouds with lasers

Atmospheric scientists have been trying to build artificial clouds since the 1940s, with mixed success. The most popular methods, which include shooting particles of silver iodide into the sky, or aerial spraying of dry ice or salt on clouds, relied on the fact that raindrops need something to condense around. Varying degrees of success have also been reported. Now a research team from the University of Geneva has achieved encouraging results from taking a more hi-tech approach – using lasers to create clouds.

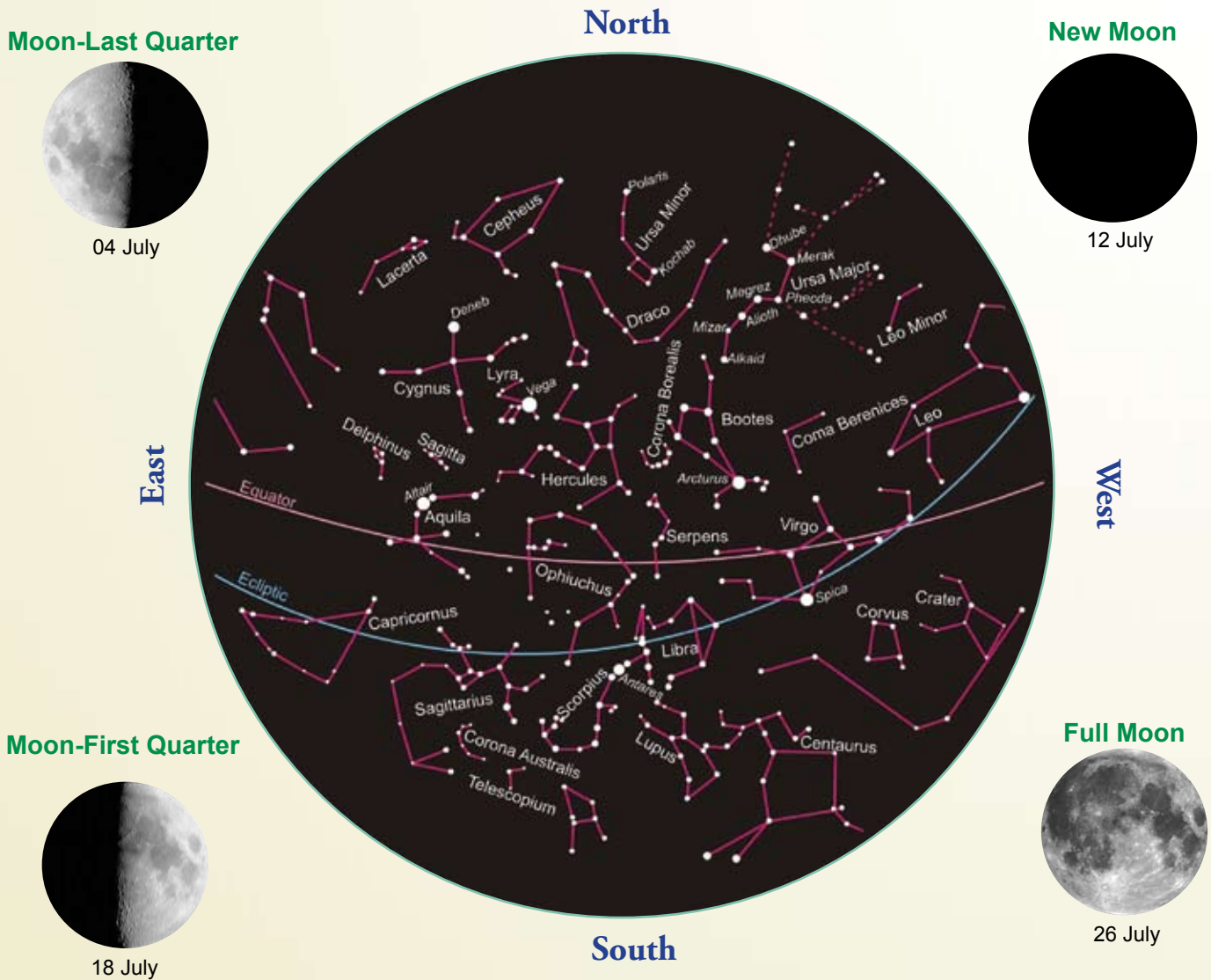
The Swiss team has reported success in laser-powered cloud seeding, both inside and outside the laboratory. Inside the lab, the researchers used a cloud chamber, normally used to detect cosmic rays, highly energetic subatomic particles that come from deep space. The cloud chamber works because the cosmic rays or other energetic particles knock electrons off the water molecules, leaving behind charged particles that act like specks of dust for water to condense on. The Swiss researchers shot powerful pulses of infrared laser beams into a cloud chamber cooled to minus 24°C to cause visible clouds of vapour to form in its wake. Droplets about 50 micrometres in diameter formed first, and grew to about 80 micrometres in diameter over the next three seconds. When they fired laser into the skies, although nothing was visible to the naked eye, condensation of water vapour could be detected by using a second laser (Nature Photonics, 2 May 2010 | doi: 10.1038/nphoton.2010.115). This is the first time that a laser was used to condense water in both laboratory and in the atmosphere.

According to the researchers, the technique provides a new and attractive tool for remote characterisation of humid atmosphere and cloud formation. In addition, it may even provide the potential to influence or trigger water precipitation using continuously operating lasers rather than rockets.



Green light reveals a cloud created by shooting a laser into a gas chamber. The same technique could create clouds in the sky. (Credit: Jean-Pierre Wolf / University of Geneva)

# Sky Map for July 2010



The sky map is prepared for viewers in Nagpur (21.090 N, 79.090 E). It includes constellations and bright stars. For viewers south of Nagpur, constellations of the southern sky will appear higher up in the sky, and those of the northern sky will appear nearer the northern horizon. Similarly, for viewer north of Nagpur, constellations of northern sky will appear higher up in the sky, and those of the southern sky will appear nearer the southern horizon. The map can be used at 10 PM on 1 July, at 9 PM on 15 July and at 8 PM on 31 July.

## Tips to use sky map:

- Choose a place away from city lights/street lights.
- Hold the sky-map overhead with North in the direction of Polaris.
- Use a pencil torch for reading the sky map.
- Try to identify constellation as shown in the map one by one.

## Visibility of Planets (IST)

	Rising	Setting	In the Zodiac
Mercury	07:08	20:05	Gemini-Cancer-Leo
Venus	08:58	21:30	Leo
Mars	10:05	22:19	Leo-Virgo
Jupiter	22:54	11:00	Pisces
Saturn*	10:40	22:59	Virgo
Uranus*	22:43	10:58	Pisces
Neptune*	20:49	08:33	Aquarius

†Time shown is subject to vary ( $\pm 1$  hr) from place to place.

\*Not naked eye object

## Sky Event

Date	IST	Event
01	15:42	Moon Apogee
06	20:29	Aphelion: 1.0167 AU
04	-- : --	Mercury begins an evening apparition
12	01:04	Total Solar Eclipse not visible in India
13	-- : --	Line of four bright planets in the evening sky
13	16:51	Moon Perigee: 361100 km
15	06:36	Moon-Venus: $6^\circ$ N
28	13:08	Delta Aquarid Shower
29	05:20	Moon at Apogee
31	19:42	Mars-Saturn: $1.8^\circ$ N

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# 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:

## Considering the vastness of our country and its large population, are we using the potential of satellite television in education adequately?

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](mailto:opinion@vigyanprasar.gov.in)) or by post to the address given below. If sent by post, "Response: Dream 2047 May 2010" should be clearly written on the envelope.



**Vigyan Prasar**

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Winners of "Your Opinion" contest for March 2010

## Topic: "Can the introduction of computers improve the standard of school education in our villages?"

### Aman Arora

Air Force Bal Bharati School  
47/2B, Sector-2, Gole Market, New Delhi-110001  
Email: [andaman21@gmail.com](mailto:andaman21@gmail.com)



Yes!! Introduction of computers can improve the standard of school education in our villages to a great extent. In fact, it is the most important step for the immensely populated India towards its development. Village children have calibre, but they lack the necessary resources - introduction of computers can change that. Rural areas have become centres of poverty and hunger due to lack of communication. Information regarding health, education, agriculture, jobs, etc. is not available to them. Computers can be used by teachers for assistance, audio-visual educational programs and lectures can be shown to students for a better understanding. Also, tests, quizzes and educational games will be a hit among them. Also, there will be an assured increase in the literacy rates of India. Computer education can bring a feeling of confidence and equality among village children and make them equal to those studying in city schools. This feeling will make them work harder to achieve their goals.

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### Dr. G. B. Singh

Scientist  
Central Sericultural Research & Training Institute  
Sreerampura, Mysore- 570008, Karnataka

Yes, I firmly believe that introduction of computers can improve the standard of school education not only in villages but also in cities also. Here I would like to add that introduction of computers with Internet helps in improvement of quality education. The application of the computer helps in providing all required information to all villagers to get their quality education simply on mouse clicks. In

the villages where there is no school or no teachers this technology is highly useful. In a country like India where millions of people cannot get their education due to various reasons, computer really is a boon. It is proven that video/picture and diagram is more helpful in explaining the things better than reading the books. Any complicated and difficult topics can be explained very easily by the help of computer. Therefore, undoubtedly introduction of computers can improve the standard of school education in our villages.

\*\*\*\*\*

### Vandana Sharma

H.No 164, MohinderSingh Colony  
Jalandhar Cantt, Punjab

Yes, introduction of computer will work like fresh air and remove monotonous atmosphere of class room and lend clarity of vast topics, especially in science subjects. Any subject can be displayed by audiovisual aids and students can learn by seeing and become curious to know more, which would open their mind like a parachute. It would help them to peep into the world through the window of computer.

Computer literacy can reduce the burden on the mind of rural children related to written work and could slowly do away the spoon feeding methods of teaching. To make rural children computer literate, the school teacher should prepare educational slides in place of teacher diary to directly introduce the children to the computer master.

In a nutshell, with the introduction of the computer education, we will not only be bringing quality education to the rural masses but also acquaint them with the latest technology and generate self-confidence which most of them are lacking today.

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# National Seminar on Gender, Technology and Communication: A Report

A two-day national seminar on Gender, Technology and Communication was organised jointly by Vigyan Prasar and NSCD on May 10 – 11, 2010 at National Science Centre.

The seminar was divided into five technical sessions highlighting the issues of ICT and Gender Development; Women's Empowerment through Application of Technology; Gender Equity in Management of Resources; Women and Health; and Women and Social Shaping Technology.

The chief guest of the seminar, Dr. Kaiser Jamil, President, Third World Organisation of Women in Science, talked about her experience as President of an organization representing more than 102 countries, plus 3-5 supporting developed countries. She mentioned that the age-old in-grained ideas of gender roles deny women's participation in decision-making and social and economic development. Rural women, who make up the majority of the world's poor engaged in unpaid household work and who have to face additional burden of harassments by family remain unlettered.

The guest of honour, Professor Asha Kapur Mehta, Professor of Economics at Indian Institute of Public Administration, New Delhi, talked about the discrimination faced by women through life right from pre-natal, childhood, adolescence, adulthood and old age. She highlighted the socio-cultural, infrastructural and access barriers for girls and women due to large gender gaps in basic literacy combined with poverty.

The first technical session on 'ICT and Gender Development' was chaired by Dr. Swapna Mukhopadhyay, Former Professor of Institute of Economic Growth and Professor of Delhi University. The first speaker of this session was Dr. Gouri Srivastava, Head, Department of Women Studies, NCERT, who presented her views on the issues of 'Representation of Women in Media'. She discussed the status of women as portrayed in the curriculum text books. She said to improve the status of women it is necessary to break the stereotypic image of women.

The second speaker Prof. V. Siva Rama Krishnaiah, National Information Centre (NIC), New Delhi presented his views on 'e-governance in Gender Development'. For the gender equity, he said, it is necessary to provide

the equal participation and opportunity to every girl child, promote equal access to the benefits made possible by ICTs. He presented interacting case studies.

Mrs. Ujjwala Tirkey, Scientist in PVPSP, DST, shared her experiences with 'Community Radio for Women'. She gave few examples and case studies of running community radio by women and how they have been empowered.

The last speaker of the session Dr. Laxmi Devi, Principal of Shahid Rajguru College for Applied Science for Women, Delhi discussed



*During the inaugural session (L-R) Er Anuj Sinha, Dr Kaiser Jamil, Prof. Asha Mehta Kapoor and Dr Subodh Mahanti*

the 'Role of women in society'. She highlighted the problem of technical education for women by examining important obstacles faced by her own institute.

Dr. Swapna Mukhopadhyay, Chairperson of the session while summing up the presentation emphasised the need of sensitizing experts involved in syllabus preparation, and taking initiatives to break the stereotypic image of women.

The second session on 'Participation of Women in Technology Developments issues in Technology Extension' was chaired by Dr



*Chief guest of the seminar, Dr. Kaiser Jamil, President, TWOWS*

Padma Vasudevan Sen. She also presented a paper role of technology and communicator in enabling women empowerment. In her talk she focussed on the importance of communicator in bridging the gap between delivery and access for inclusive growth and pointed out that various policies and programmes have been designed and formulated but have failed to give the desired results due to the gap between the two sets.

Dr. Smita Lele, Professor, UICT, Mumbai, focussed on the empowerment of both rural and urban women by training them for sustainable simple technologies like dehydration of fruits and vegetables for a holistic development of scientific temper in the society. She also pointed out that our formal science education lacks two important aspects – economic finance and human psychology. She gave an example of a drink named 'Just Sip' developed by her organisation with the help of community as an example of use of technology for empowerment.

Dr. Vipin Kumar, National Innovation Foundation, Ahmedabad recounted out the role of local women as innovators. He raised the question whether innovations are not taking place or we cannot see them. As answer to his self raised question he mentioned that women are at the top of innovation, value and ethical pyramid it is just that we need to understand and give recognition to it.

The third session was on 'Women and Health' and chaired by Dr. Mira Shiva. The first presentation was by Dr. S T Bendre, Department of Physics, North Maharashtra University, Jalgaon. His presentation was on 'Use of Satellite Interactive Terminal for the Tribal Women's Health Programme' that Vigyan Prasar has been operating since inception several anecdotal studies point to the positive changes in the surrounding areas.

Dr. Irfana Begum, Scientist, Vigyan Prasar in her talk she presented a case study conducted by All India People's Science Network study during 2001 to 2005 at three blocks of two districts of Uttar Pradesh, viz., Raibareilly and Pithoragarh.

Dr. Mira Shiva, made her presentation on 'Occupational Health Hazards'. She highlighted that, even today, the women are restricted to 3 C's i.e. Cooking, Cleaning

and Child caring. She mentioned that women's contribution remain invisible, unaccounted, unappreciated, and undervalued.

The second day of the seminar (11 May 2010) started with the fourth technical session on 'Equitable Management of Resources', which was chaired by Dr. Gouri Srivastava, Head, Department of Woman Studies, NCERT.

The first presentation was by Dr. Shelly Parveen of Indian Agricultural Research Institute, (IARI) New Delhi Plant Biology on 'Engendering Management through Equality in Natural Resources'. Dr Praveen pointed out that despite the important role being played by women throughout ages in natural resource management, they have been facing discriminations. She shared her experience of women in agriculture and areas for interaction.

The second speaker Dr. Ajinder Chawla spoke on 'Gender Bias in Disasters'. She pointed out that the pre-existing biases are prominently reflected during disaster situations and mostly reflected on women. Referring the case study of Tsunami, Dr. Chawla mentioned that in most villages, fatality rate in women generally was higher than in males. She also emphasised the need for sensitising the community based organisations on gender issues for effective involvement and participation of women in all disaster risk reduction initiatives.

Er Ajit Seshadri of Vigyan Vijay Foundation, New Delhi. He spoke about his NGO'S experience in evolving of science and technology communication in communities for conservation and rejuvenation of natural resources, viz., water, greens and biodiversity.

Dr. Lalita Balakrishnan, former Vice President of Rural Energy Department, All India Women's Conference, spoke about 'Women in Renewable Energy' and about different national programmes and schemes for women like improved chulhas, bio-gas, parabolic solar cookers to promote renewable source of energy and promote energy efficiency.

The fifth session was on 'Women and Social Shaping of Technology', chaired by Dr. Vinita Bal, Scientist from National Institute of Immunology, New Delhi. She talked on 'Missing Women Scientists' where she discussed about poor visibility of women scientists, their problems and measures to rectifying them. She put forward some recommendations like fostering and supporting women resources in S & T, measures to attract girls into science and scientific career, etc.

Ms. Sudha Sunder Raman, General



*A section of the audience*

Secretary, All India Democratic Women's Association, New Delhi, discussed impact of new technologies on women, which, according to her, is sometimes differential and contradictory. She said there are mixed opinions about the role of technology in women's empowerment. Sometimes technology is perceived as increasing subordination of women and job loss. At the same time it is also seen that technology can improve her quality of life.

Dr. Ruchi Singh, Scientist at National Institute of Malaria Research, Delhi, spoke on empowering women through Science & Technology: Social construction. She discussed about social & cultural norms.

Dr. T. V. Venkateshwaran, Scientist, Vigyan Prasar talked about 'Gender, Science and Public Communication of S & T'. Stereotypical images of women portrayed in general are far from true. He gave examples of popular treatment of palaeoanthropology of 'Man as hunter' etc. – does not have any scientific truth. He emphasised the need for science communicators in presenting the whole picture with grounding in history and sociology of science.

In the valedictory session Shri G S Rautela, Director-General, National Council of Science Museums, who was the Guest of Honour, spoke about the gender issues in career in S&T. He talked about the gender issues in



*Chief guest of valedictory session Shri G.S. Rautella, DG, NCSM*

S&T Communication and also about the social relevance of the communication effort and contextualisation of content. While highlighting the gender issues, Shri Rautela stressed on the some of the Action Points for creating special opportunities for women to take up science as technology as career option.

Dr. Reena Ramachandran, Director General of JK Business School, Gurgaon, in her valedictory address talked about Gender Parity Education by showing an index and statistics on women in higher education and distribution of women enrollment in different streams.

Dr Sreerupa Mitra Chaudhari, an advocate for Women Rights, and President of International Women Congress in her Valedictory speech mentioned that access to technology to rural women must be provided for improvement at grass root level. She suggested having knowledge ambassadors in each district of the country that would spread the message of science to people.

A set of recommendations were drawn up at the end of the seminar outlining steps needed to be taken to reduce the gender gap in ICT applications.

The following recommendations emerged from the deliberations at the seminar:

1. Creating awareness about technologies that have contributed or have potential to help women to increase productivity, reduce drudgery, create new entrepreneurial ventures or otherwise access new income generating pursuits, is important. Researchers and extension communicators must be fully sensitized on the role of these technologies, content, problems and barriers to extension.

2. Preparing a multi-media document (in several Indian languages) on how information and communication technologies (ICTs) can empower women from low-income groups may be developed after proper validation to serve as a manual for representatives of science based organizations (government and non-government).

3. Preparing a database of the schemes/initiatives of different ministries/departments of Government of India, foundations, trusts and international organisations like (Third World Organisation of Women Scientist), multilateral organizations and make them accessible to women's groups in different parts of the country.

4. Bringing out the lives and works of the recent past and present eminent women scientists, physicians, engineers and entrepreneurs

for projecting them as role models will serve to guide parents and teachers and inspire the youth in general and girls in particular.

5. Commissioning studies to examine gender bias in the existing science textbooks/popular science books in regional and national languages must be given priority.

6. Increasing the participation of women in science and technology communication particularly those who have formal education in science and competence in communication but are not working or working part time or having career break.

7. Commissioning surveys to

understand the problems faced by women scientists, professionals and workers in industry, service sector etc. Should be encouraged. And results analyzed to offer policy amendments.

8. Training of middle and high school science teachers enabling them to create a positive attitude and a gender sensitive teaching environment in their classes and in extracurricular activities must be given high priority.

9. Bringing out a series of popular publications addressing the health, livelihood and other practical needs of women in rural and tribal areas.

10. Designing and creating a technology portal for technology generators, developers, users and others may be initiated at the earliest.

11. Channels for recognising and show-casing grass root level rural women communicators must be developed.

12. Facilitate networking between educational institutions, NGO's and government extension organization for effective outreach.

13. Success stories may be compiled along with causes for failure in adopting a technology that will help technologists and researchers in their development work.

## Press Meet organised by Vigyan Prasar on International Biodiversity Day, 22 May 2010 at Press Club of India, New Delhi

### Science Outreach Campaign for Year of Biodiversity

(Vigyan Prasar is a national institution for science and technology communication under the Department of Science and Technology. This institution is engaged in developing communication material for large campaigns. The objective is to enhance level of rational decision-making in the community.)



During the press meet (L-R) Ms. K. Dasgupta Mishra, Prof. C.K. Varshney, Er Anuj Sinha and Dr. Subodh Mahanti

Vigyan Prasar organised a Press Meet on International Biodiversity Day, 22 May 2010 at the Press Club of India, New Delhi. It was well attended by representatives of various media houses including The Hindu, Times of India, UNI, UNI Television, ETV, Amar Ujala, Dainik Bhaskar, Jansatta, Web Varta, Outlook, All India Radio, Mail Today and many other regional newspapers and magazines. Science communicators, editors of the science magazines and scientists of Vigyan Prasar were present.

Prof. C. K. Varshney, eminent environmentalist and former Professor, Jawaharlal Nehru University, New Delhi was invited as keynote speaker. Ms. Arfa Khanum, Broadcaster and Film maker was invited as youth representative. She inaugurated the slogan of Vigyan Prasar for International Year of Biodiversity 2010 "Samagra vikas kaise hoga, jai vidhidhta ke sanrakshan se hoga (How will sustainable development take place, it will happen with the conservation of biodiversity)"

Er Anuj Sinha, Director, Vigyan Prasar announced the plan of action for "Science Outreach Campaign for Year of Biodiversity". Er Sinha said that Vigyan Prasar has produced interesting communication material on biodiversity conservation. This offers a rich resource for activists and media. It is now developing new training material – books, CD-Roms, and activity kits that

over the next twelve months will be used extensively for training village leaders and sensitising youth. The key message will be "Sustainable development critically depends on conservation of biodiversity".

We need to develop a tool for village centric environmental impact analysis that can support the process

of decision-making by local elected bodies.

India with an area of 325million hectares is the seventh largest country in the world with varied climatic and topographic conditions. These have resulted in a wide range of ecosystems and habitats contributing an immense biological diversity micro and macro. Anthropogenic factors have lead to



Media persons from newspapers, magazines and TV channels during the press meet

a decline in species with several under threat of becoming extinct. There is an increasing imbalance in biodiversity and ignoring this would be at our peril.

The United Nations Organization has declared 2010 as the International Year of Biodiversity. This celebrates life on Earth and aims to enhance public awareness of importance of biodiversity conservation. Commendable community efforts need to be projected and innovative solutions encouraged to reduce threat to biodiversity. The year offers an opportunity to commence a dialogue between stakeholders.



Slogan on Biodiversity: How will sustainable development take place, it will happen with the conservation of Biodiversity