Science News

India to explore the moon

India has announced that it plans to explore the Moon and will send an unmanned probe there by 2008. The Indian Space Research Organisation (ISRO) calls the first Moon Flight Project *Chandrayan Pratham,* which has been translated as *First Journey to the Moon* or *Moonshot One.* The Chandrayan-1 weighing nearly 525 kg would be launched in 2007 or 2008 from one of India's own Polar Satellite Launch Vehicle (PSLV) space rockets. At first, the spacecraft would circle Earth in a Geosynchronous Transfer Orbit (GTO). From there, it would fly on out into a polar orbit of the Moon some 96 km above the lunar surface. The Chandrayan-1 mission would carry X-ray and gamma-ray spectrometers and would send back data that scientists on Earth would use to produce a high-resolution digital map of the lunar surface. The project's main objectives are high-resolution photography of the lunar surface using remote-sensing instruments sensitive to visible light, near-infrared light, and low-energy and high-energy X-rays. Space aboard the satellite also will be available for instruments from scientists in other countries.

The European Space Agency (ESA) has agreed to support India's plan to send a probe to the Moon by providing three science instruments for Chandrayan-1. They will be identical to those already in orbit around the Moon on ESA's Smart 1 spacecraft, which is surveying chemical elements on the lunar surface. The Indian lunar satellite also would carry with it a U.S. radar instrument designed to locate water and ice.

According to an ISRO press release, Chandrayan-1 is the first mission in "India's foray into a planetary exploration era in the coming decades". Chandrayan-1 will be the "forerunner of more ambitious planetary missions in the years to come, including landing robots on the Moon and visits by Indian spacecraft to other planets in the Solar System."

(*Source:* ISRO Press Release)

ISRO, NASA sign moon mission deal

Mr G Madhavan Nair, Chairman, ISRO, and Dr Michael Griffin, Administrator, National Aeronautics and Space Administration (NASA) of U.S.A. on May 9, 2006 signed Memoranda of Understanding (MoU) at ISRO Satellite Centre (ISAC), Bangalore. According to MoU two U.S. Scientific instruments would be included on board India's first mission to Moon, Chandrayan-1. These instruments are: Mini Synthetic Aperture Radar (Mini SAR) developed by Applied Physics Laboratory, Johns Hopkins University and funded by NASA and Moon Mineralogy Mapper (M^3), jointly built by Brown University and Jet Propulsion Laboratory (JPL) of NASA.

Chandrayan-1, scheduled during 2007-2008, is India's first unmanned scientific mission to moon. The main objective is the investigation of the

distribution of various minerals and chemical elements and high-resolution three-dimensional mapping of the entire lunar surface. ISRO's Polar Satellite Launch Vehicle (PSLV), will launch Chandrayan-1 into an earth orbit. Subsequently, the spacecraft's own propulsion system would be used to place it in a 100 km polar orbit around the moon.

The Indian payloads on board Chandrayan-1 include: a Terrain Mapping Camera (TMC), a Hyper Spectral Imager (HySI), a High-Energy X-ray spectrometer (HEX), a Lunar Laser Ranging Instrument (LLRI) and a Moon Impact Probe (MIP).

The two US instruments, Mini SAR and M^3, were selected on the basis of merit out of 16 firm proposals from all over the world received in response to ISRO's announcement of opportunity. The main objective of Mini SAR is to detect water in the permanently shadowed areas of lunar Polar Regions. The objective of M^3 is the characterisation and mapping of minerals on the lunar surface.

In addition to NASA instruments, three other instruments have already been selected by ISRO to be placed on board Chandrayan-1 from the European Space Agency. These are — Imaging X-Ray Spectrometer (CIXS) from Rutherford Appleton Laboratory, U.K., developed with contribution from ISRO Satellite Centre; Near Infra-Red Spectrometer (SIR-2) from Max Planck Institute, Germany; and Sub keV Atom Reflecting Analyser (SARA) from Swedish Institute of Space Physics developed in collaboration with ISRO's Vikram Sarabhai Space Centre — besides a RAdiation DOse Monitor (RADOM) from the Bulgarian Academy of Sciences.

The inclusion of US instruments on Chandrayan-1 would further strengthen the cooperation between India and USA in the field of space research which dates back to the very beginning of the Indian space programme

(*Source:* ISRO Press Release)

First custom-made bladders transplanted

According to a research report at least seven patients had received new bladders that have been engineered from a plug of tissue grown from their own, dysfunctional bladders. Researchers claimed that such custom-made bladders grown from patients' own cells have been successfully transplanted and work, in some cases for years. Dr. Anthony Atala, Wake Forest University in North Carolina, and the leader of the research team opined that their research has shown that regenerative medicine techniques can be used to generate functional bladders that are durable. Patients given transplants of bladders made from their own cells, unlike those who are given organs transplants from either living or dead donors, would not need to take drugs to prevent organ rejection.

The patients were children and teens aged 4 to 19 who had poor bladder function because of a congenital birth defect that causes incomplete closure of the spine. According to Atala, a urinary surgeon and an expert in regenerative and stem cell science, their research suggests that regenerative medicine may

one day be a solution to the shortage of donor organs for those needing transplants.

Vitamin D and calcium may lower diabetes risk

Women with high intakes of Vitamin D and calcium appear to have a lower risk of developing type 2 diabetes, according to a team of Boston-based researchers led by Dr. Anastassios G. Pittas, of Tufts-New England Medical Centre. Dr. Anastassios G. Pittas and his colleagues analysed the data collected on 83,779 women having no history of diabetes, cardiovascular disease or cancer when they enrolled in the study. Vitamin D and calcium intake from foods and from supplements were evaluated every 2 to 4 years. A total of 4843 new cases of diabetes were documented over 20 years of follow-up.

According to researchers the latest guidelines set by the Institute of Medicine envisage that only 3 per cent of women in our cohort had adequate Vitamin D intake, and only 24 per cent had adequate calcium intake. Total Vitamin D intake was not significantly associated with type 2 diabetes, but there was a difference when it came to Vitamin D supplements. The team saw a 13 per cent lower risk of diabetes among women in the highest versus the lowest category of Vitamin D intake from supplements.

Women with the highest total calcium intake had a 21 per cent lower risk of diabetes than those with the lowest intake. In this case, the source of calcium didn't make much difference: the risk was 18 per cent lower among women in the highest versus the lowest category of calcium intake from supplements. Overall, the lowest risk of diabetes was observed among women with the highest combined intakes of calcium and Vitamin D compared with those with the lowest.

(*Source:* Diabetes Care)

Viruses 'trained' to build tiny batteries

Researchers trying to make tiny machines have turned to the power of nature, engineering a virus to attract metals and then using it to build minute wires for microscopic batteries. The resulting nanowires can be used in minuscule lithium ion battery as electrodes, which in turn would be used to power very small machines.

An international team of researchers, led by a group at the Massachusetts Institute of Technology, used the M13 virus, a simple and easily manipulated virus. They modified the M13 virus' genes so that its outside layer, or coat, would bind with certain metal ions. They then incubated the virus in a cobalt chloride solution so that cobalt oxide crystals mineralised uniformly along its length.

Next a bit of gold was added to get the desired electrical effects. Viruses cannot reproduce on their own but must be grown in cells, in this case, bacteria. Virus inject their genetic material and then the cells pump out their copies. According to researchers, viruses ultimately form orderly layers.

The resulting nanowires worked as positive electrodes for battery electrodes. The researchers hope to build batteries

that range from the size of a grain of rice up to the size of existing hearing-aid batteries. Each virus, and thus each wire, is only six nanometres — six billionths of a metre — in diameter, and 880 nanometres long. Earlier researchers have previously used viruses to assemble semiconductor and magnetic nanowires.

Stem cells could boost stroke recovery

In rat studies, they also show promise against cerebral palsy.

Researchers have claimed that they have successfully reduced the effects of stroke in rats by transplanting stem cells into the rodents' brains. According to them the treatment also seemed to help rats fight a condition similar to human cerebral palsy. However, as of now it cannot be guaranteed that the treatment will work in humans. According to Cesario V. Borlongan, Associate Professor of Neurology at the Medical College of Georgia in Augusta, a member of the research team the tests in people could begin as early as next year. Even then the treatment is not expected to totally cure stroke or cerebral palsy, still, it could help.

According to Borlongan, despite decades of research, stroke remains extremely common and very difficult to treat. Thousands of people suffer strokes each day, but only few could access to newer remedies such as tPA, a powerful clot-busting drug. Cerebral palsy, a disabling neurological disorder of childhood, currently has no effective treatment.

However, because they have the ability to transform themselves into various types of body cells, stem cells have been thought to offer hope as a means of regenerating diseased or injured tissues. In fact, neuroscientists have been experimenting with stem cell transplants in animals for several years, but with mixed results.

In the new study, Borlongan and his colleagues transplanted human bone marrow cells into the brains of rats who had suffered strokes. In their study, the researchers avoided stem cells sourced from embryos or foetuses, which is still being debated on ethical and social grounds. Movement skills in the stroke-afflicted rats improved by 25 per cent after stem cell treatment, according to Borlongan. The improvement came even though the treatment was given seven days after a stroke. A 25 per cent improvement could translate into significant changes in how human patients get around. Bedridden patients may be able to use a wheelchair, and wheelchair-bound patients might move up to a walker, he said. Researchers also observed about a 25 per cent improvement in treated rats affected with a condition equivalent to human cerebral palsy. However, the researchers only watched them for 14 days. Unlike the rats in the stroke study, these rodents were injected with rat — not human — stem cells.

Beware of the telephone sets and computer keyboards!

Textbooks often teach us that most of the common infection — colds, flu,

diarrhoea — are transmitted environmentally either through the air, water or personal contact including the surfaces we touch. According to Charles Gerba, a microbiologist and clean water expert at the University of Arizona, people often under-rate surfaces they come in contact at their place of work, at home or other places they visit.

Experts believe that telephones, computer keyboards and sinks are more potential sources of infection than the doorknobs and elevator buttons. Based on dozens of surveys conducted on bacteria and viruses in workplaces and homes, Gerba asserts that people are usually cautious about the wrong things. According to him chances that doorknobs could be potential sources of infection are usually low as they are not moist. Therefore, one need not fear a doorknob too much.

Germs do not stick where people believe they will as has been revealed by a recent informal survey. An analysis of the survey data by Gerba illustrates how microbes take advantage of misconceptions to propagate themselves. Two computer keyboards, for example, were found to carry far more bacteria than an elevator button, the handles and button on the communal microwave oven or the office water fountain. Gerba warns that keyboards and telephones — especially when they are shared — are among the most germ-laden places in home or offices. Keyboards seem to be like a lunch table for germs as a lot of studies have revealed that on an average these harbour 400 times more bacteria than the average toilet seat. The main reason for such a dismal picture seems to arise due to the fact that usually nobody cleans the desktop. It is, therefore, perhaps not surprisingly, that teachers have the highest exposure to bacteria and viruses, as has been found by Gerba through his surveys. Accountants, bankers and doctors also tend to have microbe-laden offices, while lawyers came out surprisingly clean in the germ-count stakes.

A technique is followed to have an overall bacteria count for the general surveys. Swabs of each surface are sent to Gerba's lab, where these bacteria cultures are done in a lab dish. The growth of whatever bacteria are present can be used to estimate an overall load of germs, including harmless E. coli bacteria — which are found in the gut and are an indicator of what scientists delicately call "faecal contamination". Some other bacteria usually present are Klebsiella pneumonia, Streptococcus, Salmonella and Staphylococcus aurous, some of which cause disease and some of which do not. And where there are bacteria, there can be viruses, which can stick onto a clean and dry surface for days and to a wet surface for weeks.

According to experts such knowledge may be particularly useful as the pandemic of H5N1 avian influenza may be a real threat in future. While the virus currently infects birds almost exclusively, experts say it shows the greatest potential of any virus in decades to cause a human pandemic. If it begins to spread, basic hygiene would be essential to avoid infection.

Gerba notes that people tend not to know where the most infectious places are. For example, the bathrooms, toilet

taps and their doors. Bathroom sinks, however, are another source of infection as they are usually high in bacterial counts because they have everything bacteria like. It's wet, it's moist. In a home we usually find more E. coli in a sink than a toilet. Usually, public urinals are usually the dirtiest. All taps, door and flush handles and even walls' surfaces may be laden with bacteria.

German scientists synthesise a new compound

According to a research paper that appeared in the Journal of Biological Chemistry — an American Society for Biochemistry and Molecular Biology journal — Gunter Fischer and his colleagues at the Max-Planck Research Unit for Enzymology of Protein Folding in Germany have succeeded in synthesising a new compound that dramatically decreases the damage to neurons in rats demonstrating stroke symptoms**.**

Brain strokes area is the leading cause of death world over and also the most common cause of adult disability. An ischemic stroke occurs when a cerebral vessel occludes, obstructing blood flow to a portion of the brain. Currently, there is only one approved stroke therapy, tissue plasminogen activator, which targets the thrombus within the blood vessel. Because of the lack of available stroke treatments, neuroprotective agents have also generated as much interest as thrombolytic therapies.

The immuno suppressive drug FK506 (also known as Tacrolimus or Prograf.) is often administered to patients receiving transplants to prevent organ rejection. Derivatives of the drug are also commonly used in the treatment of auto immune diseases. FK506 inhibits T-cell activation by binding to members of the FK506-binding protein (FKBP) family. Interestingly, FK506, and several molecules with similar structures, also demonstrate neuroprotective and neuroregenerative effects in a wide range of animal models mimicking Parkinson's disease, dementia, stroke, and nerve damage.

Gunter Fischer and his colleagues have now determined that neuro protective FK506 derivatives specifically target a receptor called FKBP38. According to Fischer high FKBP38 activity in neuronal cells trigger mechanisms leading to programmed cell death. Inhibition of FKBP38 make cells more predisposed to survive. The scientists also synthesised a molecule that specifically inhibits FKBP38 and administered it to rats that were experiencing stroke symptoms. Fischer and his colleagues found that their compound protected the rats' neurons and also caused neural stem cell proliferation and neuronal differentiation. Animals with symptoms of disabilities, similar to those due to strokes, also showed improvement when they were given the synthetic drug. These results suggest potential therapeutic application specific FKBP38 inhibitors in the treatment of neuro degeneration following stroke and a number of other diseases.

(*Source:* http://www.asbmb.org)

Triple discovery hints at extra-solar planets

A team of astronomers had found three enticing Neptune-sized planets orbiting a distant star. The three planets were found after a two-year monitoring of the star using a 3.6m telescope at the European Southern Observatory (ESO) in La Silla, Chile. The discovery may prove to be a further step towards the goal of finding another Earth. More than 170 planets outside our own Solar system have been spotted in the past decade or so. But almost all of them have been gaseous Jupiter-sized giants that move around their star at a close range. Their atmosphere would be too hot and too dense to have liquid water, an essential ingredient for life as we know it.

A team led by Christophe Lovis from the Geneva Observatory in Switzerland located a smaller planetary system orbiting the star HD 69830. The star is 41 light years from Earth in the Puppis constellation and is about four-fifths the mass of our Sun. The three planets are quite large, being 10, 12 and 18 times larger in mass than the Earth. That makes them about the size of our Neptune, although a lot smaller than Jupiter, the biggest planet in our Solar System, and they appear to be solid planets too, made of rock, not gas.

The two innermost planets are probably so close to HD 69830 that they would be blisteringly hot, but the outermost one lies in what planet experts call the "Goldilocks zone" — a comfortable distance where water could exist as a liquid. Another discovery is that HD 69830 also hosts, like our Sun, an asteroid belt, the rubble left over from the building of planets from dust and gassy debris that clump together through gravitational attraction.

It may be too far fetched, according to researchers, to suggest that these planets contain life or the conditions for it, and it would be ludicrous anyway to think of them as a potential home away from home, given that our puny chemical rockets and their passengers could never reach there. But it shows that with patient searching and the right tools, astronomers can uncover ever-smaller exoplanets in ever-wider orbits from their star, which may one day lead to finding copies of Earth.

According to Michel Mayor, a member of the research team who is also from the Geneva Observatory, the planetary system around HD 69830 clearly represents a Rosetta stone in our understanding of how planets form. He was referring to the stone that opened the way to understanding the hieroglyphics of ancient Egypt. No doubt it will help us better understand the huge diversity we have observed since the first extrasolar planet was found 11 years ago, asserts Mayor.

(*Source:* NASA News)

A forward step in fusion research

A fusion reactor in which controlled fusion reaction could be made use to produce huge amount of energy has been a long cherished dream of physicists. In a fusion reactor, very high speed particles are made to collide together to form a charged gas called a plasma. This plasma is contained inside a doughnut-

shaped chamber called a tokamak by powerful magnetic coils. In the various designs of tokamaks developed so far in different parts of the world, none has achieved a self-sustaining fusion event for longer than about five seconds, and that too at a cost of using up far more energy than was yielded.

In 2005, a consortium of countries has signed a deal to build the International Thermonuclear Experimental Reactor (ITER) in southern France, which could serve as a test bed for an eventual commercial design. However, experts associated with designing ITER are faced with many challenges. One of them is a phenomenon called edge localised modes, or ELMs. These are sudden fluxes or eddy in the outer edge of the plasma that erode the tokamak's inner wall — a highly expensive metal skin that absorbs neutrons emitted from the plasma. Erosion means that the wall has to be replaced more often, which thus adds hugely to costs. Eroded particles also have a big impact on the plasma performance, diminishing the amount of energy it can deliver.

Physicists working in the United States believe they have cracked the problem facing man-made nuclear fusion, touted as the cheap, safe, clean and almost limitless energy source of the future. According to a team of researchers led by Todd Evans of General Atomics, California, the problematic ELMs can be controlled cleverly. They found that a small resonant magnetic field, derived from special coils located inside a reactor vessel, creates "chaotic" magnetic interference on the plasma edge, which stops the fluxes from forming. The experiments were conducted at the General Atomics' DIII-D National Fusion Facility, a tokamak in San Diego. Nuclear fusion is the process which enables the Sun to radiate energy. In the case of our star, hydrogen atoms are forced together to produce helium. On Earth, the fusion would take place in a reactor fuelled by two isotopes of hydrogen — deuterium and tritium — with helium the waste product. Deuterium is present in seawater, which makes it a virtually limitless resource. Tritium would be derived from irradiating the plentiful element lithium in the fusion vessel. Initially very high temperature, of the order of 10^8 ^oC, is needed to kickstart the fusion process, which then could be sustained by tiny amounts of fuel pellets.

ITER is designed to be a test bed of fusion technologies, with a construction period of about 10 years and an operational lifespan of 20 years. The partners of the project are the European Union (EU), the United States, Japan, Russia, China, India and South Korea. If ITER works, a prototype commercial reactor will be built, and if that works, fusion technology will be rolled out across the world. Other problems facing fusion technology include the challenge of creating self-sustaining plasma and efficiently containing the plasma so that charged particles do not leak out.

Cosmic telescopes!

Researchers have evolved yet another innovative technique to peep deeper into the mysteries of the universe. A research

team led by a Johns Hopkins University astronomer have used massive clusters of galaxies as "cosmic telescopes". What they have found may be infant galaxies born in the first billion years after the beginning of the universe. According to Holland Ford, a professor in the Henry A. Rowland Department of Physics and Astronomy at the university's Krieger School of Arts and Sciences, if these findings are confirmed, the extra magnification provided by these gargantuan natural telescopes would give astronomers their best-ever view of galaxies as they formed in the early universe, more than 12 billion years ago. Holland Ford is the head of the Hubble Space Telescope's Advanced Camera for Surveys Science Team, which also includes researchers from the Space Telescope Science Institute, PUC in Chile, and other universities around the world.

Announcing the team's results Ford said that their team's spectroscopic observations were made possible by gravitational lenses, the bending of light caused by gravity's warping of space in the presence of such massive objects as clusters of galaxies. Explaining the basic idea of gravitational lenses Ford recalled that one of Einstein's most startling predictions was that a gravitation field can be thought of as a distortion of space and time. Gavitational lensing by massive clusters of galaxies that have about 1 million billion times more mass than the sun provide one of the most striking confirmations of Einstein's prediction.

Ford asserts that our view of distant galaxies behind a cluster can be magnified by amounts that could vary from barely detectable to as many as 50 or 100 times normal size, depending on the location of the galaxy and the distribution of mass within the cluster. The clusters are, in effect, giant cosmic telescopes that allow astronomers to find and study distant galaxies that otherwise would be too faint to study.

Astronomers want to know when the first galaxies formed, how large and how bright galaxies are at birth, and how galaxies grow into large mature galaxies like our home Milky Way galaxy. The research team is searching for infant galaxies that are less than a billion years old by comparing images of strongly lensing clusters taken by the Hubble Space Telescope with images of the same clusters taken by the Magellan, the Very Large Telescopes (VLT) and Gemini telescopes. The infant galaxies are so far away their light is almost or entirely redshifted to wavelengths that cannot be detected with Hubble's Advanced Camera for Surveys, but can be detected with infrared detectors on the world's largest telescopes.

Using this technique, the research team has searched for infant galaxies behind 14 lensing clusters. If longer spectroscopic observations of the three brightest candidate galaxies confirm that they are indeed in the early universe, these galaxies will provide astronomers their clearest view yet of the youngest galaxies ever seen.

(*Source:* Science Daily online)

60-year-old Plutonium questions resolved

Scientists have claimed to solve a

question about the nature of plutonium that has remained a mystery ever since the first nuclear device was detonated. It is known that plutonium behaves like no other element in nature. The bonding of its electrons causes its crystal structure to be uneven, similar to a mineral, and the nucleus is unstable, causing the metal to spontaneously decay over time and damage the surrounding metal lattice. First batches of the plutonium metal used in that device were too brittle due to the mineral-like structure of its crystal. In order to make the metal machinable, the high-temperature, high-symmetry cubic structure of plutonium needed to be retained at room temperature. In the first nuclear device scientists achieved this by adding a small amount of gallium.

According to Kevin Moore, a staff scientist in the Materials Science and Technology Division at Lawrence Livermore National Laboratory, U.S.A. there was never a clear explanation as to why gallium stabilised the ductile cubic structure over the low-symmetry mineral-like structure; they just did it and it worked. For the first time, researchers have determined why gallium works. In pure plutonium, the bonds between Pu atoms are very uneven, causing the metals high propensity to adopt a low-symmetry structure. However, when a gallium atom is put in the plutonium lattice, it causes the bonds to become more uniform and thus leads to the high-symmetry cubic structure. Gallium evens out the plutonium bonds, asserts Moore. The calculations strongly illuminate why gallium stabilises the machinable cubic structure to room temperature. Through a series of calculations, Moore and his Livermore colleagues, Per Söderlind and Adam Schwartz, and David Laughlin of Carnegie Mellon University have produced these results. The team next proposes to test their calculations in the laboratory.

New heart tissue grown in rats

Australian doctors have successfully grown new beating heart tissue in rats in a process that they claim could be used for people someday. The researchers say the heart tissue developed by them beats spontaneously with its own rhythm and could be used to repair heart attack damage and other life-threatening ailments. They say it is the first step to creating organs to replace diseased and injured body parts.

According to Dr. Wayne Morrison, who led a team of scientists from the Bernard O'Brien Institute of Microsurgery this is a major breakthrough for Australian medical science. Though it may still be too early to put it in practice, but nevertheless it opens up the possibilities of growing living tissue: taking the patient's cells and growing inside their own body living tissue that can be used to repair their own organs. The ground-breaking tissue-engineering technique uses a subject's own heart cells to grow new tissue in a special chamber implanted in the subject's own body, which eliminates the risk of tissue rejection.

(*Source:* Science Daily)

Magnetic thrust: fields force matter into black holes

New observations confirm that magnetic fields provide a final galactic push needed to plunge cosmic matter into a black hole. The observations come from a system in the Milky Way called GRO J1655-40, which consists of a black hole and a normal star. Gas from the star is pulled toward the black hole, where it forms what's called an accretion disk. Angular momentum keeps the disc revolving around the black hole instead of falling into it. Until now, scientists weren't sure whether magnetic fields, radiation pressure, or heat alter the orbit and trigger that fall.

Unless something knocked them off course, the gases in the disk would continue to circle the black hole forever. "To get matter in toward the black hole, we have to change the orbits in the disk," says study leader Jon Miller

Using NASA's Chandra satellite observatory, Miller of the University of Michigan in Ann Arbor, U.S.A. and his team collected data on X- rays emitted from the J1655 system. They found that the X- rays came from a wind blowing from the disk, so some force must propel the wind past the black hole's gravitational pull. After simulating the wind on a computer, the researchers conclude that only magnetic fields could create such a force. The team had ruled out a wind fuelled by heat from the core of the disc or by pressure from radiation blasting out of the disk. A heat-driven wind would have been hotter than the one that the researchers observed, and radiation pressure is too weak to drive that wind. Therefore, magnetic pressure really was the only viable means remaining, according to Miller.

Such pressure could upset the gas disc's orbit in two ways. The magnetic fields could push the wind outward like a spring, or the force of the spinning disk could fling the wind away from the disk's centre. Either disruption of the disc's orbit would cause some matter to spiral downward. Though most astrophysicists expected magnetic fields to play a role in black holes, the finding of the researchers is an important evidence to support that view because it is for the first time there is a clear evidence for wind coming off an accretion disc. According to Miller their finding could help astrophysicists understand the "complex give-and-take between galaxies and black holes.

(*Source:* Science News Online)

New finding about E Coli could help contain infections

Researchers at UT Southwestern Medical Center, USA have discovered a new receptor in a strain of Escherichia coli (E coli) that can be blocked to avert infection. The finding might help in developing better therapies to treat bacterial infections resulting from food poisoning, diarrhea or plague. The receptor, known as QseC, is used by a diarrhea-causing strain of E coli to receive signals from human flora and hormones in the intestine and express virulence genes to initiate infection.

In a study researchers have described how they used phentolamine, an alpha blocker drug used to treat

hypertension, to successfully impede signalling to the receptor. Without such signals, bacteria then pass blindly through the digestive tract without infecting cells. According to Dr. Vanessa Sperandio, Assistant Professor of Microbiology at UT Southwestern, U.S.A. and a member of the research team this receptor is found in many pathogens, so they could use this knowledge to design specific antagonists to block bacterial infections.

Prior research by Dr. Sperandio found that when a person ingests the more virulent enterohemorrhagic E coli, or EHEC — which is usually transmitted through contaminated food such as raw meat — it travels peacefully through the digestive tract until reaching the intestine. There, however, chemicals produced by the friendly gastrointestinal microbial flora and the human hormones epinephrine and nor-epinephrine alert the bacteria to its location. This cellular cross talk triggers a cascade of genetic activations prompting EHEC to colonize and translocate toxins into cells, altering the makeup of the cells and robbing the body of nutrients. An infected person may develop bloody diarrhoea or even haemolytic uremic syndrome, which can cause death in immune-weakened people, the elderly and young children.

The new study identifies QseC as the specific receptor by which EHEC senses the signals. When the receptor binds to signalling molecules, the bacterium can infect cells. Researchers tested the capacity of adrenergic antagonists, drugs such as alpha and beta blockers, to disrupt the receptor's sensing ability. They found that phentolamine binds to the QseC receptor and occupies the pocket that the receptor would use to recognise the host epinephrine and nor-epinephrine signals — thus blocking the QseC receptor from sensing the signals and preventing it from being able to express its virulence genes in cells. Dr. Sperandio opined that this knowledge could lead to further understanding of the signalling processes between microbes and humans and to the development of novel treatments of bacterial infections with antagonists to these signals.

New therapies are important because treating some bacterial infections with conventional antibiotics can cause the release of more toxins and may worsen disease outcome. The importance of the research findings can be magnified manifold because of the QseC receptor's existence in other types of bacteria. These include Shigella, which causes dysentery; Salmonella, which causes food poisoning and gastroenteritis; and Yersinia, which causes bubonic plague. All of them are infectious diseases that afflict thousands of people each year worldwide. Researchers are of the opinion that overuse of antibiotics has led bacteria to develop resistance to antibiotics, so a novel type of therapy is needed.

(*Source:* Sciencedaily)

NASA Satellite positioning software may aid in Tsunami warnings

University scientists using Global Positioning System (GPS) software developed by NASA's Jet Propulsion Laboratory, Pasadena, Calif., have

shown that GPS can determine, within minutes, whether an earthquake is big enough to generate an ocean-wide tsunami. This NASA-funded technology can be used to provide faster tsunami warnings.

A team led by Dr. Geoffrey Blewitt of the Nevada Bureau of Mines and Geology and Seismological Laboratory, University of Nevada, Reno, demonstrated that a large quake's true size can be determined within 15 minutes using GPS data. This is much faster than is possible with methods employed at present. Tsunami warning is a race against time asserts Dr. Seth Stein, Department of Geological Sciences, Northwestern University, and a member of the researcher team. Tsunamis travel at jet speed, so warning centres must accurately decide, within minutes, whether to issue alerts. This has to be done fast enough for the warning to be distributed to authorities in impacted areas so they can implement response plans. Together with seismometer and ocean buoy data, GPS adds another tool that can improve future tsunami danger assessments. However, the first level of alert for large earthquakes would always need seismology and ocean buoys to actually sense the tsunami waves. The advantage of including GPS in warning systems is that it would facilitate to quickly assess how much the ocean floor has moved, so that this information can directly set tsunami models into motion.

The new method, called GPS displacement, works by measuring the time radio signals from GPS satellites arrive at ground stations located within a few thousand kilometres of a quake. From these data, scientists can calculate how far the stations moved because of the quake. They can then derive an earthquake model and the quake's true size, called its 'moment magnitude.' This magnitude is directly related to a quake's potential for generating tsunamis.

As illustrated by the magnitude 9.2-9.3 Sumatra quake of December 2004, current scientific methods have difficulty in quickly determining moment magnitude for very large quakes. That quake was first estimated at 8.0 using seismological techniques designed for rapid analysis. Because these techniques derive estimates from the first seismic waves they record, they tend to underestimate quakes larger than about 8.5. That is the approximate size needed to generate major ocean-wide tsunamis. The initial estimate was the primary reason warning centres in the Pacific significantly underestimated the earthquake's tsunami potential.

The potential of GPS to contribute to tsunami warning became apparent after the Sumatra earthquake. GPS measurements showed that quake moved the ground permanently more than 1 centimetre as far away as India, about 2,000 kilometres away from the epicentre. The researchers hypothesised that if GPS data could be analysed rapidly and accurately, it could be possible to quickly indicate the earthquake's true size and tsunami potential.

To test the feasibility of their approach, the scientists used NASA's satellite positioning data processing

software to analyse data from 38 GPS stations located at varying distances from the Sumatra quake's epicentre. The software pinpoints a station's precise location to within 7 millimetres. Only data that were available within 15 minutes of the earthquake were used. Results indicated most of the permanent ground displacements occurred within a few minutes of the arrival of the first seismic waves. The analysis done by researchers inferred an earthquake model and a moment magnitude of 9.0, very near the earthquake's final calculated size.

(*Source:* NASA News)

Good news and a puzzle

Ozone layer on the upper strata of the Earth's atmosphere plays a vital role in protecting life on the surface from the harmful glare of the sun's strongest ultraviolet rays, which can cause skin cancer and other maladies. In the 1980s, when scientists noticed that manmade chemicals in the atmosphere were destroying this layer, it is not surprising that people all over the world were alarmed. Governments quickly enacted an international treaty, called the Montreal Protocol, to ban ozone-destroying gases such as CFCs then found in aerosol cans and air conditioners.

Today, almost 20 years later, reports continue of large ozone holes opening over Antarctica, allowing dangerous UV rays through to Earth's surface. Indeed, the 2005 ozone hole was one of the biggest ever, spanning 24 million sq km in area, nearly the size of North America. Listening to this news, one might be tempted to think that little progress has been made. However, this assertion may not be correct. While the ozone hole over Antarctica continues to open wide, the ozone layer around the rest of the planet seems to be shrinking. For the last 9 years, worldwide ozone has remained roughly constant, halting the decline first noticed in the 1980s.

The question is *why?* Is the Montreal Protocol responsible? Or is some other process at work? It's a complicated question. CFCs are not the only things that can influence the ozone layer; sunspots, volcanoes and weather also play a role. Ultraviolet rays from sunspots boost the ozone layer, while sulphurous gases emitted by some volcanoes can weaken it. Cold air in the stratosphere can either weaken or boost the ozone layer, depending on altitude and latitude. These processes and others have been presented in a review by a group of researchers from NASA and some universities in U.S.A. According to researchers, they measured ozone concentrations at different altitudes using satellites, balloons and instruments on the ground. Then they compared their measurements with computer predictions of ozone recovery. The calculations also took into account the known behaviour of the sunspot cycle, seasonal changes in the ozone layer, and Quasi-Biennial Oscillations, a type of stratospheric wind pattern known to affect ozone.

What researchers have found is both good news and also a puzzle. The good news: In the upper stratosphere (above roughly 18 km), ozone recovery can be explained almost entirely by CFC

reductions. The Montreal Protocol seems to be working at such heights, according to researchers. The puzzle: In the lower stratosphere (between 10 and 18 km) ozone has recovered *even better* than changes in CFCs alone would predict. Something else must be affecting the trend at these lower altitudes. The "something else" could be atmospheric wind patterns. This is because the winds are known to carry ozone from the equator to higher latitudes where it is destroyed. Changing wind patterns affect the balance of ozone and could be boosting the recovery below 18 km. This explanation seems to offer the best fit to the computer model of the researchers. However, other sources of natural or manmade variability may yet prove to be the cause of the lower-stratosphere's bonus ozone. Whatever be the real cause, if the trend continues, the global ozone layer should be restored to 1980 levels sometimes between 2030 and 2070. By then even the Antarctic ozone hole might close — for good.

(*Source:* NASA News)

Corkscrew Asteroid

Believe it or not the Earth has a "second moon" for early seven years. It is actually an Asteroid, only 20 metre in size, which has been going around our planet once a year. The asteroid is too small to see with the unaided eye — but it is there.

According to Paul Chodas of NASA's Near Earth Object Program at JPL, the Asteroid arrived in 1999 and it's been corkscrewing around Earth ever since. Because the asteroid is so small and poses no threat, it has attracted little public attention. But Chodas and other experts have been monitoring it, which according to him is a very curious object.

Most near-Earth asteroids, when they approach Earth, simply fly by. They come and they go, occasionally making news around the date of closest approach. This Asteroid since named 2003 YN107 is different: It came and it stayed. Astronomers believe that 2003 YN107 is one of a whole population of near-Earth asteroids that don't just fly by Earth. They pause and corkscrew in our vicinity for years before moving along. These asteroids are called Earth Co-orbital Asteroids or "co-orbitals" for short. Essentially, they share Earth's orbit, going around the Sun in almost exactly one year. Occasionally a co-orbital catches up to Earth from behind, or vice versa, and the dance begins: The asteroid, while still orbiting the sun, slowly corkscrews around our planet, which in other words means that their orbit as seen from the earth appears like a corkscrew.

These asteroids, however, are not truly captured by Earth's gravity, notes Chodas. But from our point of view, it looks like we have a new moon. Astronomers know of at least four small asteroids that can do this trick: 2003 YN107, 2002 AA29, 2004 GU9 and 2001 GO2. There may be more as Chodas believes the list will grow as asteroid surveys improve in sky coverage and sensitivity. At the moment, only two co-orbitals are actually nearby: 2003 YN107 and 2004 GU9. The others are scattered around Earth's orbit.

2004 GU9 is perhaps the most interesting. It is about 200 metre in size,

which is relatively large compared to other such asteroids. And according to latest calculations it has been looping around Earth for 500 years—and may continue looping for another 500. It's in a remarkably stable "orbit."

Right now, however, researchers are paying more attention to 2003 YN107 for one simple reason: it's about to leave the earth's orbit. The asteroid's corkscrew path is likely to come within 3.4 million km of Earth sometime in June 2006, when it will be slightly closer than usual. Earth's gravity will then give the asteroid the push it needs to leave. This would give astronomers a rare chance to observe the asteroids moving out of the earth's orbit. However, it won't be gone forever. In about 60 years 2003 YN107 will lap Earth again, resuming its role as a temporary, corkscrewing moonlet. In due course, other coorbitals will do the same.

Each encounter is an opportunity for study—and possibly profit. Even the most powerful telescopes cannot see much of these tiny asteroids; they're just specks in the eyepiece. However, Chodas is optimistic that one day, when the space program is more advanced it might be possible to visit, explore the moonlets and tap their resources and then they would not be just an object of curiosity as they are today.

(*Source:* NASA NEWS on line)
(Compiled and edited by: R. Joshi)