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Alexander Fleming and the Discovery of Penicillin

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

An Orbiting Home

Space Shuttle *Atlantis* finally landed at the Edwards Air Force Base in California on 22 June 2007 bringing Sunita Williams and her six fellow astronauts safely back home. Sunita was launched aboard the Space Shuttle *Discovery* on 10 December 2006 to join the crew of the International Space Station (ISS), orbiting the Earth at an altitude of 350 kilometres. Her journey lasted for 195 days, the longest space flight for any woman. With her four excursions spreading over 29 hours and 17 minutes, she became the most experienced woman space walker. On 16 April 2007, Sunita ran the first marathon by an astronaut in orbit. She finished the Boston Marathon in four hours and twenty four minutes that she ran tied down to a treadmill while orbiting in the ISS. And all this during her very first journey into space! Incidentally, American astronaut Clayton Anderson, launched on *Discovery*, replaced her as the new flight engineer on the ISS.

The space shuttle is the most complex space vehicle built till date. It blasts off like a rocket, flies like an aircraft, and lands like a glider. The shuttle – also called the orbiter – can fly hundreds of times. This is why it is called the Space Transport System (STS). Incidentally, the mission STS-117 that brought Sunita back was the 118th Space Shuttle flight, and the 21st U.S. flight to the ISS. Space shuttle carries large payloads to various orbits, provides crew rotation for the ISS, and performs servicing missions. Some of its notable payloads that the shuttle

carried included ISS components, Hubble Space Telescope, Chandra X-ray observatory; and *Galileo* and *Magellan* spacecrafts.

There have been numerous failed space missions involving launch vehicles and satellites, including that of India. Surely, the loss is much too poignant when precious human lives are lost. In the 46-year history of the manned space flight, 21 lives have been lost. Despite the fact that the road to space is too bumpy and hazardous, why do we feel so fascinated by space; and what is it that keeps on luring us into that infinite void again and again? And, how is it we are so keen to establish a space station some 350 kilometres above the Earth?

For some, space stations are a place to do cutting edge scientific research not possible on Earth. For some, this is where unique materials like crystals, semiconductors, and pharmaceuticals can be manufactured in better forms than on Earth. Many think of space stations as staging points for expeditions to the planets and stars. USA and Russia have had orbiting space stations since 1971. ISS is the largest international scientific and technological endeavour ever undertaken that draws on the resources and scientific expertise of 16 nations around the world, viz., USA, Russia, Canada, Japan, eleven members of the European Space Agency, and Brazil, and is under construction since 1998. Earlier, the date of completion of the ISS assembly was expected to be 2004, but, the *Columbia* disaster in 2003, in which Kalpana Chawla perished along with her six

fellow astronauts, forced the schedule to be revised. Now, the projected date of completion is 2010, with the station remaining in operation until around 2016 with facilities for six crew members to reside, as against three today.

As of today, the ISS is already larger than any previous space station. It is continuously inhabited since 2 November 2000 – a home in orbit for the visiting crew. At present, space shuttle and the Russian *Soyuz* ferry the crew. Experimental equipment, fuel and consumables are and will be delivered by all vehicles visiting the ISS: the space shuttle, the Russian *Progress*, and European and Japanese space vehicles in future.

But why so much fascination with the space station anyway? We are already familiar with the benefits we have reaped through space research in the fields of telecommunications, weather prediction, and radio and television broadcasts. Remote sensing satellites have been helping us in mapping and managing our natural resources. ISS is a permanent laboratory where gravity is only about one thousandth of that on the Earth, and temperature and pressure can be manipulated for a variety of scientific and engineering pursuits in ways that are impossible in ground-based laboratories. In microgravity, purer protein crystals can be grown that can help better understand the nature of proteins, enzyme and viruses leading to development of new drugs and treatment for cancer, diabetes,

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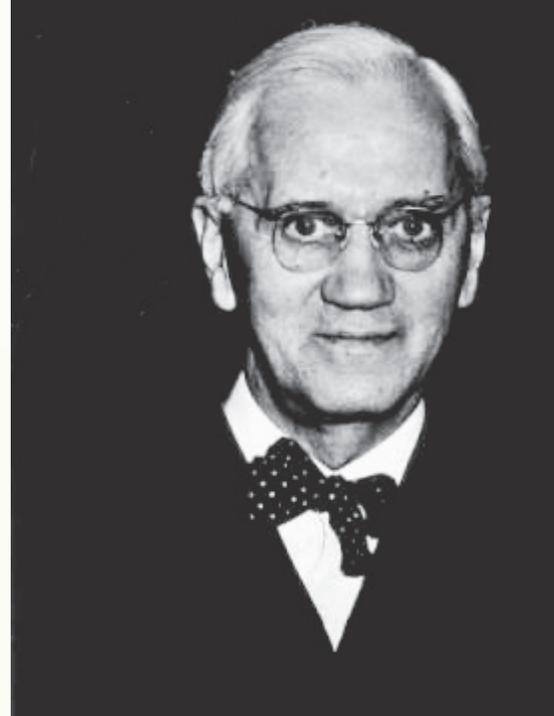
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Alexander Fleming

The Penicillin Man

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Alexander Fleming

“The widespread use of penicillin from the 1940s onwards made a vast change in the treatment of many infections; it also led to a successful search for other antibiotics, partly because of a wartime need for national heroes. The legend portrayed him as lucky and diffident; both were exaggerations, since his discovery was a part of his systematic work and good observations..”

The Cambridge Dictionary of Scientists (Second Edition), 2002

“He (Fleming) had never received any money for his hard work and discovery; he donated it all to St. Mary’s for research. Today the Wright-Fleming Institute at the Imperial College London, named in tribute to Fleming and his mentor, houses scientists dedicated to researching human bacterial and viral infections. Often serendipity is credited for the discovery that launched a medical revolution, but one must remember the man who took notice, believed, and pursued what he observed.”

*Katherine Cullen in Pioneers in Science:
Biology – The People Behind the Science, 2007.*

Alexander Fleming is mostly known for his discovery of penicillin for which he shared a Nobel Prize with Howard Walter Florey and Ernst Chain. Fleming’s discovery marked the beginning of modern antibiotics. The discovery was ranked by many as the most important discovery of the second millennium of the Christian era. It is estimated that penicillin has saved at least 200 million lives and in this respect no other discovery can match it. Like many other great men, Fleming himself was always in doubt about his role in the development of penicillin and he used to describe his fame as the “Fleming Myth”. He praised Florey and Chain for their role in ‘transforming the laboratory curiosity into a practical drug’. It should be noted that Fleming was not the first to discover penicillin. Before Fleming it was noticed by others that mould had some antibacterial properties. However, it was Fleming who first recognised its broad significance and drew attention to it. Fleming’s other major achievement was the discovery of the enzyme lysozyme, the “body’s own antibiotic.” Lysozyme shows a weak

anti-bacterial property. Fleming published innumerable research papers on bacteriology, immunology and chemotherapy.

Alexander Fleming was born to Hugh Fleming and his second wife, Grace Morton Fleming, on 6 August 1881 at Lochfield near Darvel in East Ayrshire, Scotland. He was his father’s seventh of eight children. Fleming lost his father when he was seven years old. He spent his childhood in a farm in the midst of nature. It is said he developed keen observational skills while learning to hunt for peewit eggs and rabbits with his bare hands.

Fleming went to the local school at the age of five. He spent two years at the Kilmarnock Academy. In 1894, Fleming went to London to live with his older brother Thomas, who was a physician. In London he attended the classes at the Regent Street Polytechnic Institute for two years and qualified in all his examinations. He had no plan for a specific career. He took up a job of a junior clerk in a shipping office. He worked there for five years. Among his duties were hand copying of records,

bookkeeping, and keeping track of all cargo and passengers on the ships. He also joined the London Scottish Regiment and he played in the regiment’s water polo competition. He also participated in shooting competitions and often he used to be the winner.

Fleming did not find much satisfaction in his shipping job and so when his uncle left him an inheritance he decided to do something else. He decided to pursue a career of a physician, like his elder brother Thomas. It was a delayed decision. At the time Fleming was approaching his 20th birthday and was older than most of the candidates preparing for the nation-wide examination for entering into a medical profession. He hired a private tutor to help him in preparing for the examination. In less than a year he passed the qualifying examination. He score highest marks in all of England and also won a scholarship. He could choose any of the 12 medical schools of London but he decided to join the St. Mary’s Hospital Medical School. There was a reason for it. Fleming had once played against them. He joined the Medical School in 1901. Besides his studies he participated in the School’s water polo team, drama society, debate team, and rifle club.

In 1906, Fleming qualified in the examination necessary for practising

general medicine. However, he did not become a general medical practitioner. He rather joined the inoculation department of the School as a research assistant so that he could take part in an upcoming national rifle competition as a member of the School's team. Whatever might be the reason it was a good beginning as far as Fleming's research career was concerned. The inoculation department was headed by Almroth Edward Wright (1861-1947), a distinguished bacteriologist. Wright's department extensively studied how vaccina-



Howard Florey

tions worked. They also studied phagocytes, the cells that are capable of ingesting disease-causing microbes. Fleming started working under the supervision of Wright and they continued to collaborate for the next forty years.

In 1908, Fleming obtained his final medical degree (M.B.) and was awarded the Gold Medal of the London University. He also took the examination required for specializing in surgery, which he passed in 1909. However, he continued to work with Wright. He was appointed a lecturer in the School and continued to work there till 1914.

In his early career Fleming developed a diagnostic test for syphilis, a potentially fatal sexually transmitted disease. Earlier German physician and bacteriologist Paul Ehrlich (1854-1915)

had discovered Salvarsan, a synthetic compound that was effective against syphilis. Fleming was an expert in intravenously administering Salvarsan to treat syphilis. In those days intravenous injections were not very common and many physicians did not know how to give such injections.

In 1914, when the First World War broke out Fleming along with other members of Wright's research team joined the Royal Army Medical Corps. They established a research centre at Boulogne, France. In January 1918, Fleming returned to London and resumed his work on bacteriology. Fleming was looking for a suitable antiseptic, which would effectively kill potential microbial invaders, but would not damage the patient's tissues. During the war Fleming had harrowing experiences of treating soldiers with grievous infections. In those days common antiseptics used were carbolic acid, boric acid, and hydrogen peroxide and Fleming had examined the effects of these antiseptics. He had found that these chemicals used as antiseptics actually killed the white blood cells of a patient, and what is more, they did not penetrate deep enough into the wound to be effective. So they did more harm than good. In fact Fleming showed that the chemical antiseptics used were killing more soldiers than the infection itself.

In his search of a suitable antiseptic Fleming tried to procure cultures of a wide variety of bacteria. He collected many unusual specimens and maintained these in his laboratory in Petri dishes containing artificial media. One of his plates collected a sample from his nasal mucus during a recent cold. The plate contained many colonies of a golden-yellow bacterium. Fleming later named this bacterium *Micrococcus lysodekticus*. He made an interesting observation. He found that the bacterial colonies immediately surrounding the mucus itself appeared destroyed. Did it mean that the mucus contained an antibacterial agent? This was the question that actually arose in Fleming's mind. To answer this question Fleming undertook further investigations. He

found that the mucus had a substance capable of killing bacteria. He called this substance lysozyme. Unlike chemical antiseptics mentioned earlier lysozyme did not harm the host's living tissues or the host's own immune system. Lysozyme was harmful only to the invading bacteria. It acts as a first line of defense, preventing bacteria from colonizing the body. The discovery of lysozyme demonstrated the possibility of the existence of substances harmless to the cells of the body but lethal to invading bacteria. Fleming showed the pres-



Paul Ehrlich

ence of lysozyme in tears, saliva, blood serum, pus, and egg whites. His results on lysozyme were published in 1922. Later researchers crystallized the enzyme, which proved to be a very important tool for microbiologists and molecular biologists.

In 1928 Fleming was appointed Professor of Bacteriology and in the same year he made his most important discovery, that of penicillin. Fleming was very lazy about cleaning up his old culture dishes. On his working table in the laboratory often there used to be dozens of stacked plates. But this habit, which one cannot say a good habit, resulted one of the most important discoveries in science. It was an accidental discovery. One plate containing *staphylococci* (spherical-shaped bacteria that

grow in clusters, like grapes and which may cause infections leading to pimples, boils, or a skin disease called impetigo) had become contaminated. Fleming found that bacteria were everywhere in the plate except in the near vicinity of the mould, which was later identified as *Penicillium notatum*. Fleming realized that the mold must have been screening an antibacterial substance. He named the substance penicillin. To prove that his observation was correct beyond any doubt he undertook a systematic investigation. He was correct in his observation. He determined the level of concentration (or the strength) required to destroy the bacteria. For this he performed a series of dilutions. He also looked for adverse effects on living tissues. He tested the bactericidal effect of the mould on different bacteria and observed that it killed some but not others. Fleming found that penicillin was effective against bacteria responsible for causing pneumonia, syphilis, gonorrhoea, diphtheria, and scarlet fever. However, he also found that penicillin was not effective against bacteria responsible for causing influenza, whooping cough, typhoid, dysentery and other intestinal infections. In his research paper titled "On the antibacterial use in the isolation of *B. influenzae*" published in the *British Journal of Experimental Pathology* Fleming observed that penicillin could be used as an injectable antibacterial and that it could also be used in the establishment of pure cultures of other bacteria.

Fleming demonstrated the potential of his discovery, but he was unable to isolate and identify the compound. So he could not test its effect on animals. It was not Fleming's failure. The chemical methods of the time were inadequate to allow concentrated penicillin to be obtained. Penicillin is easily destroyed and is present only in traces in a culture broth. During the World War II, there was the urgent need for new antibacterial drugs. Penicillin, the first antibiotic, was finally isolated by Howard Florey and Ernst Chain. Their procedure for isolating penicillin in-



Ernst Chain

involved lyophilization (freeze-drying) and dissolution in methanol. They could purify stable penicillin in quantities large enough for testing on animals. Florey and Chain were then working at Oxford University. Fleming was awarded the 1945 Nobel Prize for Physiology or Medicine jointly with Florey and Chain for his discovery.

Fleming received hundreds of prizes and honours including Honorary Gold Medal of the Royal College of Surgeons (1946); William Julius Mickle Fellowship, University of London (1942); Charles Mickle Fellowship, University of Toronto (1944); John Scot Medal, City Guild of Philadelphia (1944); Cameron Prize, University of Edinburgh (1945); Moxon Medal, Royal College of Physicians (1945); Cutter Lecturer, Harvard University (1945); Albert Gold Medal, Royal Society of Arts (1946); Gold Medal, Royal Society of Medicine (1947); Medal for Merit, USA (1947); and the Grand Cross of Alphonse X the Wise, Spain (1948). He was a Fellow of the Royal College of Surgeons, England (1909) and a Fellow of the Royal College of Physicians, London (1944). He was honorary members of almost all the major medical and scientific societies of the world. He received doctorate (*honoris causa*) degrees

of almost thirty European and American universities. Fleming died on 11 March 1955 in London and is buried in St. Paul Cathedral.

Two important biographies of Fleming are: 1) *Alexander Fleming: Pioneer with Antibiotics* by Beverley Birch (Blackbirch Press, Detroit, 2002) and 2) *Alexander Fleming: The Man and the Myth* by Gwyn Macfarlane (Harvard University Press, Cambridge, Massachusetts, 1984).

References

1. Charles C. Gillispie (Ed.). *Dictionary of Scientific Biography*, Vol. 5, New York: Scribener, 1970-76.
2. Katherine Cullen. *Pioneers of Science: Biology – The People Behind the Science*, New Delhi: Viva Books Private Ltd., 2007.
3. David, Ian, John and Margaret Millar. *The Cambridge Dictionary of Scientists* (Second Edition), Cambridge: Cambridge University Press, 2002.
4. *A Dictionary of Scientists*, Oxford: Oxford University Press, 1999.
5. *Chambers Biographical Dictionary* (Centenary Edition). New York: Chambers Harrap Publishers Ltd., 1997.
6. Available sources on the Internet.

(This article is a popular presentation of the important points on the life and works of Alexander Fleming available in the existing literature. The idea is to inspire the younger generation to know more about Fleming. The author has given sources consulted for writing the article. However, 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.)

The Man Behind Soviet Space Programme

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First ever satellite; first ever living being to space; first man to reach orbit; first man to come out of the spacecraft and do space walk; first women to reach space; first satellite to



Korolev after the launch of Sputnik

reach Moon and Mars; indeed the accomplishments of the Soviet space programme are long. But who was the mastermind behind all the triumphs? Who inspired, designed, and organised the Soviet space programme? Even while every newspaper around the world applauded the achievements, the man behind the successes remained a person without a name or face. Even at the pinnacle of his career, he was an anonymous 'chief designer,' and details of his life were kept top secret. Who was he? Was he old, or young? Fearing that rivals could endanger his life, the Soviet leadership kept his identity a closely guarded secret. Neither his

name nor photograph was available. Who he was remained a mystery till after his death.

The name and identity of this key figure of the Soviet space programme became public on 14 January 1966, when Leonid Brezhnev, the then Premier of the Soviet Union became one of the pallbearers at the funeral of a nondescript soviet space programme official named Sergei Pavlovich Korolev. It was then that the world learnt about the importance of this man. Afflicted with cancer, Korolev is said to have died of a botched operation in a hospital at the age of 59. After death, Korolev received accolades for the first time for his successes in spaceflight. The Soviet Union accorded him a hero's funeral and Korolev's mortal remains were interned in the wall of the Kremlin along with those of important heroes of the Russian Revolution and leaders of the Soviet Union.

Story of Korolev is the tale of early Soviet space history. Labouring in secret, Korolev and his colleagues at the Special Design Bureau-1 (OKB-1) designed and developed from scratch rockets powerful enough to launch satellites weighing 5 tonnes that could carry humans to space and return them safely to Earth, launch missions to Moon and beyond, and also send humans to space stations. Hard driving and square faced, Korolev demanded the utmost from everyone. He evoked fear, respect, adoration, hatred and love from his colleagues working under him in OKB-1. At the same time

he also took care of his people and their families making sure they got the best housing, food, health care, even during the difficult days of post-World War II Russia.

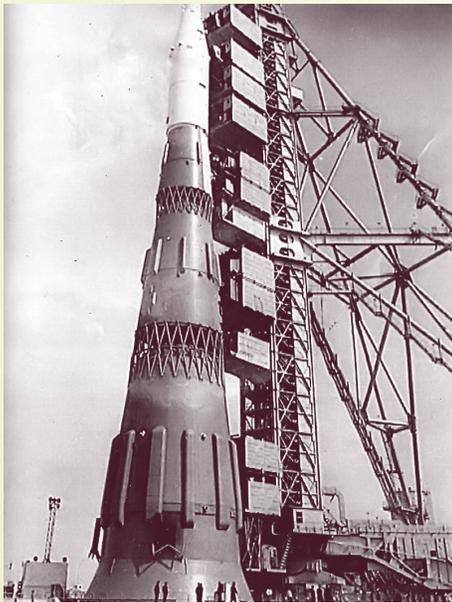
Korolev was born on 12 January 1906 at Zhitomir, in present day Ukraine, in the family of a Russian language teacher. In 1910 Korolev's parents separated and he moved with his mother to Nezhin to stay with his maternal grandparents. Korolev's parents officially divorced in October 1916 and soon Sergei's mother remarried Grigory Mikhailovich, an electrical engineer in the regional railways, and the family moved to Odessa, a major port city in Ukraine in 1917. The early years of Korolev were tumultuous; turmoil in the family was compounded by the revolutions taking place in Imperial Russia. Till about 1920s, when the Soviets acquired complete control, local schools were closed. Tormented between a broken family and Bolsheviks, Korolev had to study at home in spite of the hardship of civil war. Pursuing his studies even under adversity, Korolev passed qualifying exams for a senior year at the



Korolev

Odessa Professional Construction School in 1922.

Aged just seven, he was captivated by an air show around 1913. This event had a profound impact on his life; he longed to be a pilot and design airplanes. In June 1923, Korolev joined the newly created Society of Aviation and Aerial Navigation of Ukraine and the Crimea. He designed a glider called 'K-5' at the age of 17, thus demonstrating his skills and acumen in aeronautics. He then joined Kiev Polytechnic Institute to study aviation. His intelligence earned him a place in the highly respected Moscow Higher Technical School. After completing his graduation in 1930 he



Korolev's Sputnik rocket

joined the famous Soviet engineer Andrei Nikolayevich Tupolev to design jet engines.

In 1931 Korolev co-founded the Moscow rocketry organization GIRD (Gruppa Isutcheniya Reaktivnovo Dvisheniya - Group for Investigation of Reactive Motion). While working with GIRD, his interest turned towards liquid propellants. His first liquid propellant rocket was launched on 1933. By then the Soviet military saw the potential of rockets and provided funding for design and development of rocket-propelled missiles and gliders during the 1930s, culminating in Korolev's RP-318, Russia's first rocket propelled aircraft.

Korolev's soaring carrier plummeted when he was arrested and imprisoned on charges of anti-Soviet activities and sabotage in 1938. Although there is no evidence that Korolev himself was involved in any traitorous activities, he along with many of his colleagues at GIRD was imprisoned. Soon the mistake was

realized and he was transferred to 'Sharashka', an informal name for secret research and development laboratories set up in 1939 by Stalin to use best brains to win the war against Hitler. Korolev's sharashka was led by Andrei Tupolev. Korolev participated in the development of the Tu-2 bomber, a major aircraft of the Soviet Air Force

On the other side...

While Korolev pioneered space odyssey in Soviet Union, Wernher Von Braun is regarded as father of United State's space programme. Born in Germany, von Braun had a head start; after all he was the chief architect of the horrendous V-2 rockets of Nazi Germany.

Born in a rich and influential family on 23 March 1912, von Braun attended the Berlin Institute of Technology where he joined the *Verein für Raumschiffahrt* (VfR, the 'Spaceflight Society') and assisted Hermann Oberth, legendary space enthusiast, in liquid-fuelled rocket motor tests. Rumanian-born Hermann Oberth had in 1923 written a highly prophetic book: *The Rocket into Interplanetary Space*. The book enthralled many with dreams of space flight, including German teenager von Braun, who read the book in 1925. Five years later, von Braun had joined Oberth and was assisting him with rocket experiments.

By 1932, German Rocket Society's efforts attracted the attention of the German Army and in July of that year, a 'Mirak' rocket was launched as a demonstration. Three months after the demonstration flight, von Braun was engaged to work on liquid propelled rockets for the Army. At that time Adolf Hitler was on the rise in Germany. Von Braun chose to serve the Nazis and even joined the dreaded SS. While Prof. Willy Ley, a respected member of the Society preferred to leave Germany rather than serve Nazis, most of the German Rocket Society followed von Braun into working with the Nazis.

Hitler was keen on using rockets as missiles. With the support of Hitler, von

Braun embarked upon a programme of rocket technology for warfare. While the initial designs like the A-2, powered by ethanol and liquid oxygen demonstrated in 1934, or the A-3 were research tools, the A-4 (re-christened as V-2) was to be



Von Braun with his rocket Saturn V

a practical weapon. By the end of 1934, von Braun's group had successfully launched two rockets that rose to heights of 2.2 and 3.5 kilometres. Between 1937 and 1941, von Braun's group launched some seventy A-3 and A-5 rockets, each testing components for use in the proposed A-4 rocket. The first A-4 rocket flew in March 1942. The rocket barely cleared some low clouds before crashing into the sea about a kilometre from the launch site. The second launch in August 1942 saw the A-4 rise to an altitude of 11 kilometres before exploding. But the third try succeeded. On 3 October 1942, another A-4 roared aloft from Peenemuende, followed its



Russian's try their first liquid propelled rocket during World War II.

Meanwhile, Stalin was captivated by Hitler's secret weapon; a missile named V-2 developed by Wernher von Braun's team. Seeing the immense potential of V-2 during the then emerging cold war Stalin decided to develop ballistic missiles of his own. By 1944, Nazi Germany was in shambles; soon the V-2 rocket facility at Peenemünde fell to Soviet Red Army. Stalin wanted some capable engineer to visit the secret Nazi factory and learn whatever one could. When he asked around for a capable engineer to undertake this task, invariably everyone recommended Korolev for the job.

Korolev heeded to Stalin's wishes and went on a mission to Germany in September 1945. In August 1946, while still in Germany, Korolev was appointed chief of a department made responsible for the development and industrial production of missiles based on German hardware. Subsequently, when Stalin ordered a long-range missile development program, Korolev and other enthusiasts like Valentin P. Glushko and Mikhail Tikhonravov teamed up to take on the challenge.

However, Wernher von Braun, legendary leader of German rocketry had ideas of his own. By 1945, von Braun had realised that Germany had lost the war. He and his team were all scared of the Russians; thought the

programmed trajectory perfectly, and landed on target 193 kilometres away.

Thus, the German A-4 rocket, launched in 1942, became the first projectile to reach sub-orbital space. The design was improved upon and ballistic missile Vergeltungswaffe-2 (reprisal weapon-2 or the V-2, as commonly known) was conceived. The production started in 1943. V-2 missiles were used mainly against Britain and Belgium, causing widespread damage and destruction. The V-2, propelled by a mixture of alcohol (ethanol) and water combined with liquid oxygen, had an operational range of about 300 kilometres and could carry a 1,000-kg warhead. Under von Braun's command the Mittelwerk V-2 factory produced about 4,575 V-2s between August 1944 and March 1945.

Spirited away to US in the last days of World War II under the secret 'operation paperclip', von Braun, became the driving force behind the US rocket and space programme. Von Braun and his team were moved to White Sands in New Mexico where work began assembling and launching V-2s. By February 1946, von Braun's entire Peenemuende team had been reunited at White Sands and on 16 April the first V-2 was launched in the United States. The US space program was under way.

Shocked and awed by the success of Soviets in launching *Sputnik*, the National Aeronautics and Space Administration (NASA) was established in 1958 and two years later, von Braun, his team and the entire Army Ballistic Missile Agency were transferred to NASA to become the nucleus of the Agency's space program. By then von Braun had become a naturalized US citizen and had worked on the American ICBM program.

However, much to the embarrassment of US, the first attempt to launch the Vanguard rocket failed on

6 December 1957 when it exploded in the launch pad. Further, it was designed to carry a satellite weighing just 1.36 kg, a mere grapefruit compared to the *Sputnik*! Even the improved Vanguard had a designed capacity to take only a 9-kg payload, when Soviets could launch 1,000-kg payloads with ease. The Soviet R-7 booster generated a thrust of 500 metric tons. By contrast, the Atlas booster, which was the most powerful rocket in the United States at the time, had a thrust of only 200 metric tons. First success for the US came only in 1958. Riding on von Braun's Jupiter-C launch vehicle, a modified Redstone ballistic missile, *Explorer-1* was the first US satellite to be launched successfully on 31 January 1958. Designed at Jet Propulsion Laboratory (JPL), *Explorer-1* carried Van Allen's experiment to measure cosmic rays. The results from this experiment and similar ones aboard other US and Soviet satellites launched that same year revealed that Earth was surrounded by two zones of radiation, now known as the Van Allen radiation belts, comprising energetic particles trapped by Earth's magnetic field. By then the Soviets had launched *Sputnik-2*, carrying the dog Laika on 3 November 1957.

In 1961, as Alan Shepard, the first American in space, touched down in the Atlantic Ocean, President Kennedy committed his nation to be the first on the Moon. NASA's Marshall Center was charged with developing a family of giant rockets that could meet the mission target. Von Braun served as director of NASA's Marshall Space Flight Center and the chief architect of the Saturn-V launch vehicle, the super-booster that propelled the United States to the Moon. Kennedy's speech galvanised Americans and the first men – two Americans – landed on Moon in 1969. The US remains the only nation to do so till now, a fete truly possible only due to skill and perseverance of Wernher von Braun.

French would crush them; and believed England was too poor to support a full-fledged rocket programme. Hence contravening direct orders of the

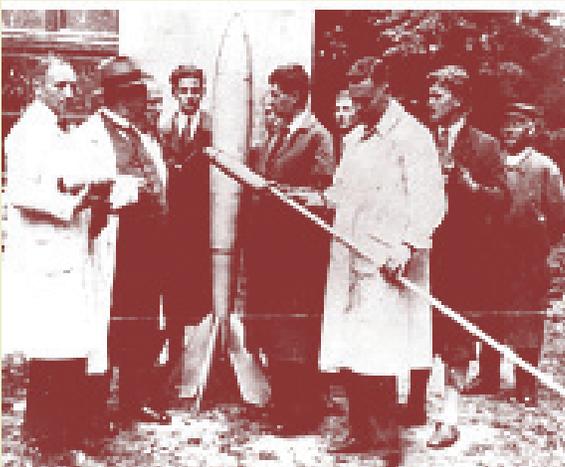
Headquarters, von Braun took his team of rocket scientists to find an American soldier to whom they could surrender. In a cloak and dagger operation fit for



Von Braun in his Nazi uniform

a thriller movie, code-named 'operation paperclip', he and his team were spirited by American secret service from falling into the hands of advancing Soviets. Over 300 train-car loads of spare V-2 parts ultimately found their way to America. By the time the Red Army and Korolev reached V-2 production centre at Mittelwerke, there were hardly anything left. Only bits and pieces were available. About 118 members of von Braun's team and all their hidden documents were with the US.

Nevertheless Korolev did not lose heart. He salvaged what was left of the V-2 production effort, and began interviewing dozens of V-2 engineers and technicians who still remained in Germany. Following Korolev's instructions, 200 German employees of the Mittelwerke V-2 factory were rounded up and deported to the Soviet Union. Korolev and his team used their



Von braun with v-2

skill to reconstruct the V-2 design almost from nothing. Aside from assisting in the launch of a few more V-2s from Kapustin Yar, the captured Germans mainly answered written questions. They were finally returned to Germany between 1950 and 1954.

The first Soviet rocket based on V-2, called R-1, was tested in October 1947 by the Soviets. Eleven tests were carried out, of which only five reached the target. Though formidable, Korolev found that the V-2 rockets would not meet his requirements – neither as an ICBM nor as a launch vehicle to place a spacecraft in orbit. It was clear that he has to move on his own strength.

Korolev commenced his own design. The first Soviet-designed missile, the R-2E, was launched in 1949. The R-2 doubled the range of the R-1 and ethyl alcohol used in the V-2 and R-1 was replaced by methyl alcohol in the R-2. The R-2A version could carry 1,400 kg on a 209-km vertical shot. Korolev made several improvements. The new design R-3A completed in 1949 had a range of 900 to 1,000 km, with a payload of 1,530 kg. An advanced version in this series, the R-5 engine, which was provided with a special extension nozzle that enabled to increase its flight range up to 1,200 km, was tested in 1953. Incidentally the R-5 was used to catapult animals, especially dogs to study the effect of rocket travel and higher altitude on life. Initially these rockets used liquid oxygen and alcohol as propellants; subsequently R-7, a two-stage rocket, was developed which used liquid oxygen, kerosene and liquid hydrogen as propellants.

Meanwhile Korolev published a scientific paper on Earth satellites in 1954. In January

Chronology of space events (1957-58)

1957

- 4 October, USSR: *Sputnik-1* (83.6 kg) launched
- 3 November, USSR: *Sputnik-2* (508.3 kg), with dog Laika as passenger, launched
- 6 December USA: Vanguard TV-3 explodes on launch pad

1958

- 31 January, USA: *Explorer-1* (14 kg), America's first satellite, discovers the Van Allen radiation belts
- 3 February, USSR: First try to launch *Sputnik-3* fails
- 5 February, USA: A second Vanguard launch fails
- 5 March, USA: *Explorer-2* fails to orbit
- 17 March, USA: Vanguard-1 (1.47 kg) successfully placed in orbit
- 26 March, USA: *Explorer-3* launched into orbit, collects radiation and micrometeoroid data
- 28 April, USA: Another Vanguard launch fails (third failure)
- 15 May, USSR: *Sputnik-3* (1,327 kg) placed in orbit, carrying large array of scientific instruments
- 27 May, USA: Vanguard fails for the fourth time
- 26 June, USA: Vanguard fails for the fifth time
- 26 July, USA: *Explorer-4* placed in orbit and maps Van Allen radiation belts for 2½ months
- 24 August, USA: *Explorer-5* fails to go into orbit
- 26 September, USA: Vanguard fails for the sixth time

1955 a group of Soviet scientists, who had been inspired by Korolev's paper, met to promote his satellite project, and thus his dream of launching a spacecraft came true with the launch of the Sputnik in 1957.

A modified R-7 was used in the initial years by the Soviets to launch various spacecrafts, including the historic *Sputnik* and later the *Vostok-1* with Yuri Gagarin as the passenger. Korolev too had a role in design of the spacecrafts such as *Vostok* and *Voskhod*. While *Vostok* could take one or two cosmonauts to space, the *Voskhod* was designed to take three cosmonauts for the space ride. The Vostok rocket (East or dawn), a two-stage rocket, had a capacity placing a payload of 4,725 kg in a low earth orbit. An improved version, the Voskhod rocket (Sunrise) was a derivative of the R-7, designed for the human spaceflight, with a payload capacity of 5,900 kg in low earth orbit. It could carry 500 kg to Moon. This launch vehicle was used 300 times between 1963 and 1976 for manned and unmanned launches. The Soyuz launch vehicle – an expendable launch system – is even now used to launch unmanned *Progress* supply spacecraft to the *International Space Station* and for various commercial launches.

Unlike the Americans, the Soviet space programme under Korolev was indeed cautious; it definitely aimed at exploring space, but doing it safely. Because of safety concerns, Korolev made sure his designs evolved gradually over time, always using a design that worked safely and building on the success.

The *Vostok* capsule evolved directly into the *Soyuz* capsule, which underwent several subsequent design changes and is still in use.

There was a systematic approach in the Soviet space programme. Following the initial reconnaissance of the Moon by *Luna-1*, *Luna-2*, and *Luna-3* spacecraft, Korolev established three largely independent efforts aimed at achieving a Soviet lunar landing. The first objective, met by *Vostok* and *Voskhod*, was to prove that human space flight was possible. The second objective was to



Operation Paperclip. Von Braun surrenders to US army

develop lunar vehicles that could soft-land on the Moon's surface to ensure that a cosmonaut would not sink into the dust accumulated by four billion years of meteorite impacts. The third objective, and the most difficult to achieve, was to develop a huge booster to send

cosmonauts to the Moon. His design bureau began work on the N-1 launch vehicle, a counterpart to the American Saturn-V, beginning in 1962. However, N-1 never made a successful flight.

Korolev's death at the age of 59 was untimely. If he were alive may be he could have won the race to Moon. One of the biggest craters on the far side of Moon and a minor planet No. 1855 have been named 'Korolev' in his honour. As a testimony to his skills, the *Soyuz* spacecraft, which he conceived at the dawn of the space era, completed forty years in operation in 2006. It has become the world's most used spacecraft, and has flown over 1,700 missions, far more than any other spacecraft. It is a very old basic design, but is notable for low cost and very high reliability, both of which appeal to commercial clients. It still remains a reliable and trustworthy spacecraft to ferry passengers; between 1 February 2003 and 26 July 2005, when the US space shuttle fleet was grounded after the Challenger accident, *Soyuz* was the only means of transportation to and from the *International Space Station*. This included the transfer of supplies, via *Progress* spacecraft, and crew changeovers. Space stations like *Salyut*, *Mir* and the *International Space Station* are truly Korolev's dreams that came true. ■

(VP News Contd. from page...19) Workshop on Innovative Physics Teaching

Vigyan Prasar and Department of Physics, Indian Institute of Technology (IIT), Kanpur, have jointly undertaken a project entitled "Open-ended Experiments in Physics at School Level". As part of the project, a national level workshop on Innovative Physics Teaching was organized at IIT Kanpur during 8–13 June 2007. About 40 physics teachers participated in the workshop. Dr. V. B. Kamble, Director, Vigyan Prasar and Prof. S. C. Shrivastava, Dean of Research and Development, IIT Kanpur inaugurated the workshop.

Prof. H.C. Verma, coordinator of the project and Professor of Physics at IIT, Kanpur, briefed the participants about the

theme of the workshop and conducted a number of sessions. Dr. Kamble gave a presentation on Vigyan Prasar activities and invited participation from all sections of society in the efforts of Vigyan Prasar to popularize science among people in general and students in particular. Prof. Mohapatra, Head, Department of Physics, IIT Kanpur, in his lecture, described the current directions of physics research. Shri Rintu Nath from Vigyan Prasar demonstrated a few physics experiments using the PC interface that Vigyan Prasar has developed. Sessions were organised by Prof. Verma and Shri

Brajesh Pandey, Research Scholar, IIT, Kanpur to demonstrate experiments, hands-on practice by the participants, discussions with experts on different concepts of physics and hands-on practice on informal lab activities.



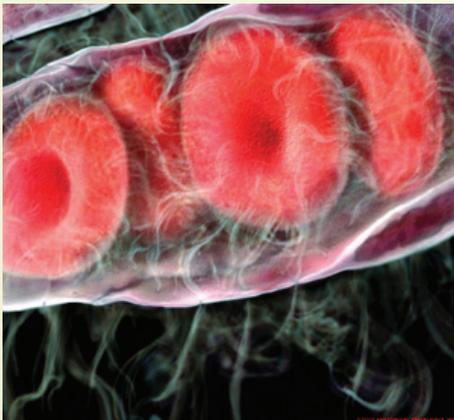
Hands-on practice during the workshop

The Magic Effect of Exercise on Diabetes



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

The healthful role of exercise and physical activity in the management of diabetes has been emphasized in Ayurveda since the ancient times. In one of the most celebrated works of Ayurveda, the *Susruta Samhita*, written around 600 BC, Susruta has prescribed that a person with diabetes must walk at least four miles a day. Modern medicine has also set its seal of approval on this noble advice. Research substantiates



that exercise and increased physical activity bring a bounty of health benefits – especially if you have diabetes.

Benefits of exercise

By exercising regularly, you stand to reap a rich bonanza. The benefits include:

Healthier blood sugar level: This happens because of several reasons. Each act of exercise requires energy, and this means the body uses up the excess sugar in the blood. Naturally, the body's blood sugar level comes down. On top of it, the body's sensitivity to insulin improves, and this allows insulin to escort sugar into your cells, bringing a further improvement in the blood sugar level.

Reduction in weight: Regular exercise takes off kilos by burning

calories and increasing your metabolism. This weight loss also helps improve the body's ability to use insulin, and this lowers the blood sugar to a healthier level.

Reduced risk of heart disease: Exercise increases the heart's pumping power, lowers the blood pressure, and improves the blood circulation. It also reduces LDL cholesterol and triglycerides, which cause fat deposits in the arteries, and increases the HDL cholesterol that keeps your arteries clean.

Boost in overall fitness: Exercise is a wonderful tonic for the mind and body. It heightens your mental abilities, improves your concentration and increases your creativity. It stops osteoporosis and bone loss, improves the flexibility of muscles and joints and tones up your muscles. If you exercise regularly, you feel less tired.

Reduction in stress and tension: Exercise is a balm for mind. It eases stress, depression and negative thought and increases your self-esteem.

Are these incentives not a good enough reason to become active? If you feel motivated, get started, now! There are a whole lot of choices, depending on your age, health and fitness.

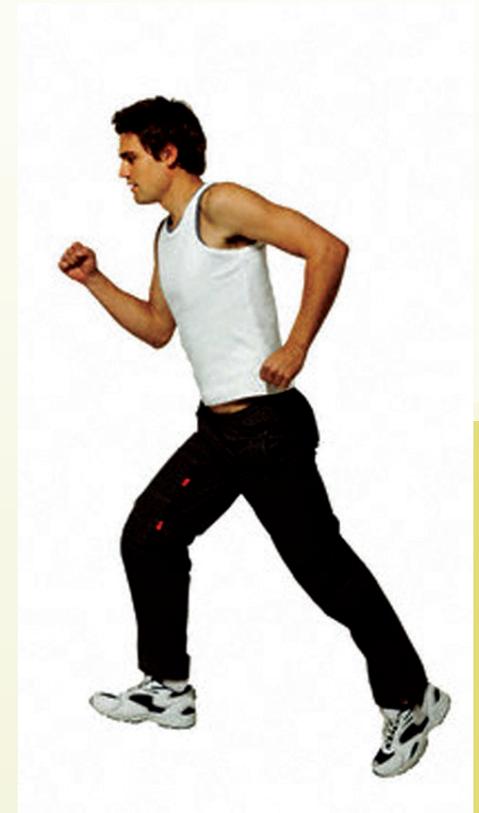
The choice of exercise

Broadly, exercise is of two types: *aerobic* and *anaerobic*.

Aerobic exercises: Aerobic simply means 'with oxygen'. Such physical activities that require extra supply of oxygen, but this can be met through an increase in breathing and heart rate are called aerobic. The underlying principle is that the muscles do not feel starved for oxygen while doing the work out. Aerobic exercises include activities such as: walking, jogging,

aerobic dancing, cycling, swimming, skating, golfing, badminton and tennis. They benefit all people, including people with diabetes.

Anaerobic activities: These activities are short bursts of intense physical effort. Energy for such actions is obtained from glucose metabolism,



which occurs in the absence of oxygen with a resultant formation of lactic acid within the body. Such activities include weight lifting. These are not advisable for people with diabetes.

Getting started

Before getting started, it is always safer to see your doctor first. A thorough medical examination is a must to tailor your fitness plan. This restriction particularly applies if you are over 35 years of age. Once you receive the go-ahead from your doctor and understand

the safety restrictions you must observe, you can quickly choose the activities you would like to do.

Walking is easiest: Unless you have lost the protective sensation in the feet, walking is one of the easiest ways to get aerobic exercise. It is safe and requires no special training or equipment. You just need to put on clean, smooth-fitting cotton socks, proper walking shoes, and cloth yourself right for the weather before setting out. The benefit is immense: studies have established that walking just 30 minutes four times a week lowers insulin resistance, and improves the blood sugar control.

What if you lose the sensation in your feet? Longstanding diabetes can lead to loss of protective sensation in the feet. It is a good reason to limit weight-bearing exercise. Repetitive exercise on insensitive feet can lead to ulceration and fractures. You should therefore avoid prolonged walking, jogging or step exercises. Instead, swimming, cycling, chair exercises, arm exercises, and rowing should suit you since they do not put any weight on the feet.

Draw a safe and enjoyable fitness plan

Warm up and cool down: Before you begin exercising, get your body ready. A proper warm up should include 5-10 minute of aerobic activity at low intensity level. The warm-up session is to prepare the heart, lungs and muscles for more intense activity.

Just as at the beginning, it helps if you walk less intensely for a while to allow your heart rate to gradually slow down when you are about to finish the exercise session. A couple of slow stretches afterward can help keep your muscles limber and prevent them from tightening up.

Do stretching exercises: Gentle stretching of the muscles should also be a part of the routine. It increases the range to which you can bend and

stretch your joints, muscles and ligaments and also helps prevent joint pain and injury. Here are three stretches you can try:

Calf stretch : Stand at arm's length from the wall. Lean your upper body into the wall. Place one leg forward with knee bent. Keep your other leg back with your knee straight and your heel down. Keeping your back straight, move your hips toward the wall until you feel a stretch. Hold for 30 seconds. Relax. Repeat with the other leg. Repeat five to 10 times.

Lower back stretch : Lie on a table or bed with your hips and knees bent and your feet flat on the surface. Gently pull one knee toward your shoulder with both hands. Hold for 30 seconds. Relax. Repeat with the other leg. Repeat five to 10 times.



Chest stretch : Clasp your hands behind your head. Pull your elbows firmly back while inhaling and exhaling deeply. Hold for 30 seconds. Relax. Repeat five to 10 times.

Drink plenty of fluids

You lose fluid when you sweat, and it is important to replace this fluid. If you are not careful and get dehydrated, it can affect blood glucose level and heart



function adversely. Water is the best choice. Drink plenty of it before, during and after exercise.

How much exercise?

You should aim for at least 30 minutes of aerobic activity most days of the week. If you have not been active for a long time, start slowly and build up your endurance. Begin by exercising 10 minutes a day. Each week, increase the length of time you exercise by five minutes, until you start doing 30-45 minutes a day. You may also break your routine into shorter intervals. You might walk for 10 to 15 minutes in the morning before going to work, for a like period during the lunch hour and for another 15 minutes in the evening.

Listen to warning signs

Never ignore symptoms that may signal a health snag. These include:

- ▶▶ Dizziness or faintness
- ▶▶ Tightness in the chest
- ▶▶ Chest pain
- ▶▶ Pain in an arm or the jaw
- ▶▶ Palpitations
- ▶▶ Unexpected shortness of breath

If you experience these symptoms, talk to your doctor. Until you get an all clear from the doctor, take a break from the fitness programme.

(Watch out for 'Yoga and diabetes' in the next issue!)

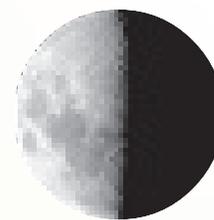
Sky Map for August 2007

Full Moon



28 August

Moon - Last Quarter

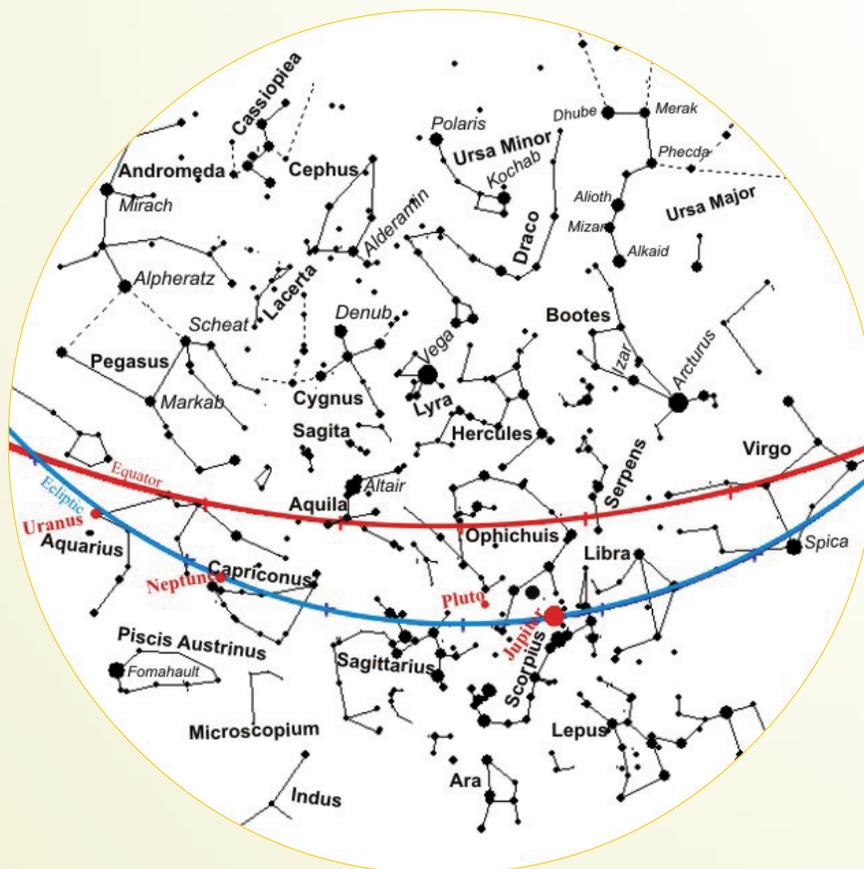


5 August

North

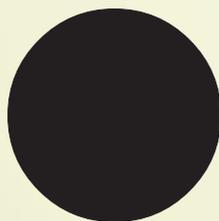
East

West



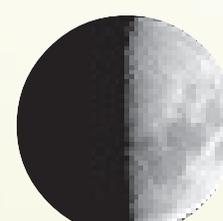
South

New Moon



12 August

Moon - First Quarter



20 August

The sky map is prepared for viewers in Nagpur (21.09° N, 79.09° E). It includes bright constellations and planets. 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 viewers 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 01 August, at 9:00 PM on 15 August and at 8 PM on 30 August.

Tips for watching the night sky :

- (1) Choose a place away from city lights/street lights
- (2) Hold the sky-map overhead with 'North' in the direction of Polaris
- (3) Use a pencil torch for reading the sky map
- (4) Try to identify constellations as shown in the map one by one.

Planet/Dwarf Planet Round Up:

- Jupiter:** In the constellation Ophiuchus (*Bhujandhari*) up in the zenith.
- Uranus:** In the constellation Aquarius (*Kumbha Rashi*) near Eastern horizon.
- Neptune:** In the constellation Capricornus (*Makar Rashi*) up in the Eastern Sky.
- Pluto:** In the constellation Sagittarius (*Dhanu Rashi*) up in the zenith.

Prominent Constellations: Given below are prominent constellations with brightest star therein (in the parenthesis). Also given are their Indian names.

Eastern Sky : Andromeda/*Devayani*, Aquarius/*Kumbha Rashi*, Capricornus/*Makar Rashi*, Pegasus/*Mahashva*, Pisces Austrinus.

Western Sky : Bootes (Arcturus)/*Bhutaap (Swati)*, Libra/*Tula Rashi*, Serpens, Virgo (Spica)/*Kanya (Chitra)*.

Southern Sky : Ara, Indus, Lepus / *Shashak*, Microscopium, Sagittarius/*Dhanu Rashi*, Scorpius (Antares)/ *Vrischik Rashi (Jeshta)*.

Northern Sky : Cassiopeia/*Sharmishtha*, Cepheus/*Vrishaparv*, Draco/*Kaleey*, Ursa Major/*Saptarishi*, Ursa Minor (Polaris)/*Dhruva Matsya/Dhurva Tara*, Zenith : Aquila (Altair)/*Garuda (Sravan)*, Cygnus (Deneb)/ *Hansa*, Hercules/*Shauri*, Lacerta, Lyra (Vega)/*Swaramandal (Abhijeet)*, Ophiuchus/*Bhujandhari*, Sagita.

□ Arvind C. Ranade

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Earthquake Tip-14

Why are Horizontal Bands Necessary in Masonry Buildings?

Role of Horizontal Bands

Horizontal bands are the most important earthquake-resistant feature in masonry buildings. The bands are provided to hold a masonry building as a single unit by tying all the walls together, and are similar to a closed belt provided around cardboard boxes. There are four types of bands in a typical masonry building, namely gable band, roof band, lintel band and plinth band (Figure 1), named after their location in the building. The lintel band is the most important of all, and needs to be provided in almost all buildings. The gable band is employed only in buildings with pitched or sloped roofs. In buildings with flat reinforced concrete or reinforced brick roofs, the roof band is not required, because the roof slab also plays the role of a band. However, in buildings with flat timber or CGI sheet

roof, roof band needs to be provided. In buildings with pitched or sloped roof, the roof band is very important. Plinth bands are primarily used when there is concern about uneven settlement of foundation soil.

The lintel band ties the walls together and creates a support for walls loaded along weak direction from walls loaded in strong direction. This band also reduces the unsupported height of the walls and thereby improves their stability in the weak direction. During the 1993 Latur earthquake (Central India), the intensity of shaking in Killari village was IX on MSK scale. Most masonry houses sustained partial or complete collapse (Figure 2a). On the other hand, there was one masonry building in the village, which had a lintel band and it sustained the shaking very well with hardly any damage (Figure 2b).

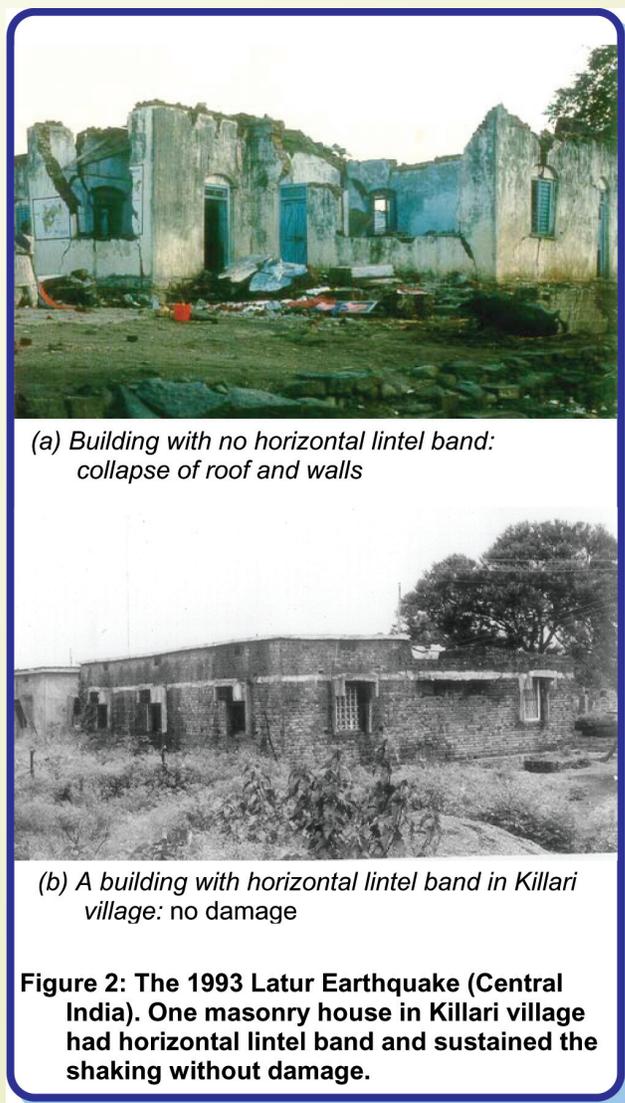
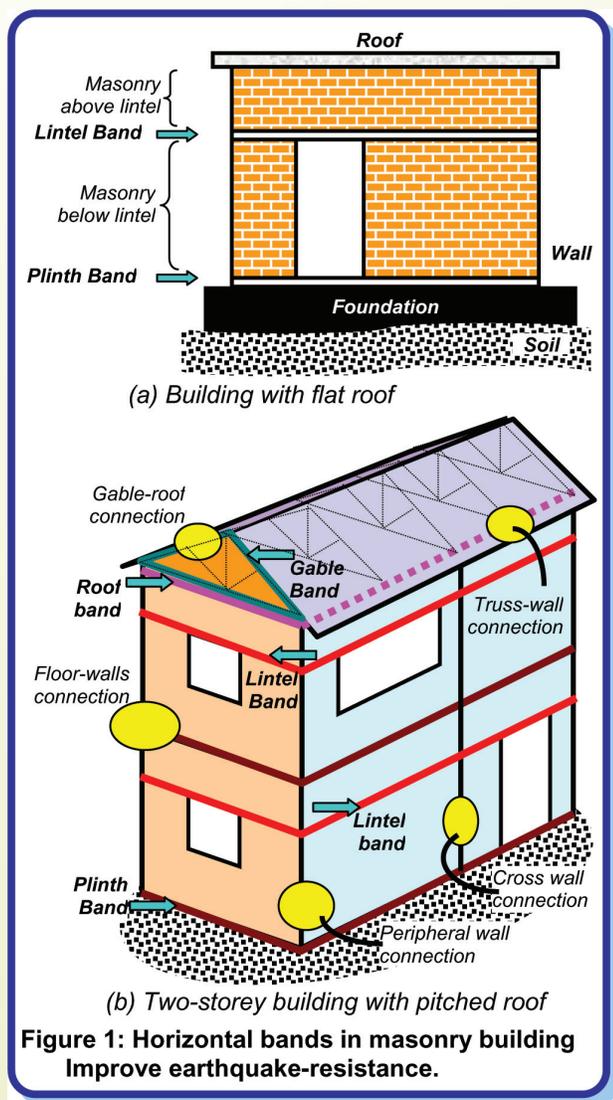


Figure 2: The 1993 Latur Earthquake (Central India). One masonry house in Killari village had horizontal lintel band and sustained the shaking without damage.

Design of Lintel Bands

During earthquake shaking, the lintel band undergoes bending and pulling actions (Figure 3). To resist these actions, the construction of lintel band requires special attention. Bands can be made of wood (including bamboo splits) or of reinforced concrete (RC) (Figure 4); the RC bands are the best. The straight lengths of the band must be properly connected at the wall corners. This will allow the band to support walls loaded in their weak direction by walls loaded in their strong direction. Small lengths of wood spacers (in wooden bands) or steel links (in RC bands) are used to make the straight lengths of wood runners or steel bars act together. In wooden bands, proper nailing of straight lengths with spacers is important. Likewise, in RC bands, adequate anchoring of steel links with steel bars is necessary.

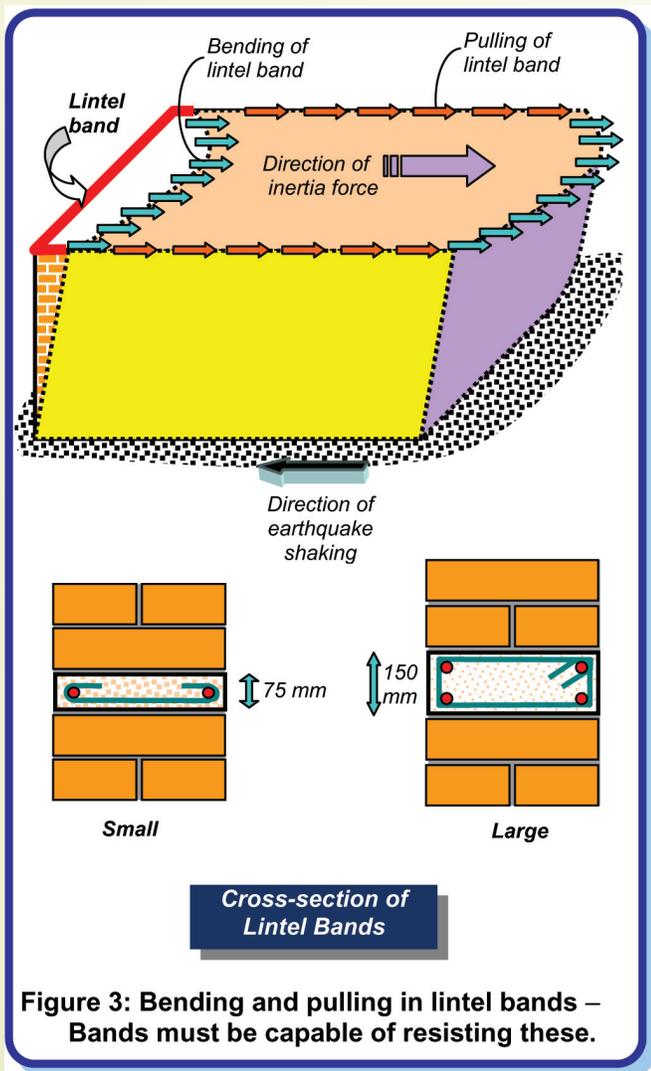
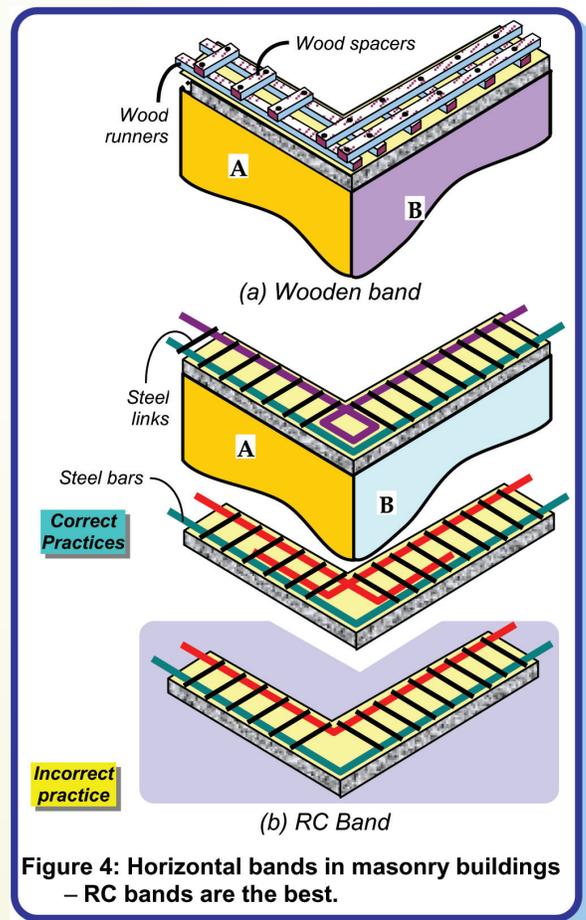


Figure 3: Bending and pulling in lintel bands – Bands must be capable of resisting these.

Indian Standards

The Indian Standards IS:4326-1993 and IS:13828 (1993) provide sizes and details of the bands. When wooden bands are used, the cross-section of 'runners' is to be at least 75 mm × 38 mm and of 'spacers' at least 50 mm × 30 mm. When RC bands are used, the minimum thickness is 75



mm, and at least two bars of 8 mm diameter are required, tied across with steel links of at least 6 mm diameter at a spacing of 150 mm centres.

Related IITK-BMTPC Earthquake Tip

Tip 5 : What are the seismic effects on structures?

Tip12 : How brick masonry houses behave during earthquakes?

Tip13 : Why masonry buildings should have simple structural configuration?

Resource Material

1. IAEE, (1986), *Guidelines for Earthquake Resistant Non-Engineered Construction*, International Association for Earthquake Engineering, Tokyo, available on www.nicee.org.
2. IS 4326, (1993), *Indian Standard Code of Practice for Earthquake Resistant Design and Construction of Buildings*, Bureau of Indian Standards, New Delhi.
3. IS 13828, (1993), *Indian Standard Guidelines for Improving Earthquake Resistance of Low-strength Masonry Buildings*, Bureau of Indian Standards, New Delhi.

Acknowledgement :

Authored by : C.V.R.Murty, Indian Institute of Technology Kanpur, Kanpur, India.

Sponsored by : Building Materials and Technology, Promotion Council, New Delhi, India

Recent Developments in Science and Technology

□ Biman Basu

Email: bimanbasu@gmail.com

Liquid-Mirror Telescope on Moon

Astronomers have long considered the Moon to be an ideal base for putting up large astronomical telescopes. The absence of atmosphere on Moon means no air turbulence that mars ground-based observations from Earth and also much longer uninterrupted observing periods. But the main hurdle foreseen to building a telescope on Moon has been the need to carry large telescope mirrors, which could present enormous problems of logistics. But a recent technological breakthrough may obviate the need to carry large mirrors to Moon; instead the mirrors would be produced right at the place they are needed using novel materials called 'ionic liquids' and coating them with silver (*Nature*, 21 June 2007).

Ionic liquids are organic salts with melting points under 100°C, often even lower than room temperature. They are non-volatile and are commonly employed as a substitute for more traditional organic solvents in chemical reactions. The most common ones are imidazolium and pyridinium derivatives, but also phosphonium or tetralkylammonium compounds can be used for this purpose.

Dubbed the 'Lunar Liquid Mirror Telescope' (LLMT), the project is supported by the NASA Institute for Advanced Concepts. It aims at creating a parabolic reflecting surface by spinning ionic liquids coated with silver. Liquid mirrors are known to have excellent optical qualities and are easier to carry and assemble than solid mirrors. According to the team of American and Canadian researchers working on the project, the new technology may be ready for use by 2020. To build the telescope astronauts

would deliver the observatory (all folded up) to the Moon during one of their upcoming "return to the Moon" missions. It would unfold into the shape of a telescope mirror made of mesh. The astronauts would then pour a reflective ionic liquid onto the mesh. The rotating mesh would create the reflective surface of the mirror. Of course, the LLMT would only point vertically up at the sky and would not be steerable, but astronomers consider it a minor problem for selected fields of astronomical research, like cosmology.

Indigenous device to measure snow surface temperature

Monitoring of snow surface temperature on mountains is essential for reliable prediction of avalanches and also for the study of the impact of global warming. Till recently there were few temperature monitoring stations in the vast snow-bound regions of the Himalayas in India, and the few monitoring instruments that were installed were all imported. Now Indian scientists have developed the first indigenous infra-red probe to measure snow surface temperature. The probe, designed by the Central Scientific Instruments Organisation (CSIO) in Chandigarh is capable of operating round-the-clock in harsh weather conditions in snow bound areas, and can withstand temperatures between - 40°C and + 50°C and wind speeds up to 200 km per hour (*Journal of Scientific and Industrial Research*, May 2007).

The new instruments have already been set up in the Siachen region of Jammu and Kashmir and at some locations in Himachal Pradesh, and have started transmitting data via

satellite on an hourly basis to the Snow and Avalanche Study Establishment (SASE) in Chandigarh. The probe's main component is the detector, which converts radiant energy into electrical energy that is read by a processor and displayed on a LCD screen. The final output of the probe is in volts and frequency to make it compatible with most snow data recording systems. According to the researchers, indigenous manufacture will slash the cost of the equipment by a third and make monitoring a cheaper option.

The Defence Research and Development Organisation plans to set up about 50 weather stations equipped with the new probe to monitor various snow parameters in the western Himalayas over the next five years. The first inferences on rate of glacial melt can be drawn after five years since conclusive evidence comes only from a long-term study. Wide use of indigenous instruments will help in accumulation of data from a wider spread of locations rather than just a few regions, which would make predictions more realistic than those made on the basis of readings from just a few stations.

Gene therapy for Parkinson's disease

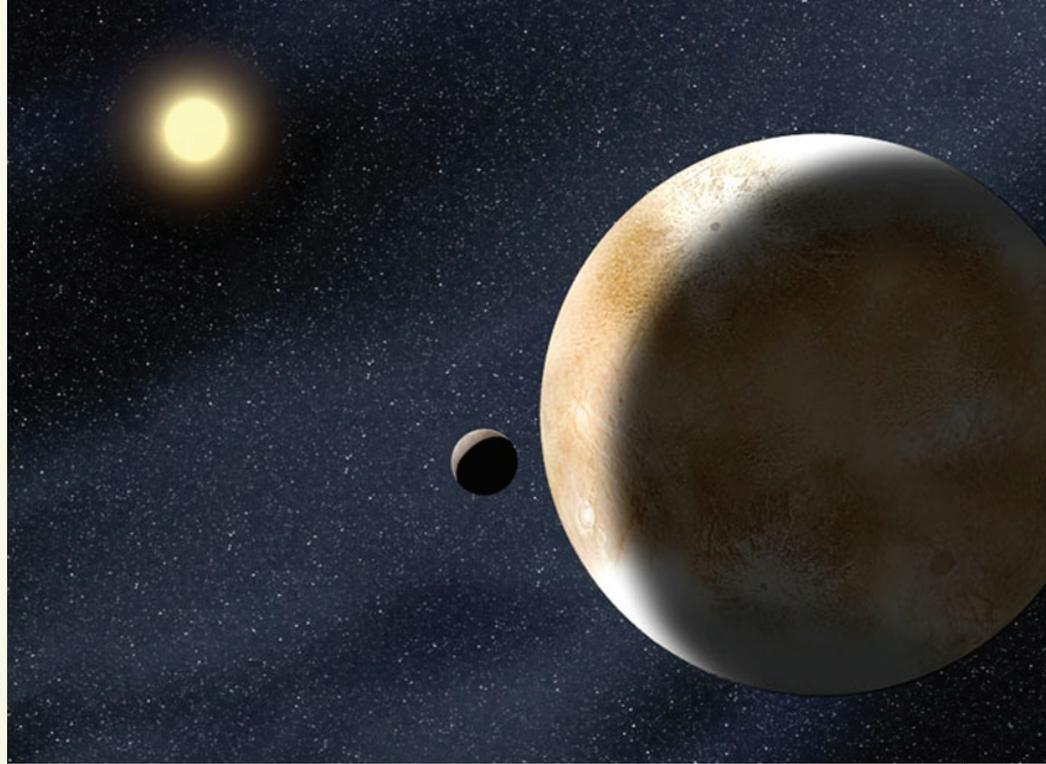
Parkinson's disease is a degenerative disorder of the central nervous system that often impairs the patient's motor skills and speech. Symptoms of Parkinson's disease have been known since ancient times, but it was not formally recognised and its symptoms were not documented until 1817 in *An Essay on the Shaking Palsy* by the British physician James Parkinson, after whom the disease is named.

At present, there is no cure for the disease, although medications or surgery can provide some relief from the symptoms. But the first-ever gene therapy trial for Parkinson's disease has given encouraging results (*The Lancet*, 23 June 2007). Although the study was carried out on only 12 patients, most of them showed noticeable improvement in motor ability.

No side effects related to the treatment were observed. The research team led by Michael Kaplitt and Matthew During of Weill Medical College of Cornell University in New York City wanted to add a gene called glutamic acid decarboxylase (GAD) to cells in the area of the brain called subthalamic nucleus, which is more active than normal in Parkinson's patients. The gene codes for the enzyme that makes gamma-aminobutyric acid (GABA), a neurotransmitter that inhibits neuron firing. The idea was that if the production of GABA could be stimulated, the activity in the subthalamic nucleus and other brain parts could be calmed. In patient trials it indeed seemed to work.

Pluto loses further ground

In August 2006, subsequent to the discovery of larger objects in the Solar System, Pluto lost its status as a planet and was redesignated as a 'dwarf planet', along with Eris and Ceres, by the International Astronomical Union. The dwarf planet Eris (original name 2003 UB313) was known to be larger than Pluto, but now it has been found that it is also significantly more massive than Pluto. Thus once



Eris and its moon

considered the ninth planet, Pluto has now been relegated to the position of a lowly dwarf planet (*Science*, 15 June 2007).

Astronomers calculated the mass of Eris by studying the orbital motion of its tiny moon Dysnomia. Eris's discoverer, Michael Brown, a planetary scientist at the California Institute of Technology in Pasadena, California, along with colleague Emily Schaller,

used the Keck Observatory and the Hubble Space Telescope to determine the orbital motion of Dysnomia. Considering the radius of Dysnomia's orbit and the time it takes to complete one lap, the team calculated the mass of Eris to be 16.6×10^{21} kilograms, which is 27% more than the mass of Pluto. In fact, Eris turned out to be the most massive of the three presently known dwarf planets. ■

Editorial (Contd. from page 35)

emphysema (an abnormal condition of lungs) and immune system disorders. Tissue culture (growing living cells) for long periods in such an environment could help develop new treatment of cancer without risking harm to patients. Further, fluids, flames, molten metal and other materials would form a subject of basic research on the space station. They all behave differently in reduced gravity.

Observations of the Earth from orbit can help the study of large-scale, long-term changes in the environment and monitor climate change as a result of global warming. The effects of long-term exposure of reduced gravity on humans like weakening of muscles;

changes in the way the heart, arteries and veins work; and the loss of bone density, among others, could be studied aboard the station. These studies may lead to a better understanding of the body's systems and similar ailments on Earth. Further, a thorough understanding of such effects and possible methods of counteracting them is required to prepare for future long-term human exploration of the solar system.

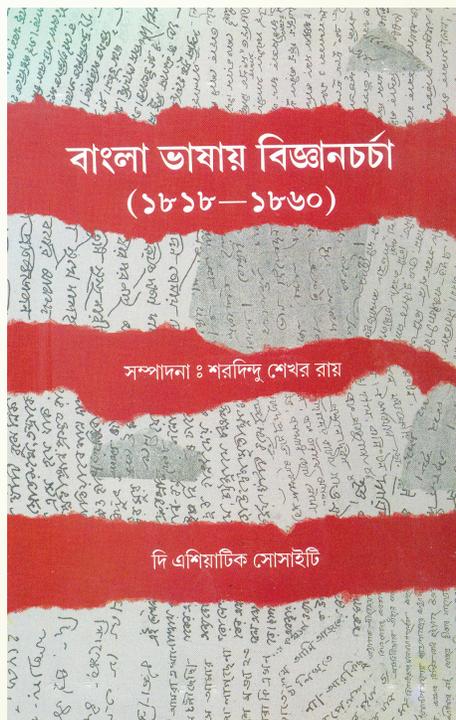
The new focus for the manned space program is to go out beyond Earth's orbit for purposes of human exploration and scientific discovery. And the International Space Station is a stepping-stone on the way. On the space station, it would be possible to learn how to live and work in space, and build hardware that can survive and

function for the years required to making the round-trip voyage from Earth to Mars. Incidentally, journey to Moon takes only three days. Indeed, throughout history, the great nations have been those that are at the forefront of the frontiers of time. This was true for India in the ancient times. Britain became great in the 17th century through its exploration and mastery of the seas. In the years to come, the frontier will be space. Today, we need to catch up with the rest of the world, and *Chandrayaan*, India's mission to Moon to be launched in 2008, is only one small step in this direction. It is, however, needless to say that the ultimate goal of space exploration has to be universal peace and progress of humankind.

□ Vinay B. Kamble

Documenting Science Popularisation Efforts in Bengali during 1818-1860

Vigyan Prasar has been trying to document science popularisation activities in different Indian languages in the past. As part of this effort it had assigned a project to Science Communicators' Forum, Kolkata to prepare a compilation of popular science writings in Bengali during the period 1818-1860. The 700-page compilation was recently published by the Asiatic Society, Kolkata. The book provides a glimpse of the adverse circumstances under which serious attempts were made to popularise science in Bengali in the 19th century. Dr. Saradindu Sekhar Roy has edited the compilation and has also given a glossary of Bengali scientific words with their English meanings. Dr. Ramakanta Chakrabarty, General Secretary, Asiatic Society in his foreword says, "The book makes it amply evident that, even during the first half of the nineteenth century, a



large section of the educated Bengalis felt the necessity of disseminating science through the vernacular medium, and the need to modernise the Bengali mentality, without disturbing tradition in a violent manner." The book contains many important articles written during that period in fifteen journals, beginning from *Digdarshana* to *Krishi Darpana*, some of which are very rare. The book will prove to be very useful both for the science historians and the students of science.

Vigyan Prasar had earlier brought out two volumes on popular science writings in Hindi during 1850-1950. The project in Hindi was undertaken by Vigyan Parishad, Prayag and the volumes were edited by Prof. Shiv Gopal Misra. Vigyan Prasar will endeavour to bring out similar publications in other Indian languages. ■

Radio Programme from AIR, Agartala

The broadcast of a 13-episode radio programme started from AIR, Agartala 17 June 2007. The serial would be broadcast on every Sunday at 8:35 AM. The theme of the serial is the International Year of the Planet Earth, in which Tripura-specific issues have been highlighted. Each episode has three components. The main issue is presented in a drama format followed by presentation of an expert on the topic and discussion; and a question-answer session. The serial has been produced jointly by Vigyan Prasar, AIR,

Agartala and Tripura Science Forum. There has been a provision for registration for the programme and the first 1000 registered listeners would be given some VP software.

A Curtain Raiser programme was broadcast on 16 June 2007 (Saturday evening), which discussed about Vigyan Prasar's activities with special emphasis on its activities in Tripura and the objective and contents of the programme. Dr. Mahanti of Vigyan Prasar and Shri Sanjay Banerjee of Tripura Science Forum took

part in the programme. A press conference was organised by Tripura Science Forum at AIR Agartala on 15 June 2007 in which representatives of both electronic and print media participated. ■

Letters to the Editor

A purposeful magazine

As president of the Centre for Consumer Education and Environment Protection, I have been receiving copies of *Dream 2047* for nearly a decade. I read it regularly, and often make copies of selected articles and circulate them among my colleagues in the Mysore Grahakara Parishat, Peoples Education Trust, Mysore University Committee on Generation of Interest in Science at High School Education Level, and to other bodies. Most of them have benefited from it. We need more articles that would help to generate scientific and secular temper as stated in our constitution. We need help from VP in this respect as the rising tide of ritualistic and superstitious outlook dominates the thought process of teachers and teacher trainers, which need to be reversed by re-educating them in science. I would like to have more articles that link daily life with science. Fortunately the *Dream 2047* meets the point to a large extent. I congratulate you on this meaningful progress.

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Participants at the Press Conference