

NEWS ITEM

Researchers from IIT (BHU) found a breakthrough in detoxifying toluene

Using bacteria isolated from soil and effluents near an oil refinery, researchers from the University of Delhi and Indian Institute of Technology (BHU), Varanasi, have successfully degraded toluene into less-toxic by products. Toluene is one of the petrochemical wastes that get released without treatment from industries such as refineries, paint, textile, paper and rubber. Toluene has been reported to cause serious health problems to aquatic life, and studies point that it has genotoxic and carcinogenic effects on human beings. To the soil and effluent samples containing some bacteria 100 mg/L of toluene was added and incubated for four weeks. The bacteria were isolated from the samples, identified and studied for their toluene-degrading abilities. They isolated eight to 10 strains of bacteria and found that a particular bacteria *Acinetobacter junii* showed good degrading potential - about 80% of toluene (50 ppm) in a liquid medium was degraded within 72 hours. A consortium of *A. junii* bacteria was found to be more effective than using a single strain. Different bacterial strains have different characteristic potential to degrade intermediate by-products formed during the degradation process and, hence, increase the efficiency, says Pardeep Singh. Another interesting find was that when exposed to toluene, these bacteria changed their morphology to escape toxicity. Electron microscopy studies revealed that the cylindrical cells transformed into an ovoid or spherical structure. The researchers also examined the pathway by which the bacteria were doing the degradation and found it to be general aerobic biodegradation pathway. The researchers also tested the bacterial strain for the degradation of benzene, phenol, and xylene and they showed effective results towards degradation of these compounds - both individual compounds and their mixtures.

Researchers from JNCASR reports restoration of memory in Alzheimer's mice

Using a small molecule that activates two enzymes (CBP/p300 histone acetyltransferases), researchers from India and France have been able to completely recover long-term memory in mice with Alzheimer's disease. Neuron-to-neuron connections that form the network were re-established leading to memory recovery in the diseased mice. The therapeutic molecule used in the study was synthesised by a team led by Tapas Kundu from the Molecular Biology and Genetics Unit at Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru. The small molecule was found to activate the two enzymes, and the two enzymes by virtue of being the master regulators activate several genes that are important for memory. In a June 2013 paper in the *Journal of Neuroscience*, Prof. Kundu's team had demonstrated the small molecule's ability to generate new neurons and induce long-term memory in normal mice. If it is able to induce memory in normal mice, we wondered if it can induce and recover lost memory in mice with Alzheimer's, recalls Prof. Kundu. We found the molecule activating the two enzymes in the diseased mice and producing new neurons. Also, 81 genes whose expression was repressed in mice with Alzheimer's were activated to normal levels. Besides completely recovering lost memory, other symptoms of Alzheimer's such as balance problem was also addressed. The amyloid plaques and neurofibrillary tangles contribute to the degradation of the neurons leading to memory loss in Alzheimer's. The plaques and tangles absorb these two enzymes. So once the enzymes are activated by the small molecule, the whole process of neurodegeneration gets reversed, he says.

Shells of Sea Snails are dissolving due to Climate change

Researchers from the University of Plymouth in the UK and the University of Tsukuba,

Japan assessed the impact of rising carbon dioxide levels on the large predatory “triton shell” gastropod. They found those living in regions with predicted future levels of CO₂ were on average around a third smaller than counterparts living in conditions seen throughout the world’s oceans today. However there was also a noticeable negative impact on the thickness, density, and structure of their shells, causing visible deterioration to the shell surface, researchers said. The study, published in the journal *Frontiers in Marine Science*, found that the effects are down to the increased stresses placed on the species in waters where the pH is lower, which reduce their ability to control the calcification process. The researchers have warned other shellfish are likely to be impacted in the same way, threatening their survival and that of other species that rely on them for food. Using computed tomography (CT) scanning, the scientists measured the thickness, density and structure of the shells, with shell thickness halved in areas with raised CO₂ while average shell length was reduced from 178mm in sites with present day levels to 112mm. In some cases, these negative effects left body tissue exposed and the shell casing dissolved, with the corrosive effects of acidification far more pronounced around the oldest parts of the shell.

Researchers from IIT Guwahati invents superior scaffold which aids in cartilage repair

Implanting cartilage alone or injecting cells found in healthy cartilage (chondrocytes) at the site of injury to heal the damaged cartilage in patients with osteoarthritis does not produce favourable results. Similarly, implanting two different scaffolds joined together to simultaneously regenerate the cartilage and reconstruct the bone too has many limitations. The problem arises because the interface between the cartilage and bone scaffolds, which are made of different materials, is not connected but has a distinct boundary. As a result, the interface tends to delaminate and degrade. Now, researchers from Indian Institute of Technology (IIT) Guwahati have addressed this shortcoming by fabricating a silk scaffold where the junction between the cartilage

and bone scaffold is continuous and seamless and hence less prone to damage under load-bearing environment of the joint. A team led by Biman B. Mandal from the Department of Biosciences and Bioengineering has fabricated the biphasic scaffold where the top portion is highly porous and spongy thus mimicking the cartilage, while the bottom portion is reinforced with silk fibre thus imparting more stiffness and less porous to mimic the bone. Since the entire scaffold is made of silk, the interface merges with one another and is seamless despite having different porosities and stiffness. The results of the study were published in the *Journal of Materials Chemistry B*. The researchers made scaffolds using both wild silkworm (*Antheraea assamensis*) and mulberry silk (*Bombyx mori*) and found scaffolds made of non-mulberry silk were superior to the one made of mulberry silk in all respects. To make the biphasic scaffold we prepared silk solution by completely dissolving the silk. We then added chopped silk fibres to the solution so the bottom half portion of the scaffold becomes fibre-reinforced silk composite while the rest of the top portion had only the silk solution, says Prof. Mandal.

Scientists from IISc finds novel ways to dismantle Tuberculosis bacteria

Oxidative stress can directly damage the DNA, proteins and lipids of most of the bacteria and eventually kill them. However, disease-causing bacteria have evolved mechanisms to survive such stressful conditions. One of the ways bacteria overcome oxidative stress is by condensing or compacting the DNA (nucleoid). Compacted DNA has reduced surface area and hence lower vulnerability to oxidative stress. The role of several nucleoid-associated proteins produced by bacteria in condensing the DNA is also well known. But for the first time a protein (WhiB4) that condenses the DNA of TB-causing bacteria in response to oxidative stress has been found by a multi-institutional team led by Prof. Amit Singh from Indian Institute of Science (IISc), Bengaluru. Though the role of proteins in condensing DNA and the connection between DNA

compaction and bacteria's ability to survive oxidative stress are already known, this is the first time the role of a protein to condense DNA upon directly sensing oxidative stress in any bacteria has been reported, says Prof. Singh. The results were published in the journal *Redox Biology*. While DNA compaction helps the bacteria survive stressful conditions, the compaction has to be only for a brief period and should be reversible. Prolonged compaction could adversely impact bacterial multiplication, conversion of DNA into RNA, and formation of protein molecules. The active form of WhiB4 protein is produced in the presence of oxidative stress leading to compaction of TB bacterial DNA. The protein level reduces after a while and thus preventing long-lasting condensation, and also allows the compacted DNA to revert to its original state.

Researchers reports micro spheres which traps water pollutants

Scientists have created tiny spheres that can catch and destroy bisphenol A (BPA), a synthetic chemical used to make plastics that often contaminates water. BPA is commonly used to coat the insides of food cans, bottle tops and water supply lines, and was once a component of baby bottles. While BPA that seeps into food and drink is considered safe in low doses, prolonged exposure is suspected of affecting the health of children and contributing to high blood pressure. Scientists at Rice University in the U.S. have developed something akin to the Venus' flytrap of particles for water remediation. The supple petals provide plenty of surface area for researchers to anchor cyclodextrin — a benign sugar-based molecule often used in food and drugs. It has a two-faced structure, with a hydrophobic (water-avoiding) cavity and a hydrophilic (water-attracting) outer surface. BPA is hydrophobic and naturally attracted to the cavity. Once trapped, reactive oxygen species (ROS) produced by the spheres degrades BPA into harmless chemicals. The size of the particles is less than 100 nanometers. Because of their very small size, they're very difficult to recover from suspension in water, said Mr. Zhang, lead author

of the study published in the journal *Environmental Science & Technology*.

Study reported that human eyes have innate mode for night vision

Our eyes have in-built night vision mode, say scientists who found that to see under starlight and moonlight, the retina changes both the software and hardware of its light-sensing cells. Retinal circuits that were thought to be unchanging and programmed for specific tasks are adaptable to different light conditions. However, scientists have now identified how the retina reprograms itself for low light. To see under starlight, biology has had to reach the limit of seeing an elementary particle from the universe, a single photon, said Greg Field, an assistant professor at Duke University in the US. The findings, published in the journal *Neuron*, show that the reprogramming happens in retinal cells that are sensitive to motion. Even in the best lighting, identifying the presence and direction of a moving object is key to survival for most animals. In humans, these directional neurons account for about 4% of the cells that send signals from the retina to the brain. In a study with mouse retinas conducted under a microscope equipped with night vision eye pieces in a very dark room, researchers found that the retinal cells sensitive to upward movement change their behaviour in low light. The 'up' neurons will fire upon detecting any kind of movement, not just upward. When there is much less light available, a weak signal of motion from the 'up' neurons, coupled with a weak signal from any of the other directional cells can help the brain sense movement. The loss of motion perception is a common complaint in human patients with severe vision loss. Field said this finding about the adaptability of retinal neurons may help the design of implantable retinal prosthetics in the future.

Pathway for Klebsiella's colistin resistance unearthed

A study carried out in Chennai has found bacteria resistant to colistin drug, a last-line antibiotic, in 51 of the 110 (46%) fresh food

samples (poultry, mutton, fish, and vegetables) tested. Though colistin-resistant bacteria have been found in food samples in more than 30 countries, this is the first time researchers in India have looked for and found them in fresh food. More importantly, the researchers, led by Dr. Abdul Ghafur of Apollo Cancer Institute, Chennai, have for the first time uncovered the mechanism by which *Klebsiella pneumoniae* bacteria in food samples develop resistance to colistin. While *mcr-1* gene in *E. coli* confers resistance to colistin drug, mutations and insertional inactivation in *mgrB* gene are responsible for colistin resistance in *Klebsiella*. In the case of insertional inactivation, an external genetic element (called insertion sequence) gets inserted into a normal *mgrB* gene leading to its inactivation. Once the *mgrB* gene gets inactivated, the *Klebsiella* bacteria become resistant to colistin antibiotic. In clinical settings, the *mcr-1* gene is less significant than the *mgrB* gene mutations for colistin resistance. This is because most of colistin resistance seen in clinical settings comes from *Klebsiella* bacteria and not *E. coli*, says Dr. Ghafur. The results of the study were published in the *Journal of Global Antimicrobial Resistance*. The researchers first identified colistin-resistant *Klebsiella* in the food samples. Then they looked and found *mgrB* gene mutation in *Klebsiella*. We identified 30 samples with colistin-resistant *Klebsiella*. Of the 30 samples, six had insertion sequences. This is the first time that *mgrB* gene mutation and the presence of insertion sequence have been identified in food *Klebsiella*, he says. This finding has remarkable public health significance as colistin resistance in *Klebsiella* can spread to humans.

Researchers reports DNA aptamer prohibiting Tuberculosis bacteria' entry into cells

By using a small single-stranded DNA molecule (DNA aptamer) that specifically binds to a single protein (HupB) present in TB bacteria, researchers have been able to achieve 40-55% reduction in the bacteria's ability to enter into human cells and infect them. Besides facilitating entry into host cells, HupB also helps the TB

bacteria survive various stresses encountered inside host cells. The HupB protein was discovered in late 1990s by Prof. H. Krishna Prasad, formerly with AIIMS, while looking at specific TB bacterial antigens that induced immune response in humans. He found the protein was associated with the DNA of the bacteria (*Tubercle and Lung Disease journal*). Since it is associated with the DNA, we didn't expect it to be found on the surface of the bacteria. But to our surprise, it was seen on the surface of the TB bacteria too," recalls Prof. Prasad. Further studies showed that the HupB protein was able to interact and bind to proteins found on the surface of host cells, which will facilitate the entry into host cells. HupB is an essential protein of TB bacteria and so an attractive drug target, says Prof. Jaya Sivaswami Tyagi from the Department of Biotechnology at AIIMS and one of the corresponding authors of a paper published a few days ago in the *Journal Molecular Therapy - Nucleic Acid*. From a collection of two types of DNA libraries, the researchers selected 23 aptamers. Of the 23, only two aptamers (4T and 13T) were chosen based on high binding affinity and specificity to the HupB protein. Both the aptamers remained stable when exposed to serum, an essential requirement for an inhibitor. The aptamers were found to bind at different positions of the protein.

Researchers from IIT – B worked out Biomarkers for lung cancer detection, air pollutants and explosives

Researchers at the Indian Institute of Technology (IIT) Bombay have set the stage to possibly sniff out in about a minute early-stage lung cancer from exhaled breath. A two-member team led by Chandramouli Subramaniam from the institute's Department of Chemistry has developed a platform that detects volatile organic compounds such as benzene, acetone, benzaldehyde and ethanol in a gas phase at single molecular levels. These organic compounds in exhaled breath are clinically established biomarkers for early stage lung cancer. The same platform can also be used to monitor air-pollution levels or detect explosives like TNT (trinitrotoluene). The volatile compounds

have been detected using lab samples and clinical applications for detecting early-stage lung cancer will become possible once validated on human subjects. The results were published in the journal ACS Sustainable Chemistry and Engineering. Since Raman scattering is an inherently weak phenomenon, the researchers turned to surface-enhanced Raman scattering to dramatically increase the sensitivity of the platform such that it detects molecules at extremely low concentrations using a small amount of sample. We put the molecule of interest on a gold or silver nanoparticle and then record the Raman spectrum. When we shine light [laser] on the sample [molecule plus the nanoparticle], the Raman spectrum of the molecule gets enhanced, says Prof. Subramaniam. The intensity enhancement of Raman spectrum happens predominantly through the interaction of localised electromagnetic field on the nanoparticles surface with the vibrational modes of the molecule.

Can the human's retina be regenerated just like the zebra fish does, IISER Mohali researchers founds new pathway?

In stark contrast to mammals, the zebrafish has the ability to completely regenerate its retina and restore vision after an injury. Researchers from Indian Institute of Science Education and Research (IISER) Mohali, have decoded the signals and genes behind this tremendous feat and hope to uncover valuable clues as to why we humans fail at such regeneration. A particular signalling system — sonic hedgehog (Shh) — in zebrafish has been previously reported to aid in developmental and tissue regeneration activities. To decipher the influence of Shh signalling on retina regeneration, the researchers first inhibited its function. They found that impairing this signal made 90% of the zebrafish embryo exhibit a birth defect called cyclopia. Cyclopia is also seen in humans, where there is a single median eye or a partially divided eye. Detailed understanding of this signalling may provide insights into the rare defect. Since this signalling is also responsible for retina regeneration in zebrafish, the researchers are trying to understand why the signalling does

not bring about retina regeneration in humans. They performed whole retina RNA sequencing at various time points post-retinal injury to the zebrafish eye. Several genes (zic2b, foxn4, mmp9) were found to be upregulated through Shh signalling. Zic2b and foxn4 are essential components for development and tissue regeneration, whereas mmp9 is an enzyme which makes the environment congenial for freshly formed cells. Individual knockdowns of these genes also revealed that these are indeed essential for normal retina regeneration. They further carried out studies on mice models by injecting the protein.

SCIENTIFIC NEWS

Mission embarked to sequence Indian genomes announced

A group of Indian scientists and companies are involved with a 100k GenomeAsia project, led out of the Nanyang Technological University (NTU), Singapore, to sequence the whole genomes of 100k Asians, including 50,000 Indians. India is planning a major mission to sequence the genes of a "large" group of Indians — akin to projects in the United Kingdom, China, Japan and Australia — and use this to improve health as well as buck a global trend of designing 'personalised medicine.' This was among the key decisions taken at the 1st Prime Minister's Science, Technology and Innovation Advisory Council (STIAC) in its first meeting on Tuesday. The Ministry of Health and Family Welfare and the Department of Biotechnology would be closely associated with the project. Ever since the Council of Scientific and Industrial Research in 2009 announced that it had sequenced the genome of an Indian, then making India one of six countries to achieve such a feat.

Study suggests declining rate of wetlands exceeds thrice that of forests

Wetlands, among the world's most valuable and biodiverse ecosystems, are disappearing at an alarming speed amid urbanisation and agriculture shifts. We are in a crisis, Martha Rojas Urrego, head of the Ramsar Convention on Wetlands, told reporters in Geneva, warning of the potential devastating impact of

wetland loss, including on climate change. The convention, adopted in the Iranian city of Ramsar nearly a half-century ago, on Thursday issued its first-ever global report on the state of the world's wetlands. The 88-page report found that around 35% of wetlands — which include lakes, rivers, marshes and peatlands, as well as coastal and marine areas like lagoons, mangroves and coral reefs — were lost between 1970 and 2015. Today, wetlands cover more than 12 million square km, the report said, warning that the annual rates of loss had accelerated since 2000. We are losing wetlands three times faster than forests, Mr. Rojas Urrego said, describing the Global Wetland Outlook report as a red flag. While the world has been increasingly focused on global warming and its impact on oceans and forests, the Ramsar Convention said wetlands remain dangerously undervalued. The Ramsar Convention has been ratified by most of the world's nations, including the U.S., China and India, and has designated more than 2,300 sites of international importance.

Japanese and European Spacecraft embarked on Mercury journey

European and Japanese space agencies said an Ariane 5 rocket successfully lifted a spacecraft carrying two probes into orbit on Saturday for a joint mission to Mercury, the closest planet to the sun. The European Space Agency and the Japan Aerospace Exploration Agency said the unmanned BepiColombo spacecraft successfully separated and was sent into orbit from French Guiana as planned to begin a seven-year journey to Mercury. They said the spacecraft, named after Italian scientist Giuseppe "Bepi" Colombo, was in the right orbit and has sent the first signal after the liftoff. ESA says the 1.3 billion-euro (USD 1.5 billion) mission is one of the most challenging in its history. Mercury's extreme temperatures, the intense gravity pull of the sun and blistering solar radiation make for hellish conditions.

OBITUARY

Shimomura, Nobel laureate in Chemistry passed away : Japanese-born Marine biologist Osamu Shimomura, who won the Nobel Prize in

chemistry, has died. He was 90. He shared the 2008 Nobel prize for the discovery and development of a jellyfish protein that later contributed to cancer studies, Shimomura and two American scientists shared the 2008 Nobel prize for the discovery and development of a jellyfish protein that later contributed to cancer studies. His alma mater Nagasaki University said on Oct. 22, that Shimomura died on October 19 of natural causes.

NOBEL PRIZE AWARDS 2018

Nobel Prize in Physiology or Medicine

The 2018 Nobel Prize in Physiology or Medicine has been jointly awarded to James P. Allison and Tasuku Honjo, by the Nobel committee of the Karolinska Institute. The two immunologists — from the U.S. and Japan, respectively — were awarded the Prize for their discovery of cancer therapy by inhibition of negative immune regulation.

Nobel Prize in Chemistry

The Royal Swedish Academy of Sciences has awarded the Nobel Prize in Chemistry 2018 with one half to Frances H. Arnold for the directed evolution of enzymes and the other half jointly to George P. Smith and Sir Gregory P. Winter for the phage display of peptides and antibodies.

Nobel Prize in Physics

American scientist Arthur Ashkin, French engineer Gérard Mourou and Canadian professor Donna Strickland have been awarded the Nobel Prize in Physics for their work in the field of laser physics. Dr. Ashkin has been awarded the Prize for the optical tweezers and their application to biological systems, and Dr. Mourou and Dr. Strickland have been awarded for their method of generating high-intensity, ultra-short optical pulses stated the Royal Swedish Academy of Sciences.

Post-Doctoral Research Fellows

1. Indian Govt. Fellowships - Fellowship of Ministry of Science & Technology (DST/ DBT / CSIR(DSIR)/SERB): Different Indian Govt. Fellowships are available for different streams of

science and engineering like life sciences, chemical sciences, physical sciences and others, please refer <http://dst.gov.in/fellowship-opportunities-researchers>

2. Institute of Nano Science and Technology, Mohali: The applicants should Either hold a Ph.D. degree in Science/Engineering or should have submitted the PhD thesis in Science/ Engineering. Proven research competence in any of the above related areas. Please refer <http://www.inst.ac.in/careers.php>

3. Indian Institute of Technology (IIT Delhi) PDF : IIT Delhi invites applications from qualified Indian Nationals, Persons of Indian Origin (PIOs) and Overseas Citizens of India (OCIs) for the Post

Doctoral Fellows (PDF) in the various Departments/Centres/Schools (in the fields mentioned alongwith them). Please refer <https://recruit.iitd.ac.in>

4. IISER Pune Postdoctoral Research Associate : Applications are invited for Postdoctoral Research Associate (PRAs) positions at the Indian Institute of Science Education and Research (IISER) Pune, India. These positions are open for candidates with 0-5 years of experience after the submission of their PhD thesis. Candidates should provide evidence of having carried out high quality research. Appointments will be made for two years at a time with a maximum tenure of three years. Please refer <http://www.iiserpune.ac.in/opportunities/postdoctoral-research>

