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Monthly Newsletter of Vigyan Prasar

DREAM 2047

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VP News

A Science Channel for India

Development and Educational Communication Unit /ISRO and Vigyan Prasar/ DST have jointly planned to launch a dedicated science channel with an objective to make information science, engineering and technology accessible to all sections of the society, there by empowering people to take initiatives based on this knowledge. After a series of meetings with scientists, educationists, teachers, students, NGOs, film-makers and other media personalities and concerned individuals, a vision statement for the channel was prepared. Based on the deliberations of these meetings, it is planned to start a pilot project

Sitting from L to R (Front Row) Dr. V.B. Kamble , Director, Vigyan Prasar, Prof. V.S. Ramamurthy, Secretary DST, Hon'ble MOS Shri Kapil Sibal, Shri B.S. Bhatia, Director, DECU.

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Inside

Vigyan Prasar's Activities in Andaman & Nicobar Islands

A 13-episode science quiz programme produced by Vigyan Prasar jointly with CHETNA, a socio-cultural organisaiton at Port Blair, Andaman and Nicobar Islands, was broadcast by All India Radio, Port Blair, from 11 July to 10 October 2004. This was the first major activity of Vigyan Prasar in the region. Fifty-four students from twenty-seven schools participated in the quiz programme. Before finalising the contents of the programme, a meeting of local resource persons and experts was organised at Port Blair in the month of February 2004. The programme was very well received by the audience. To mark the completion of the project and to give away prizes to the winners, a function was organised at the Tagore Government College of Education, Middle Point, Port Blair.

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Dr. V.B. Kamble, Director, VP, presenting a set of Vigyan Prasar publications to His Excellency Prof. Ram Kapse, Lt. Governor of Andaman and Nicobar Islands. Dr. Subodh Mahanti of Vigyan Prasar looks on.

... think scientifically, act scientifically... think scientifically, act scientifically... think scientifically, act...

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Editor : Dr. V.B. Kamble

Dream 2047 – 75th Issue

This is the 75th issue of *Dream 2047*. It started as an in-house publication and a monthly newsletter of Vigyan Prasar in August, 1998. Over the years, it has flourished into a monthly newsletter-cum-popular science magazine that reaches 32,000 subscribers in all parts of the country – students, teachers, scientists, schools and R&D organizations.

Surely, the main objective has been to provide information on current topics in science and technology and spread awareness about Vigyan Prasar's programmes and activities among individuals and agencies involved in the field of science and technology popularization. A modest newsletter though, the production of every issue has invariably posed a few problems and challenges, from conceptual stage to the production stage. Articles may not be ready on time, or the English to Hindi translation (or vice versa) may not have been completed! Then, some key member may be on leave when he / she is most needed, or the DTP system may refuse to co-operate! No doubt, it is maddening at time. Yet, there is method in madness and harmony within the group that eventually brings each issue to your hands – on time!

Dream 2047 has been a common thread binding thousands of individuals and government and non-government organizations. The interaction with readers has not only helped us exchange useful information, but also evolve and formulate some of our projects and programmes. It has brought us in contact with individuals in diverse fields and from all walks of life with expertise in specific fields who are eager to render their services to the cause of science popularization. *Dream 2047* has proved to be an effective two-way communication channel between Vigyan Prasar and students, teachers, scientists, S&T communicators and social workers. Truly, it has been a symbiotic relationship. Initially, the articles in *Dream 2047* were mainly written by the Vigyan Prasar team. Today, we have regular columns and articles contributed by well-known and accomplished scientists and science communicators throughout the country active in diverse fields of human activity. This shows the readers' support and reputation *Dream 2047* has earned over the years.

We continue to receive letters from our readers day in and day out from every nook and corner of the country, sometimes from even the most interior parts, regarding the articles published in the magazine. In particular, articles on current topics and biographies of scientists are especially appreciated. Indeed, we are extremely grateful to our esteemed readers who have been keeping us on the tenterhooks for a continuous effort on our part for improvement in the quality of the magazine through their valuable comments and suggestions.

In an earlier issue of *Dream 2047* (August 2001), we had published a questionnaire for a survey of readers' responses. Most readers agreed that the newsletter is serving its purpose in providing information and spreading awareness about current topics / issues in science and technology alongwith Vigyan Prasar's programmes and activities. To improve its utilitarian value further, it is imperative that *Dream 2047* reaches even more people. May be it would then help us locate those hidden, silent and dedicated activists and communicators engaged in their own inimitable way in the spread of science and scientific outlook, and in the development of technologies suited to our country. This would also help us evolve programmes and schemes more meaningful for specific groups of people, say, cultural or geographical. Our strength lies in such individuals who have been contributing to scientific awareness and inculcation of scientific temper in the country.

The editorials and articles have often dealt with current topics, events, trends, new approaches and so on. Our readers write to us how eagerly they wait for each issue of *Dream 2047* every month and how they treasure it! Often, we received accolades, often brickbats. But, *Dream 2047* has always continued to look forward with a firm commitment to serve its ever growing community of readers to keep them abreast of current topics and issues, Vigyan Prasar's activities, and has been acting as a two-way communication channel with them. We look forward to continued support from our esteemed readers.

❒ V. B. Kamble

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Raja Ramanna

India's Most Eminent Nuclear Physicist

❑ Subodh Mahanti
e-mail : mahantisubodh@yahoo.com

"All history revolves itself very easily into the biography of a few stout and earnest persons."

Ralph Waldo Emerson

"Lives of great men all remind us
We can make our lives sublime,
And, departing, leave behind us
Footprints on the sands of time."

Henry Wadsworth Longfellow

"A towering and multi-faceted personality, Dr. Ramanna was always keen to contribute to national development with a sense of mission in any capacity, which was evident in his role as a Union Minister and Member of Parliament. For us in the science and technology community, Dr. Ramanna was always a source of inspiration and a guide."

A.P.J. Abdul Kalam, The President of India

"Out of the uncertain beginnings in the 1950s, if we have today achieved the status of a "developed country" in nuclear science and technology, it is in large measure a consequence of Dr. Ramanna's ideals, policies and efforts. He certainly leaves behind the proud legacy of a magnificent edifice of scientific and technological achievements and attainments, particularly towards the country's energy and national security."

P. K. Iyengar, former Chairman of the Atomic Energy Commission, Govt. of India

Raja Ramanna was a multifaceted personality – an eminent nuclear physicist, a highly accomplished technologist, an able administrator, an inspiring leader, a gifted musician, a scholar of Sanskrit literature and philosophy, and above all a completed human being. He made important contributions, both theoretical and experimental, in various areas of nuclear physics. He was not a so-called ivory tower scientist. Following the ideals of his illustrious predecessors Homi Bhabha and Vikram Sarabhai in India's nuclear energy programme, Ramanna played an important role in placing the country's indigenous nuclear capabilities on a firm footing and in this process his contributions towards shaping India's energy and security programmes are quite significant. In fact Ramanna is regarded as one of the most successful creators of Science and Technology in India. Ramanna's contribution to India's peaceful nuclear explosion experiment is well-known. India's first peaceful nuclear experiment was carried out underground in the Rajasthan desert on May 18, 1974. As Ramanna later pointed out, "The Pokhran experiment was a landmark in the history of nuclear research in the country. It was an assertion of the technological advancement India had determined to perfect in the post-independence era."

Raja Ramanna

Ramanna was a staunch patriot. He could have easily settled abroad but he spurned the charm of living in a developed country and responded to the call of Homi Bhabha and joined India's effort to develop a strong indigenous base of science and technology. He helped to create an efficient manpower in the country. Ramanna had a deep interest in music. He himself was an accomplished musician. He wrote a book on music, *The structure of Music in Raga and Western Music*. He was actively involved in setting up the Bangalore School of Music. Ramanna had interest in philosophy. He also took keen interest in yoga. He had a sense of humour, that was subtle and enjoyable. He was a very simple person and he was approachable to all.

Raja Ramanna was an able administrator. He occupied many prestigious positions. He was the Director of the Bhaba Atomic Research Centre (1972-78 and 1981-83). He was Scientific Advisor to the Minister of Defence; Director-General, DRDO and Secretary for Defence Research, Government of India (1978-81). He was Chairman of the Atomic Energy Commission (1984-87). He was first Director of the National Institute of Advanced Studies, Bangalore established by J. R. D. Tata.

Ramanna served as the Minister of State for Defence in the Union Cabinet (January to November 1990). Ramanna was a nominated Member of the Parliament, Rajya Sabha, (August 1997-August 2003). He was a member of the first National Security Advisory Board. In whichever capacity he worked, he worked with a missionary zeal.

B. Ramanna, Raja Ramanna's Father (1889-1955)

Rukminiamma, Raja Ramanna's Mother (1893-1980)

Ramanna was born in Tumkur in Karnataka on January 28, 1925. Commenting on his parents, B. Ramanna and Rukminiamma, Ramanna wrote in his autobiography: "My mother was born into a family of considerable influence and wealth and was the youngest of a large family of eight children. Her father was a district judge, a position of no mean stature in those days...my mother was an intelligent woman. A voracious reader, she read much of Shakespeare and Dickens, though Sir Walter Scot was her favourite. Her deep forays into literature were possible because of her command over the English language and it seemed to me there wasn't a word in the English dictionary she didn't know. She was equally comfortable with Kannada and composed poems and speeches in the language but had a slight contempt for its lack of modernity. Considering all this, she wasn't exactly avant-garde—she dressed in traditional attire, was religious and even though she exchanged views on sex with my older brothers these were thoroughly Victorian in their orientation. She was superstitious, which was absolutely contradictory to her character, but this could probably be explained as clinging to the old traditions because the new trends were still unfamiliar ground. Yet she was fascinated by and understood modern gadgets. She loved to repair electrical goods and was the first woman in Mysore to use electricity for domestic purposes. She also spent a lot of time in re-designing the house and making changes to the sewage system."

Malathi Ramanna, Raja Ramanna's wife, with Mrs Indira Gandhi Bombay, 1984.
(reproduced from Raja Ramanna's autobiography "Years of Pilgrimage")

On his father he wrote: "My father, B. Ramanna, was in the judicial service of the Mysore state and earned the reputation of being a kind-hearted judge. Although he was reticient, he was nevertheless a sociable person. A sports enthusiast, he loved playing tennis, played a good game of billiards and was especially fond of bridge–a game he played almost till the end of his life. My mother learnt to play bridge from him, but never quite captured the subtelities of the game and they would often launch into mutual criticisms after every rubber. In spite of the differences in their temperaments, my parents made the best of their lives and were a major influence in the growing up of all their children."

Besides his parents Ramanna was greatly influenced by one of his aunts. His mother's sister Ramanna wrote: "Another member of the family who was a quite influence on my life was my mother's sister, Rajamma. Widowed at a young age, Rajamma was considered a beauty as a young woman. After she lost her husband, my grandparents, who were progressive, had her trained to become a schoolteacher. Rajamma finally rose to become the headmistress of a Government Middle School on a salary of fifty rupees a month...A fantastic story-teller, Rajamma would often tell me stories from the *Puranas* and the great epics. In retrospect that was the best education I ever received. I'm proud of the fact that Raja, the name by which I am referred to by all my friends, is taken from my aunt's name—Rajamma."

He had his early education in Mysore and Bangalore. When his family shifted to Bangalore, Ramanna joined the Bishop Cotton School. The school was part of an English public school system that had been originally established as an orphanages of Anglo-Indian children. However, by the time Ramanna joined the school its character had been totally changed. It had become an elitist school. Commenting his school education Ramanna wrote: "Although I managed to do well in school as far as studies were concerned, I still felt somehow a misfit as I couldn't conform to a major activity in the curriculum set up by the British–sports. However, that did not pose a great problem because I'd another support system–music. Classical music during my school days, as evident today, was not particularly liked by many, but that did

not kill my enthusiasm for it because the then warden of my school, Canon Elphick, was a music lover and I struck up a friendship with him…Yet another teacher whom I remember fondly at school was Maurice Lanyon. A missionary, he had come to India at a very young age, charged with the spirit of self-sacrifice. Lanyon was an excellent musician, a good pianist and a baritone with a fine voice and I used to wonder why, with his talent, he had come to India and buried himself in missionary service. I was drawn to him and recall several hours of playing the piano together and listening to lectures on musicology…The Bishop Cotton School, was known for its discipline and I benefited a lot from this. Despite facing problems of transition, my school kept up standards and remained a good institution within the definition of "good" of that period." From Bishop Cotton School he went St Joseph's School for his intermediate studies.

After completing his intermediate studies at St Joseph's, Bangalore he joined the Madras Christian College in Tambaram. He did very well in his intermediate examination. He was among the six students who were selected for BSc (Honours) course majoring in physics. After obtaining his BSc (Honours) degree in physics from Madras Christian College in Tambaram, he went to England to work for his doctoral in the field of nuclear physics at the King's College, London, as Tata Scholar. He obtained his PhD degree in 1948.

The present premises of Tata Institute of Fundamantal Research

Ramanna was deeply influenced by Homi Jehangir Bhabha. He had met Bhabha for the first time in 1944. Ramanna was introduced to Bhabha by Dr. Alfred Mistowski, an examiner from the Trinity College of Music, who had to stay back in India due to the outbreak of the Second World War. Recalling his first meeting with Bhabha, Ramanna wrote: "One day, in 1944, Dr. Mistowski told me that there was a famous Indian scientist and his mother spending their vacation in the state guest house where he was staying and wondered whether, I, a science student, would like to meet them. He said the scientist was also interested in music, especially in Mozart. Apparently, they came down from their rooms every evening, formally dressed, in order to listen to music on the gramophone records. 'But,' Dr. Mistowski said 'you must of course know him, his name his Homi Bhabha.' My meeting with Bhabha would determine the course of the next several years of my life. But even as I looked forward to the future, I was aware that my youth and my childhood would now be in the past." This was not to be the first and last interaction with Bhabha. During one of his trips to London in 1947, Bhabha offered Ramanna a job in Tata Institute of Fundamental Research, the cradle of India's atomic energy programme. Bhabha allowed Ramanna to complete his PhD. Ramanna joined the TIFR on December 01, 1949. In those days TIFR was being developed. To quote B. V. Sreekantan, a colleague of Ramanna in TIFR: "When Ramanna joined TIFR, the institute had just been shifted from its first premises at Kenilworth, 54, Pedder Road, Cumbala Hills in Bombay to the Yatcht Club premises and alteration work of the building was in full swing. The so-called servants' quarters of the Yacht Club were converted as the hostel for unmarried scientists of TIFR. Bhabha, who had known Ramanna's interests and abilities in music, allotted him two adjacent rooms in the top-most fourth floor of the hostel, one for Ramanna and the other for his piano. The ground floor of the hostel became the nuclear physics laboratory of Ramanna, where he started his work on nuclear fission and scattering." Recalling his own impression of TIFR at the time of his joining Ramanna wrote in autobiography: "I joined the TIFR when it was in its fifth year and the initial problems of administration and finances had been overcome. To begin with, it was essentially a laboratory confined to aspects of science in which Bhabha was primarily interested. However, by the time I arrived the institute had expanded and now even had a School of Mathematics which helped it gain a stronger foothold as a major centre of learning. Among others, the school boasted on its faculty, Dr. D. D. Kosambi, who was not only an expert in differential geometry but was a numismatist, historian, linguist, Sanskrit scholar and a pleasant man who was something of a gourmet. I would have never learnt to appreciate Chinese food, especially crabs, had he not taken me to the Nanking Restaurant, across the road". Further he continues, "Although Bhabha's contribution to cosmic ray physics was internationally known even before his return to India at the outbreak of the War, the TIFR had yet to make its mark as a centre for scientific learning. Its work in theoretical physics was known because of the work done by Bhabha and his students, but the other branches had a long way to go. The experimental group started by Bhabha deserves special mention because they became the forerunners of all indigenous technological activity in the country and heralded the beginnings of an

extensive atomic energy programme in India. The initiation of these activities was partly due to A. S. Rao, head of the Department of Electronics, who started these programmes under the most difficult of circumstances."

Dr. Homi Bhabha

Ramanna made important contributions in several areas of neutron, nuclear and reactor physics. Ramanna played a leading role in organizing physics and rector physics programmes at the Bhabha Atomic Research Centre, Trombay. Ramanna was a young reactor physicist in the team under Bhabha, when India's first research reactor, Apsara, was commissioned on August 04, 1956. M. R. Srinivasan, a former Chairman of the Atomic Energy Commission wrote: "A team with varied skills took charge of different aspects of the reactor. Raja Ramanna, a physicist from the Imperial College of Science in London, drew up the requirements for neutronic experiments. K. S. Singhvi, a theoretical physicist, headed the team's theoretical work on the physics of the reactor. A. S. Rao, an associate of Bhabha, was an electronics specialist in cosmic ray studies using balloons that were being sent up at the Indian Institute of Science, Bangalore. Rao was responsible for the control and instrumentation work. N. Bhanu Prasad was responsible for overall design of the reactor and auxiliary equipment. Homi Sethna, a chemical engineer, was manager of the India Rare Earths Plant; this plant extended logistic support to the construction of the swimming pool reactor. An important member of the team was V. T. Krishnan, an old school mechanical engineer who had been teaching in an engineering college in Maharashtra. He was put in charge of the construction of the reactor building and the reactor pool."

As a part of the studies relating to the design and construction of Apsara, India's first reactor, Ramanna studied the process of neutron thermalisation in several moderating assemblies. Ramanna and his group determined the neutron diffusion and slowing down constants in water and beryllium oxide by using a pulsed neutron source. The neutron spectra emerging out of these moderating assemblies were also studied. Apsara, once commissioned, made intense thermal neutron beams available for basic research. This prompted Ramanna to undertake a programme of experimental investigations of secondary radiations emitted in thermal neutron-induced fission of U235. Ramanna and his coworkers measured the energy and angular distributions of prompt neutrons and gamma rays emitted by fission fragments. Such measurements provided important information on the times of these radiations, presence of scission neutrons, the average spin of the fission fragments and so on. The investigations carried out by Ramanna and his coworkers on light charged particle emission in fission induced by thermal and fast neutrons provided important insight on the mechanism of emission of these particles. The stochastic theory of fragment mass and charge distributions in fission is a unique contribution of Ramanna to fission theory. The theory, which was based on the model of a random exchange of nucleons between the two nascent fission fragments prior to scission, could explain most of the observed features of fragment mass and charge distribution in low energy fission and their dependence on the excitation energy of the fissioning nucleus. A geometrical interpretation of atomic and nuclear binding energies was another novel contribution of Ramanna and his group.

Dr. Vikram Sarabhai

Ramanna's most important contribution was the creation of a vast pool of trained scientific manpower. Thus M. R. Srinivasan, a former Chairman of the Atomic Energy Commission, wrote: "The legacy of Ramanna is that over a half century of his association with atomic energy programme, he helped build up a large pool of scientists and technologists who could take on new and challenging problems in nuclear science and technology for national progress..." To develop the skilled manpower required for this task, the BARC (DAE) Training School was established in 1957 under the leadership of Ramanna. In his autobiography Ramanna wrote: "One aspect of the atomic energy programme that I had a lot to do with was the BARC Training Programme. It was imperative that well-trained scientists be involved in our programmes and as I've said earlier the universities had become rather ineffectual in imparting useful scientific education; again we did not want to deplete the universities of the few good teachers by recruiting directly. It seemed a somewhat obvious solution to utilize the services of the large number of trained instructors we already had to teach a small number of bright students. The interaction, it was felt, would not only benefit the students but also teachers who would be able to concentrate on a few, particularly when the handful had already proved their worth. It was these considerations that led to the creation of the BARC Training School in 1957. Apart from churning out scientists for the future, the school also helped greatly in stalling the emigration syndrome." The training school has proved to be remarkably successful. B. V.

Sreekantan wrote: "…the (training) school has produced more than 6000 scientists and engineers who are manning various divisions of the Atomic Energy Establishment in different parts of the country. It is indeed remarkable that some of the older alumni of this school have achieved such distinction as becoming Chairman of Atomic Energy and Space Commissions, Adviser to the Ministry of Defence, Directors of several laboratories, Secretaries to Science Departments of Government of India, senior professors at institutions like TIFR; some have moved to industry and some have settled abroad in good positions…It would have made made a big difference if this successful model had been adopted in many other fields of scientific activity too."

Ramanna encouraged creativity at every level. He particularly encouraged the young scientists to take up challenging tasks. In Ramanna's schema of things there was no place for complacency or mediocrity. K. S. Parthasarathy, who had the opportunity to work with Ramanna, said: "During the Divisional Review Programme, he (Ramanna) started in BARC, the senior staff of every division presented their work. We attended them primarily to listen to Dr. Ramanna's delightful and erudite concluding remarks. He would cut the pretentious to size, compliment the deserving and point out areas for further study. His incisive analysis was a treat; his acidic tongue lashed at the mediocre. He hated "slide rule" engineering! He craved for originality and creativity."

Ramanna directly or indirectly helped to build up a number of institutions in the country. In the early 1980s

Raja Ramanna with President R. Venkataraman (extreme left) and Prime Minister V.P. Singh (centre) at his swearing-in as Minister of State for Defence
(reproduced from Raja Ramanna's autobiography "Years of Pilgrimage")

he took the initiative for setting up a Centre for Advanced Technology at Indore, devoted to the development for advanced accelerators, lasers and other related technologies. He helped to establish the Variable Energy Cyclotron Centre (VEC) at Kolkata. He was the founder-Director of the National Institute of Advanced Studies (NIAS) at Bangalore established by JRD Tata. He was

The first home of the Tata Institute of Fundamental Research (TIFR), Bombay
(reproduced from Raja Ramanna's autobiography "Years of Pilgrimage")

the Chairman, Board of Governors of the Indian Institute of Technology Bombay (1972-78); President of the Indian National Science Academy (1977-78); Member/ Chairman, Scientific Advisory Committee to the Director General, International Atomic Energy Agency; President, 30th General Conference of the International Atomic Energy Agency (1986).

Ramanna was associated with a number of science academies and learned bodies. He was Vice President, Indian Academy of Sciences (1977-79), President, Indian National Science Academy, New Delhi (1977-78); President, General Conference of Atomic Energy Agency, Vienna (1986). Among the various awards that he received included: Shanti Swarup Bhatnagar Award (1963), Padma Vibhushan Award (1975), Meghnad Saha Medal of the Indian National Science Academy (1984), R. D. Memorial Award (1985-86), Asutosh Mookerjee Gold Medal (1996). He was awarded doctorate (honoris causa) by several universities.

Any write-up on Ramanna would not be complete without mentioning his love for music. He was not only an expert on music but he himself was an accomplished musician. He was drawn to music at an early age. To quote Ramanna: "My close association with Western music started with my changing schools when I was six years old. The old school, called the Dalvoy School, was an overcrowded cattle-shed and my parents realized that it would not sut me. I was shifted to the Good Shephered Convent which was located on the outskirts of Bangalore. The nuns of this convent had taught the members of the royal family and enjoyed a good reputation. Apart from that, the main advantage at this school was that they also taught European music. At home, there was now the general feeling that because there was enough appreciation of Carnatic music somebody should also study European music. It was decided eventually that I make the effort and so began my piano lessons at the new school at the ripe age of six. I guess the nuns at

Ramanna Planting a sapling at CAT site, Indore (1983)
(reproduced from Atomic Energy in India: 50 years)

the convent must have been conscientious but I was not particularly attracted to any of them except for one outstanding lady, an Irish nun called Mother Maurice. She had been the music teacher to the Yuvaraja's son, Jaya Chamaraja, and all the princess of Mysore court. Philomena Thumboo Chetty, a distinguished violinist of the thirties, had also been her student. Mother Maurice was a sensitive teacher and was particularly good with young children. It was she who made music an indispensable part of life."

Krisnaraja Wadiyar, the then Maharaja of Mysore was a great admirer of young Ramanna's abilities in music. Ramanna valued this appreciation with gratitude. He wrote: "....I had the good fortune of coming to the attention of the Mysore Maharaja. An ardent music-lover, the Maharaja appreciated both Western and Indian music. His court was supported by a good orchestra under the conductor Otto Schmidt, a German. The Maharaja also patronized a host of Carnatic and Hindustani musicians, as was the tradition of the time. Word reached him, through various sources, that I could play the piano well and an audition was fixed for me at the Jaganmohan Palace in 1937.

On the day of the audition, the Maharaja listened intently to a new set pieces that I played for him. Later, he came up for a chat and asked whether my teachers were guiding me properly and whether they discriminated between me and the European children. I was touched, the Maharaja was genuine in the care he showed towards a twelve-year-old."

Ramanna died on 24th September, 2004 at Mumbai after a cardiac arrest.

Ramanna is no more. We Indians must honour his memory. But then as P. K. Iyengar has pointed out, Ramanna's "more important legacy is his uncompromising belief in intellectual clarity and rational thinking in every facet of life, and his unwavering belief (which he inherited from Jawaharlal Nehru and Homi Bhabha) that the nation could progress only by embracing science and scientific thinking. The best way to honour his memory is not through eulogies, but by rededicating ourselves to his policies and belief."

Raja Rammana, as a boy of eleven
(reproduced from Raja Ramanna's autobiography "Years of Pilgrimage")

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Vigyan Prasar participated in the Times book fair held at Mumbai from 21-25, October 2004

Spices in Our Diet

A Role Beyond Food Flavouring

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Spices are consumed all over the world as food adjuncts to enhance sensory quality of foods, the quantity and variety consumed in tropical countries being particularly extensive. The primary function of spices in food is to improve the organoleptic quality of our otherwise insipid food preparation. Many spices like coriander, cumin, cinnamon, asafoetida, clove, cardamom, garlic, onion, etc, impart typical characteristic aroma or flavour to different foods. Red pepper or black pepper gives the desired pungency; Spices such as turmeric impart the attractive color to food enhancing the eye appeal, while fenugreek can alter the textural property of food. Besides enhancing the flavour and aroma of food, spices have also been long recognized to possess physiological effects supposed to be beneficial to human system. They act as stimulus to the digestive system, relieve digestive disorders, and some spices have some antiseptic value. Their attributes such as tonic, carminative, stomachic, diuretic, anti-spasmodic largely empirical nevertheless efficacious have earned them pharmacological applications in the indigenous system of medicine in India.

The spice trade, probably, is the most ancient trade practiced by man. The affluence generated by the spice trade has been responsible for several historic voyages and discoveries of new lands. Today, the annual global spice trade is estimated to be over $2000 million involving a quantity of 500,000 tons. Incidentally, India is not only the largest producer of spices but also the biggest exporter and the largest consumer of spices in different forms. Over 60 species of spices are grown in India which include the pungent spices, aromatic fruits, umbelliferous fruits, aromatic barks, phenolic spices and colour spices. Spices are not only used individually, but also in the form of spice mixtures known as curry powders to suit different tastes and dishes.

Nutrient makeup of spices

Although spices have never been considered to be contributing anything to human nutrition, this group of food adjuncts is in use in human diets for centuries as flavour modifiers to make food more palatable. Interestingly, the protein content in spices varies from 4.5 % in rosemary leaves to 31.5% in mustard, fat level varies from 0.6 % in garlic to 42.6 % in mustard. The ash content can be anywhere from 2.3 % in marjoram to 16.7% in basil leaves reflecting high mineral levels in them. Some of them contain significant levels of vitamins and minerals, which cannot be ignored. A few spices are also rich sources of dietary fibre. Amongst common spices consumed, the dietary fibre is highest in chilli, as high as 43.3% while black pepper (27.8%), coriander (36.2%), cumin (23.0%), fennel (28.7%) and fenugreek (33.5%) also are rich sources of dietary fibre, both soluble as well as insoluble. However, due to low levels of consumption of spices, their impact on nutrient makeup may not be as dramatic as other food ingredients.

Nutraceutical attributes of spices

In the last 3 decades, many beneficial physiological effects of spices have been experimentally documented which suggest that the use of these food adjuncts extend beyond taste and flavour. The components of spices responsible for the quality attributes have been designated as active principles, and in many instances they are also responsible for the beneficial physiological effects of spices. Thus, curcumin of turmeric, capsaicin of red pepper, piperine of black pepper, and eugenol of cloves are responsible for the beneficial effects of the respective spices. The salient features of multifaceous beneficial physiological effects of spices so far documented are summarized below:

Digestive stimulant action : The digestive stimulant action of spices is probably the most common experience. Spices like ginger, mint, ajowan and garlic are used as ingredients of pharmacological preparations for digestive disorders. Extensive animal studies have revealed that many spices (curcumin, capsaicin, ginger, fenugreek, mustard, cumin, coriander, ajowan, tamarind and onion) stimulate bile acid production by the liver and its secretion into bile. Bile acids play a major role in fat digestion and absorption. Several spices are also evidenced to stimulate the activity of digestive enzymes of pancreas, particularly lipase and terminal digestive enzymes of small intestinal mucosal upon continuous intake.

Table-1
Medicinal properties of spices recognized for long time.

Spice	Medicinal Properties
Turmeric (*Curcuma longa)*	Anti-inflammatory, diuretic, laxative, good for affections of the liver, jaundice, diseases of blood
Red pepper (*Capsicum annuum*)	Anti-inflammatory, for pain relief (Rheumatism /neuralgia); useful in indigestion, rubefacient
Garlic (*Allium sativum*)	Anti-dyspeptic, anti-flatulent, for ear infection, duodenal ulcers, as rubefacient in skin diseases
Onion (*Allium cepa*)	Diuretic, emmenagogue, expectorant, for bleeding piles
Fenugreek (*Trigonella foenumgraecum*)	Diuretic, emmenagogue, emollient, useful in heart diseases
Cumin (*Cuminum cymminum*)	Antispasmodic, carminative, digestive stimulant
Coriander (*Coriandrum sativum*)	Anti-dyspeptic

Antidiabetic potential : In a search for novel dietary antidiabetic agents, spices have also been examined. Fenugreek, garlic and onion, and their sulfur compounds, turmeric and its colouring principle - curcumin have been found to be effective in improving the glycemic status and glucose tolerance in diabetic animals / NIDDM patients. Animal studies and clinical trials on antidiabetic properties of fenugreek and onion have been particularly extensive, while human studies are limited in the case of garlic and turmeric. The fibre-rich fenugreek is believed to delay gastric emptying by direct interference with glucose absorption. The hypoglycaemic potency of garlic and onion is attributed to the disulfide compounds present in them, which cause direct or indirect stimulation of insulin secretion, by the pancreas. In addition, they may also have insulin-sparing action by protecting from sulfhydryl inactivation. Nephropathy is a common complication in chronic diabetes. Dietary curcumin and onion have been shown to ameliorate kidney lesions in streptozotocin diabetic rats. Hypocholesterolemic effects as also their ability to lower the extent of lipid peroxidation under diabetic condition are implicated in the amelioration of renal lesions. Capsaicin, the pungent principle of red chilies has been shown to be useful in diabetic neuropathy.

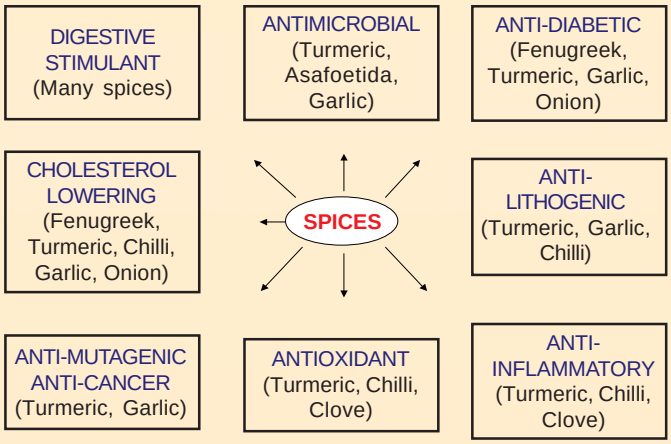
Hypolipidemic influence : The importance of blood cholesterol levels and of lipoproteins in relation to atherosclerosis and coronary heart diseases is well known. Several common spices have been evaluated for a possible cholesterol lowering effect in a variety of experimental situations in both animals and humans. Fenugreek, garlic, onion, turmeric and red pepper are found to be effective as hypocholesterolemics under various conditions of experimentally induced hypercholesterolemia / hyperlipidemia. Further, fenugreek, onion and garlic are effective in humans with hyperlipidemic condition. In addition, garlic exhibits anti-thrombotic and hypertensive properties, which also contribute to cardiovascular protection besides the hypolipidemic properties.

Anti-lithogenic effect : Persistent lithogenic diet leads to cholesterol satu-ration in bile resulting in formation of cholesterol crystals, i.e., gallstones in gall bladder. Animal studies to examine the efficacy of dietary curcumin and capsaicin in regressing the preformed cholesterol gallstones have revealed significant regression by these spice active principles. The possibility of such a beneficial prevention and regression of cholesterol gallstones by other known hypocholesterolemic spices remains to be examined.

Antioxidant activity : Reactive oxygen radicals are detrimental to cells at membrane and genetic level. They induce lipid peroxidation in cellular membranes generating lipid peroxides, which cause extensive damage at cellular and sub-cellular level. Oxidative damage is an important even in disease processes such as CVD, inflammatory disease, carcinogenesis, and aging. Studies with several *in vitro* systems as well as *in vivo* animal studies have revealed that spice principles curcumin (turmeric), capsaicin (red pepper) and eugenol (cloves) have beneficial antioxidant property by quenching oxygen free radicals, by inhibiting the production of superoxide anion and hydroxyl radicals, and by enhancing the antioxidant enzyme activities.

Anti-inflammatory property : Lipid peroxides play a crucial role in arthritis and other inflammatory diseases. The antioxidant spice turmeric is probably the earliest anti-inflammatory drug employed. Turmeric extract, curcuminoids, and volatile oil of turmeric have been found to be effective as anti-inflammatory in several studies. Both *in vitro* and *in vivo* animal experiments have documented the anti-inflammatory potential of spice principles curcumin, capsaicin and eugenol. Animal studies have revealed that curcumin and capsaicin also lower the incidence and severity of arthritis and also delay the onset of adjuvant induced arthritis.

Antimutagenicity and anti-cancer effect : Since mutation is a primary event by which cancer is caused, an



antimutagenic substance is likely to prevent carcinogenesis. Turmeric / curcumin, garlic / its sulfur compounds have been shown to be antimutagenic in several experimental systems. Animal studies involving experimental induction of tumour of specific tissues have revealed significant reduction of the incidence of tumour in curcumin treatment. Cancer preventive ability of garlic has also been documented in etiological studies.

In summary, many health beneficial attributes of these common food adjuncts have been recognized in the past 3 decades. A few of the above health beneficial attributes of spices have the potential of a possible therapeutic exploitation in a variety of disease conditions. In view of the many promising health beneficial physiological effects spices are understood to exert, these food adjuncts have now assumed the status of "Nutra-ceuticals" and are considered as the natural and necessary component of our daily nutrition. Since each of the spices possesses more than one health beneficial property and that there is a possibility of synergy among them in their action, a spiced diet is likely to make life not only more 'spicy' but more healthy also.

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(VP News)

EDUSAT Science Channel *(contd. from page....36)*

on Doordarshan for a year and then switch over to EduSat. A meeting with producers, representatives of private channels and media persons for inviting ideas on software to be prepared for the Science Channel and to discuss possible collaboration with private channels was organized on October 12, 2004 at India Habitat Centre. The meeting was chaired by Shri Kapil Sibal, Hon'ble Minister of State (Independent Charge) for Science and Technology and Ocean Development. Professor V. S. Ramamurthy, Secretary, DST, was also present. About 25 producers and representative participated in the meeting.

Dr.V. B. Kamble, Director, Vigyan Prasar, welcomed the Hon'ble Minister and other participants. He gave brief introductions about the activities and objectives of Vigyan Prasar. Shri B. S Bhatia, Director, DECU, made a presentation on the background of the proposed Science Channel and the progress made thus far. Shri Bhatia informed that to begin with there will be three slots in a week—one morning slot say, 1030 hrs for half an hour on Sunday (the flagship programme), and two evening slots on other week days, say at 1930 hour for half an hour on DDK (Delhi). Subsequently two more slots will be added.

Participants at the meeting

Hon'ble Minister said that within a year, before we go on to EDUSAT, we must build a brand name for the science channel. Emphasis should be on evolving a business model bringing together producers, marketing managers and consumers. He emphasized that for any channel, the quality of programmes is of paramount importance. This is equally true for science channel. The Hon'ble Minister requested the producers and the media persons for their ideas on the kind of software and the formats suited for the Science Channel.

Professor V. S. Ramamurthy in his remarks pointed out that the idea behind starting a science channel was not to look for something novel. This is the first time that India has got a satellite totally dedicated to education, science and technology and it is also the first time that we are talking about a dedicated science channel. We have to evolve our own model. He urged the producers to come up with novel ideas and be prepared to experiment. He assured that the best ideas will be picked up by the channel management. He stated that efforts will be made to develop a business plan within a year. DECU/ISRO and VP/DST will run the channel but eventually the science channel will have to be on its own.

The participants made a number of valuable suggestions for production of software and running the channel.

Benjamin Franklin

A scientist extraordinary and a versatile personality

❑ P.K. Mukherjee

We know of Benjamin Franklin as a scientist who performed the famous kite experiment in a stormy weather that led to the discovery of static electricity. But, all the same, he was a versatile personality. He was a printer, writer, philosopher, statesman and a politician par excellence. Today, he is remembered in America as one of the founding fathers of the nation who was also a signatory to the draft of the Declaration of Independence. However, long before the idea of independence, Franklin had already outlined how a union of colonies might be achieved. He have had the privilege of representing Pennsylvania and eventually several colonies at the Court of King George II of England, and when the king died, his son George III. His modest dress and workman's background, together with his benign and quiet manner, were deceptive to those used to grand gestures and obfuscating talks. But, he was an epitome of simple living and high thinking.

Benjamin Franklin

Benjamin Franklin was born on 17th January, 1706 in Boston, Massachusetts. His father Josiah Franklin, had emigrated from the village of Ecton in the English midlands in 1685. At Boston, his father started his career as a soap and candle maker. His mother, Abiah Folger, was a discreet and virtuous woman. Benjamin was the eighth child of his parents.

Benjamin's father sent him to the Boston Latin School at the age of eight. But, after a year because of financial stringency his father withdrew him and sent him to a local schoolmaster who taught him grammar, writing and mathematics.

At the age of twelve, Benjamin joined as an apprentice to his brother James who as a printer and used to bring out the newspaper Courant. Benjamin not only helped James in printing and publishing but also used to write articles for the newspaper. His articles were in the form of letters, which he wrote by the ghost name of a fictional middle – aged widow, Silence Dogood. On 2 July 1722, when Benjamin was 16 years old, his eighth letter appeared in print which reflected his philosophy and his discreet political wisdom. "Without Freedom of Thought, there can be no such Thing as Wisdom; and no such Thing as Public Liberty, without Freedom of Speech, which is the Right of every Man", wrote Benjamin.

In 1723, Benjamin left Boston for Philadelphia. In fact a deep seated inner urge had prompted him to do so. He, therefore, decided to change the way of his life. Consciously, he was inducted to the patterns of science and resolved to make his own life his first experiment. He had read The Way to Health by Thomas Tryon. After reading the book Benjamin became a vegetarian for a while, began a regular exercise programme and started taking bath regularly. He also became concerned with ventilation, proper breathing and good air. These decisions flowed in part from the idea that respecting his body made his a better, more productive persons. He firmly held the view that better individuals made better citizens, and better citizens made for a more civil society.

In 1727, Benjamin proposed to a group of friends that they join together to start what he called the "Junto". It was his first experience with the power of small associations. This junto model later on came in handy and was particularly effective in the creation of a hospital, an insurance company, a college, fire companies, libraries, learned societies, sanitation programmes, and police departments. Benjamin indeed became successful in transforming Philadelphia with the creation of the above facilities. His weekly newspaper Pennsylvania Gazette (whose name was later changed to Saturday Evening Post), which he started in 1729,and his earlier journal Poor Richard's Almanac were also highly instrumental in moulding public opinion. These publications were brought out from his own printing house which was situated on the Market Street in Philadelphia.

Benjamin chanced to meet Deborah Read Rogers, a carpenter's daughter, and married her in September, 1730. However, it is said that before he got married to Deborah he fathered a child, William whose mother's identity was never known. In 1732, a son, Francis, was born to the Franklin couple. But, he unfortunately died from smallpox at the age of four which distressed Benjamin very much . However, to his delight, in 1743 a daughter, Sarah, known as Sally, was born. Benjamin used to adore her very much.

Before marriage, Benjamin had compiled a list of thirteen virtues which were Temperance, Silence, Order, Resolution, Frugality, Industry, Sincerity, Justice,

Benjamin Franklin along with four others who drafted the declaration of Independence

Moderation, Cleanliness, Tranquility, Chastity, and Humility. He tried to follow these virtues but sometimes he fell short of his own standards. He then wouldtry to improve upon them.

Benjamin not only excelled as a journalist, he was a good writer too. The Autobiography authored by him is now regarded a classic book. He also learnt many languages. He was very fluent in French, Spanish and Italian languages. He rode well, loved good food and made a wonderful company. He loved to travel as well and was willing to take up any challenge. That is why when in 1753, he was made the deputy postmaster general of North America, he took up the appointment with delight.

Benjamin was a great humanitarian too. He was instrumental in eliminating the institution of slavery the country he helped found. Although he had owned slaves, advertised their sale in his newspaper and even traded in human beings, by 1971 he had begun to think that the institution was philosophically and economically unsound. In 1787, he helped reinvigorate the Pennsylvania Society for Promoting the Abolition of Slavery, the first such society in America, by becoming its President.

Benjamin was dedicated to the cause of independence of his nation. His dream was to see America as a democratic republic whose political power flowed form its citizens. He was one of the five men who drafted the Declaration of Independence in 1776, the remaining four being Thomas Jefferson, Jonn Adams, Roger Sherman and Robert R. Livingston. In late October, 1776, at the age of seventy, Benjamin sailed for France in the American ship *Reprisal* to secure support of the Fraench government to the cause of American independence. Benjamin had no idea at that time this task would keep him in France for almost ten years.

It might sound strange that under the terrible pressure of his wide- ranging activities and busy schedule how he could spare time for science. But all said and done, Benjamin was a compulsive scientist. Insatiably curious as he was, he could not cross an ocean without measuring currents, nor could he look at a stream without considering the fish that swam within. In 1743, he began his work on the formation of the American Philosophical Society that was modelled on the London's Royal Society. He invited the leading colonial natural scientists to join him in this noble venture.

As a scientist, Benjamin is mainly recognized for his experiments in electricity. But his contributions

Franklin's Experiment with the kite

ranged across disciplined – from climatology to oceanography to geology to medicine to what today we would call physics.

It is said that Benjamin's kite experiment was inspired by his experiments on Leyden jars during which he had noticed sparks of light and crackling sound. He used to wonder whethen what he had observed on the mini laboratory scale could be duplicated on a larger scale.

It was a stormy day of 1752 the sky was badly overcast. With his son William, he designed a kite made of a large silk handkerchief. A pointed wire was attached to the tip of the Rite. A sting attached to the kite whose lower end was tied to a metallic key. This, in turn, was attached to a silk ribbon.

The first American cartoon, drawn by Franklin and published in the Pennsylvania Gazette, May 9, 1754

The kite was flown high up in the air. Benjamin held it with the help of the silk ribbon. Both father and the son stood beneath a cowshed so that the ribbon would not get wet in the rain.

Some of the electricity in the thundercloud travelled down the wet string to the metallic key. But, it was not safe to touch the key. Nonetheless, Benjamin mustered courage and finally decided to touch he key. Carefully, he extended his hand towards the key. But, he had to withdraw his hand immediately as he had received a stinging shock. This proved that (static) electricity was produced during lightning.

This discovery took Benjamin to a plateau of celebrity. The Royal Society honoured him by making him its member in 1756. He was later also made member of the French Academy of Science in 1772. Benjamin put his discovery to practical use by inventing the lightning conductor. A lightning conductor is a pointed metal rod, placed above the roof of large buildings, the lower end of which is buried under the ground. This protects the buildings and houses form lightning bolts by discharging the clouds safely through it.

Although Benjamin discovered electricity in lightning, his understanding about electricity was limited. He regarded electricity as fluid; and proposed one- fluid theory for it which had to be later abandoned.

He also delved in many diversified fields, such as, geology, meteorology, navigation and even artificial fertilizers. He pioneered the study of oceanography by mapping the course of the Gulf Stream in the Atlantic Ocean. He also experimented with the heat absorption of different colours and proved that the reflection of the sun rays by the white colour was maximum while the black colour maximally absorbed the sun's rays. He also investigated the problem of the production of smoke in chimneys. Besides, he observed the behavior of common ants and was able to show that not only are the ants intelligent but they also have a way of communication.

Benjamin died on the night of 17 April, 1790, three months past his 84th birthday. His was the largest funeral that had ever been held in America. It was estimated that about 20,000 people witnessed the procession and ceremony.

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VP News

Vigyan Prasar film screened in International Film Festival

Vigyan Prasar film "Shukra Paragaman" was nominated in the 42nd International Festival of Films on Science, Technology and Art (TECH FILM), held at Prague in Czech Republic. The festival held at University Hradec Kralove in Czech Republic from 8th to 11th November 2004. Techfilm is organized by Czech Technical University in Prague and Krátký Film Prague and held under the auspices of Ministry of Education, and UNESCO. This festival is one of the premier science & technology International film festivals where entries come from all over the world from the field of science and technology. Shri Rakesh Andania, Director of the film, attended the festival and presented the film to the international audience. The film was screened on 10th November 2004 in the main festival Hall and was followed by discussion. Mr. Andania introduced Vigyan Prasar and explained the context in which the film was made. The film Shukra Paragaman was screened three times on request by the science students and local amateur astronomer groups. After this festival, the film was screened in the schools and educational institute in Czech Republic. Kudos to Shri Rakesh Andania and the VP team.

Heartburn

Practical Ways to Douse the Flame

❑ Dr. Yatish Agarwal
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Heartburn or acid reflux is an extremely common problem. It occurs when the hydrochloric acid formed in the stomach flows back into the food pipe and sets its delicate lining aflame. The discomfort occurs primarily because the lining of the food pipe is not adequately protected against the harmful effects of the stomach acid. This causes inflammation and a burning sensation behind the breastbone. You may also suffer a sour acidic taste in the mouth and a sensation that the food is turning back. Sometimes, this may also be the root cause of persistent cough.

Attacks of heartburn are usually brief and relatively mild. If they are persistent, the lining of the food pipe may be permanently damaged and scarred.

The condition is called gastro-esophageal reflux disease. Doctors generally refer to it by using the acronym GERD.

CAUSES OF ACID REFLUX

In the normal course, the contents of the stomach are kept from entering the food pipe by a natural valve mechanism. One part of this mechanism is the muscular ring at the lower end of the food pipe, the other the effect of the diaphragm on the food pipe as it passes through the narrow opening in the diaphragm. These together serve to provide an effective one-way valve.

Several factors however, can undo the valve. These factors include increased abdominal pressure due to obesity or pregnancy, a weakness in the diaphragm opening that allows a part of the stomach to slide into the chest, and a weak muscle tone in the ring at the lower end of food pipe. Certain foods and drinks, particularly fried food, high fat diet, pickles, spicy, acidic, tomato-based foods, carbonated soft drinks, alcohol, tea and coffee, and some medicines can also lead to mild attacks of heartburn. Tobacco is also a known culprit.

MANAGING HEARTBURN

Stamping out the fire in the food pipe is easy, provided you know the rules:

Put a stop to big meals : Eat small, frequent meals and never overfill your belly. A full belly conspires to put pressure on the diaphragm and lead to gastro-esophageal reflux.

Stay up after a meal : Gravity has many wonderful uses, but it can also be quite fussy. If you stoop, bend over or lie down straight after a meal, it is simply asking for trouble. That's like defying the gravitational force and still hoping that the hydrochloric acid will stay within the stomach. No way! Always sit upright or take a walk after a meal, and you will feel a lot more comfortable.

Eat supper on time : Partake of your supper at least a good two to three hours before retiring to bed. If you lie down supine soon after a meal, the contents of a bulging stomach are very likely to spill over into your food pipe.

Sip plain water : Rinse your food pipe frequently by taking small sips of water. This will wash it clean of the acid and lessen your troubles.

Check your waistline : Being overweight can disturb the valve at the lower end of food pipe. It sometimes pushes the stomach into the chest and disturbs all anatomical equations; a condition called hiatus hernia results. To avoid it, lose weight and cut yourself to size.

Wear comfortable clothes : Keep your belt a wee bit loose, and never wear tight jeans or pants. Close-fitting clothes may be fashionable, but they mess up your insides. The diaphragm is unable to breathe and the acid spills on to the wrong side.

Count out the culprits : Hot food, laced with chilli, peppers and their spicy cousins, may or may not ignite problems but citrus juice and tomato products almost always do. The bottom line, of course, is to avoid such foods that affect you adversely.

Go easy on caffeine : Caffeine containing beverages—coffee, tea and colas—have the irritating habit of loosening the food pipe valve. Down a cup of tea or a cola a few more times than usual in a day, and you could feel the acid rise up behind your breastbone.

Quit tobacco : Avoid tobacco, be it smoke or juice. Chewing tobacco is just as bad as smoking. It throws your food pipe sphincter out of gear and also, increases the acid production.

Alcohol is bad : Swear off alcohol. It makes your food pipe valve tipsy and irritates an inflamed food pipe even more badly.

Sweet confection is for kids : Spare yourself from chocolate and peppermint—they make the food pipe valve weak.

Check your medicine cabinet : You may find the source of your grief lurking in there. A number of commonly prescribed medicines like anti-hypertensives such as amlodepine, asthma pills such as theophylline, heart medications, progesterone, ascorbic acid (vitamin C), antidepressants, sedatives, and antibiotics, particularly tetracycline and erythromycin, can initiate heartburn. When in doubt, check with your physician.

Take antacids : An over-the-counter antacid such as Digene or Mucaine Gel will generally offer quick relief. Often, the liquid antacids prove more effective than the tablets. It is okay to use the antacids for a once-in-a-while attack of heartburn.

Raise the head end of your bed : Use bed blocks and raise the head-side by four to six inches. This would elevate your upper body without folding you up in half, change the gravitational dynamics of the body and relieve you of reflux.

If symptoms do not ease, see the doctor : In case heartburn continues to bother you for longer than two weeks, see a doctor, preferably a gastro-enterologist. Such symptoms must never be neglected. The doctor may advice you to undergo an endoscopy or barium swallow test. These investigations can help make a correct diagnosis.

If self-measures do not suffice, you may be required to take a medicine that reduces the stomach's acid production. These medicines include lansaprazole, omeprazole and ranitidine.Medicines that help hasten the emptying of the stomach such as mosapride and domperidone may also prove beneficial. A hiatus hernia may however call for surgery.

(VP News) ***Vigyan Prasar's Activities...*** *contd. from page....36*

The function was presided over by Prof. Ram Kapse, his Excellency Lt. Governor of A&N Islands. Dr. R. N. Rath, and Shri K. D. Shukla, of CHETNA, Dr. R. B. Rai, Director, Central Agricultural Research Institute (ICAR), Port Blair, and Shri Debesh Banerjee, honorary secretary, WWF, India, Port Blair, were present. Among those who attended the function included Dr. V. B. Kamble, Dr. Subodh Mahanti, and Dr. Amit Chakraborty of Vigyan Prasar. Besides, a large number of students also took part in the function. The Naval Public School, Port Blair, won the first prize. The second and the third prizes went to the Carmel Senior Secondary School and the Model Senior Secondary School respectively.

Later, a discussion was held with the experts for exploring future activities in A&N Islands. Based on this discussion it was suggested that a radio programme on the natural wealth of the A&N Islands may be taken up and subsequently a TV programme also produced. On October 14, 2004, a meeting was organised at the Panchayat building at Kadamtala in Middle Andaman, about 120 km from Port Blair. A large number of local residents took part in the meeting. It was planned to established a science club with the help of Dr. B. Ajit Kumar, Medical Officer, Primary Health Centre, Kadamtala and Shri Sampad Kumar Roy, Sarpanch, Kadamtala Panchayat.

Participants at the meeting at Port Blair

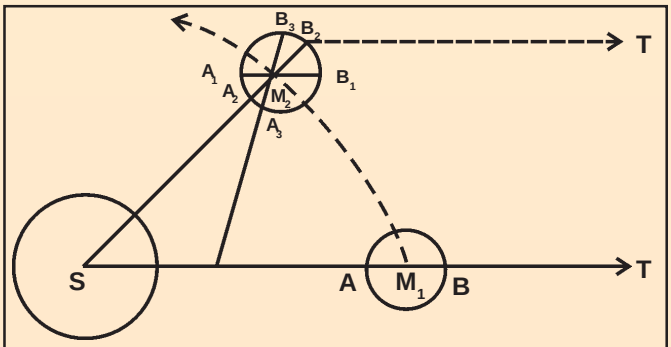
Relation between solar day and sidereal year of Mercury

❑ Utpal Mukhopadhyay

Sidereal day, Solar day and sidereal year

In order to understand the relation between the day and the year of Mercury, knowledge about sidereal day, solar day and sidereal year is necessary. The time taken by a planet to rotate once on its axis with respect to a distant star is known as one sidereal day. Again, the time elapsed between two successive sunrise (or noon) at a particular place on the surface of the planet is known as one solar day. For every planet length of a sidereal day differs from the length of a solar day and the lengths of sidereal day and solar day for planets other than earth are calculated on the basis of the sidereal day of the earth. For Mercury, the length of one sidereal day is about 58.6 days.

Suppose, at any instant, the centre (M1) of Mercury dies on the line joining a distant star (T) and the Sun(s) and a diameter AB of Mercury is situated on the line ST(Fig.1) So, at that instant, A experiences midday and B



Sidereal and Solar day of Mercury

experiences midnight. One day later, it will be noon at that point on the sunbound diameter A_2B_2 of Mercury which is nearer to the Sun and at the other extremity of A_2B_2 it will be midnight. Since Mercury rotates on its own axis as well as moves in its orbit, so on a particular day, midday and midnight do not occurred on those points of the sun bound diameter where midday and midnight had occurred exactly one day earlier. For this reason, length of a sidereal day is not equal to one solar day.

The time taken by a planet to revolve once around the Sun relative to a distant star in known as one sidereal year. The number of days passed between the occurrence of two successive mid nights at any particular point (say, point B in Fig.1) on the surface of a planet with reference to a distant star is known as one sidereal year of that planet. For Mercury, length of one sidereal year is about 87.9 days. Now let us see how the length of one solar day of Mercury becomes equal to two of its sidereal years.

Relation between solar day and sidereal year

Mercury takes 58.6 earth days to rotate once on its own axis and 87.9 earth days to revolve around the sun with reference to a distant star. So, Mercury rotates thrice on its own axis in about 176 days and takes the same time to revolve twice around the Sun. For this particular relation between the rotational period and the period of revolution, one solar day of Mercury is equal to its two sidereal years.

Suppose on a particular day, midday occurs at A and midnight occurs at B (Fig. 1). Exactly one day later, centre of Mercury shifts from M_1 to M_2 due to its orbital motion. Due to this movement in the orbit, exactly one day later midday and midnight will not occur at A and B respectively. Suppose after one day when it is midday and midnight at A_2 and B_2 respectively, then the new position of AB is A_3B_3 and another diameter A_1B_1 is now parallel to the original position AB.

\ Angular rotation of Mercury in one day = Ð $A_1M_2A_3$

\ Angular rotation of Mercury on its own axis relative to a distant star T in one day = Ð $A_1M_2A_3$

\ Angular rotation of Mercury on its own axis relative to the Sun in one day = Ð $A_1M_2A_3$

Again angular displacement of Mercury in its orbit orbit in one day relative to the distant star = Ð $A_1M_2A_3$

Now, clearly Ð $A_1M_2A_3$ = Ð $A_1M_2A_3$ - Ð $A_1M_2A_3$ --------- (1)

If, D, V and y be the lengths of one solar day, one sidereal day and one sidereal year of Mercury, then from (1) we have,

$360^0/D = 360^0/V - 360^0/Y$

\ 1/D =1/58.6 - 1/87.9

\ D = 175.8 (approximately)

\ Length of one solar day of Mercury is 175.8 days which is equal to its two sidereal years.

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Recent Devlopments in Science & Technology

MRI machine tracks brain's metabolism

An unusually powerful magnetic resonance imaging (MRI) machine will be useful not only in the anatomy but also the metabolism of the human brain, say scientists at the University of Illinois at Chicago.

If it lives up to its promise, the machine should help researchers to probe how the brain thinks, learns, fights disease and responds to experimental therapies. But it will involve exposing patients to stronger magnetic fields than ever before.

MRI uses a combination of magnetism, radio waves and computing power to peer inside the body. Patients lie inside a large circular magnet. When turned on, the magnetic field causes the nuclei of certain atoms, including hydrogen, to line up. A pulse of radio waves is then sent through the magnetic field. The aligned nuclei absorb this radiation and emit it again, producing a signal that reveals the structure of the molecules in which the atoms sit.

Most MRI machines use magnets with field strengths of around 3 tesla (equivalent to around 30 fridge magnets). This allows researchers to image water molecules and create pictures of anatomical structures within the body.

At 9.4 tesla, the new machine's magnetic field is more than three times as strong. This will enable scientists to capture signals not just from molecules containing hydrogen, but also from the body's metabolic building blocks: sodium, phosphorus, carbon, nitrogen and oxygen atoms. This should allow them to watch metabolism in action.

Source : Nature.com

Ox's Natural Mosquito Repellant Synthesized in Lab

An Asian wild ox is helping scientists in the fight against pesky mosquitoes. Researchers have succeeded in determining the exact structure of a compound that gaurs excrete as a mosquito deterrent and synthesizing it in the laboratory. The results could help control the spread of mosquitoes that carry tropical diseases, such as yellow fever and malaria.

Researchers had previously determined the basic building blocks of gaur acid—a ring made of four carbon atoms and one oxygen atom with two different side chains—but just how the atoms were arranged remained unclear. P. Andrew Evans of Indiana University and his colleagues designed a new synthesis that successfully recreated gaur acid.

Source : Scientific American com

Titan's complex and strange world revealed

Two days after Cassini's close encounter with Titan captured the first ever close-up images, it is becoming clear that Saturn's giant moon is a complex and strange world.

Its diverse geography is crossed by channels, ridges and great windblown streaks. Organic materials abound, and may even cover the moon entirely.

It was possible that Cassini would reveal a dead world covered in impact craters. But in fact Titan boasts an enormous variety of surface structures - and it is evolving. "Titan is an extremely dynamic and active place," says Jonathan Lunine at the Jet Propulsion Laboratory in California, an interdisciplinary scientist with the Cassini mission.

Surprisingly, there is no clear sign of impact craters so far. There are some circular features that might be craters, but they have been largely eroded, or buried by organic material raining from the sky.

Source : New Scientist.com

First insects are cloned

As if there weren't enough of them in the world already, scientists have succeeded in cloning flies. The identical fruitflies are the first insects ever cloned, says the Canadian team that created them.

The question everyone asks, says group leader Vett Lloyd of Dalhousie University in Halifax, Nova Scotia, is why anyone would want to clone flies in the first place.

She hopes that the insects, which are very easy to experiment with, will help to fine-tune the cloning process in other animals and even in humans, where the technique is being researched to aid production of therapeutic stem cells.

In cloning, the DNA-containing nucleus of an adult cell is injected into an egg whose own nucleus has been removed. At the moment, the majority of cloned mice, sheep and other animals die before birth. It is thought this is because the adult DNA is not properly 'reprogrammed' and cannot orchestrate the growth of an embryo.

Using flies, researchers might reveal genes that are important for this reprogramming, and that have counterparts in other animals. That is because it is relatively easy in flies to knock out the function of a single gene and then attempt cloning with these cells, which will test whether that gene is crucial.

Source : Nature.com

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