

## NEWS ITEM

### SCIENTIFIC NEWS

#### Potent Antagonistic Molecules to TB bacteria

Indian Institute of Science (IISc) Scientists have developed two new potent molecules that can severely impact the survival of mycobacteria, including *Mycobacterium tuberculosis* that causes TB. Unlike most antibiotics that target the bacterial metabolism by aiming at the cellular components, the novel molecules inhibit the stress response pathway of mycobacteria. The master regulator of stress pathway in case of mycobacteria is (p)ppGpp (Guanosine pentaphosphate or Guanosine tetraphosphate). Though a molecule that inhibits the (p)ppGpp formation has already been synthesised, the efficacy is not much. Very high concentration of Relacin molecule is needed to inhibit the pathway and, therefore, the efficacy is low. So we synthesised two new molecules — acetylated compound (AC compound) and acetylated benzoylated compound (AB compound) — by bringing about a modification in the base of the Relacin molecule, says Prof. Dipankar Chatterji. We found our compounds were targeting the Rel gene. The Rel gene makes Rel protein, which in turn synthesises (p)ppGpp. When the Rel gene is knocked out, the long-term survival of *Mycobacterium smegmatis* decreases and the molecules were able to inhibit biofilm formation by *M. tuberculosis* and *M. smegmatis* and also disrupt the biofilm already formed.

#### Zika virus vaccine

The Hyderabad-based Bharat Biotech developed Zika virus vaccine developed using African strain (MR 766) has shown 100% efficacy against mortality and disease in animal studies. Two doses (5 and 10 microgram) of the vaccine given through intramuscular route on days 0 and 21 to mice were found to protect the animals against Zika virus seven days after the second vaccination. The vaccine was found to confer 100% protection against infection caused by an Asian Zika virus strain as well as by the African Zika virus strain. All the animals that were not vaccinated died eight days after infection by the African strain of the virus and 12 days after infection by the Asian strain. All the mice that did not receive the vaccine, showed progressive morbidity before succumbing to infection. While all the animals that received the vaccine exhibited “undetectable” viral load, the amount of virus present in animals that did

not receive the vaccine peaked four days after being infected with either the African or Asian Zika virus strain. The vaccine was developed using the African strain of the virus. It is important to prove that the vaccine developed with the African strain also protects against Zika infection caused by the contemporary Asian strains of Zika virus. Importing the contemporary Asian strains into the country was difficult, and hence the vaccine challenge studies with Asian strain had to be outsourced to a CRO in U.S. according to official of Bharath Biotech. A particular kind of mouse, AG129-which is highly immunocompromised and hence highly susceptible to virus infection was used for studying the protection conferred by the vaccine against Zika virus, disease pathogenesis and mortality. All the AG129 animals received the vaccine showed 100% protection against the virus, demonstrating the superior efficacy of the vaccine.

#### Relief to Dialysis patients

Scientists from University of California at San Francisco, USA, have developed first bionic kidney, which can replace damaged kidneys easily and effectively. The bionic kidney is a perfect replica of our kidneys. It consists of numerous microchips and is moved by the heart. Like the normal kidneys, it is able to filter waste and toxins from the bloodstream. The project was unveiled by William Vanderbilt Fissels and Shuvo Roy from the University of California, offering renewed hope for millions of kidney dialysis patients. Bionic kidney is made from renal cells. The first prototype is the size of a coffee cup and can balance the levels of sodium and potassium in the body while regulating blood pressure. The scientists have high hopes for the bionic kidney, that this device will be available for sale in next 2 years.

#### Vitamin-C in killing bacteria

A study by a team of researchers at the Indian Institute of Science, Bengaluru has found the molecular mechanism by which vitamin-C impedes and even kills *Mycobacterium smegmatis*, non-pathogenic bacteria that belongs to the same genus as the TB causing mycobacteria. The effects of vitamin-C on the stress response pathway has been studied and the vitamin-C has been chosen, because its structure is similar to (p)ppGpp. It was hypothesised that the

vitamin-C should be competing to bind to the Rel enzyme and inhibiting (p)ppGpp synthesis. In vitro studies showed, significant inhibition of (p)ppGpp synthesis in the presence of vitamin-C. The inhibition level was seen to be increasing as the vitamin-C concentration increased. More the vitamin-C concentration the greater the possibility of vitamin-C binding to the Rel enzyme, thus inhibiting (p)ppGpp synthesis. At about 10 mM concentration, the synthesis of (p)ppGpp was completely inhibited. Using Mycobacterial cells, it was found that 1 mM of vitamin-C produced 50% inhibition in (p)ppGpp synthesis. Vitamin-C is able to get inside cells and inhibit (p)ppGpp synthesis. Source - Journal FEMS Microbiology Letters

### **Negative Mass**

Scientists from Washington State University (WSU), cooled rubidium atoms to just above the temperature of absolute zero (close to -273oC), creating what's known as a Bose-Einstein condensate. They also synchronise and move together in what's known as a superfluid, which flows without losing energy. To create the conditions for negative mass, the researchers used lasers to trap the rubidium atoms and to kick them back and forth, changing the way they spin. When the atoms were released from the laser trap, they expanded, with some displaying negative mass. With negative mass, if you push something, it accelerates toward you, scientists described. Also described that it looks like the rubidium hits an invisible wall. The technique could be used to better understand the phenomenon, it was clear that it is the exquisite control we have over the nature of this negative mass, without any other complications. This heightened control also gives researchers a tool for exploring the possible relationships between negative mass and phenomena observed in the cosmos, such as neutron stars, black holes and dark energy. Source-Physical Review Letters journal.

### **Smart phone laboratory that can detect cancer**

In a major step towards faster and convenient delivery of medical tests, Washington State University researchers have developed a low-cost, portable laboratory on a smart phone that can analyse several samples at once to catch a cancer biomarker, producing lab quality results. The research team created an eight channel smart phone spectrometer that can detect human interleukin-6 (IL-6), a known

biomarker for lung, prostate, liver, breast and epithelial cancers. A spectrometer analyses, the amount and type of chemicals in a sample by measuring the light spectrum. The spectrometer would be especially useful in clinics and hospitals that have a large number of samples without on-site labs, or for doctors who practice abroad or in remote areas. The multichannel spectrometer can measure up to eight different samples at once using a common test called ELISA that identifies antibodies and colour change as disease markers, according to a study published in the journal Biosensors and Bioelectronics.

### **Early dinosaurs were similar to Crocodiles**

Scientists have unearthed fossils of the earliest known dinosaur relative, a 245-million-years old giant reptile that walked on four legs like a crocodile. The six-foot-long, lizard-like carnivore, called Teleocrater rhadinus, was discovered in Tanzania. The finding fundamentally changes our ideas about the evolution of the prehistoric animals. It is the earliest member of the bird-like side of the family. It is not a direct ancestor of dinosaurs, but it's the oldest known dinosaur cousin, researchers said. We used to think that many of the distinctive features of bird-line archosaurs evolved very quickly after they diverged from the crocodile line because early bird-line archosaurs like Marasuchus, Dromoeon, and Lagerpeton were small and very dinosaur-like.

### **Rampatri proved to be a Potential Source of anti Cancer drug**

BARC scientists have developed two anti-cancer medicines from the fruit extract of the Rampatri plant, which may help destroy tumours and revive cells damaged by radiation. Rampatri plant, which is used as a spice in foods, belongs to the Myristicaceae family and is found in western coastal region of the country. Scientists at Bhabha atomic Research Centre (BARC) based in Anushaktinagar, Mumbai tested the medicines made from this plant on mice and found that they may help in treating lung cancer and neuroblastoma, a rare cancer found in children. In neuroblastoma, cancer cells grow in nerve cells of adrenal glands, neck, chest and spinal chord. The molecules of Rampatri fruit may destroy the cancer cells. Medicines developed from these molecules may also help in reviving cells destroyed due to radiation. Pre clinical trials have been done for both These fellowships are designed for Indian faculty and researchers who are in the early stages of their

again. The test results of the trial in Guinea were released Thursday in *The Lancet*. The vaccine was not ready in time to stop the outbreak, which probably began in a hollow, bat-filled tree in Guinea and swept Liberia and Guinea before being defeated. But the prospect of a vaccine stockpile has brought optimism among public health experts. "While these compelling results come too late for those who lost their lives during West Africa's Ebola epidemic, they show that when the next outbreak hits, we will not be defenseless," said Marie-Paule Kieny, World Health Organization's assistant director-general for health systems and innovation and the study's lead author. "The world can't afford the confusion and human disaster that came with the last epidemic. "It's certainly good news with regard to any new outbreak — and one will occur somewhere," said Anthony S. Fauci, director of the National Institute for Allergy and Infectious Diseases, which makes many vaccines and did some early testing on this one. "But we still need to continue working on Ebola vaccines." The *Lancet* study was done in 11,841 residents of Guinea last year. Among the 5,837 people who got the vaccine, none came down with Ebola 10 or more days later. There were 23 Ebola cases among the thousands of others not immediately vaccinated.

Indian Pepper may serve as a Potential Cancer Drug: The Indian long pepper, widely popular for spicing up food, may soon be used as a potential cancer treatment drug, according to a new study. The Indian long pepper contains a chemical that could stop your body from producing an enzyme that is commonly found in tumours in large numbers, according to the study in *Journal of Biological Chemistry*. UT Southwestern Medical Center scientists have uncovered the chemical process behind anti-cancer properties of a spicy Indian pepper plant called the long pepper, whose suspected medicinal properties date back thousands of years. The secret lies in a chemical called Piperlongumine (PL), which has shown activity against many cancers including prostate, breast, lung, colon, lymphoma, leukaemia, primary brain tumours and gastric cancer. Using X-ray crystallography, researchers were able to create molecular structures that show how the chemical is transformed after being ingested. PL converts to hPL, an active drug that silences a gene called GSTP1. The GSTP1 gene produces a detoxification enzyme that is often overly abundant in tumours, the study said.

Scientists hear voice of ancient humans in baboon calls: The barks, yacks and wa-hoos of the Guinea baboons reveal distinct human-like vowel sounds. Baboon grunts and mating calls may hold secrets about human speech, according to a new study suggesting that the origins of human language could reach back as much as 25 million years. The barks, yacks and wa-hoos of the Guinea baboons reveal distinct human-like vowel sounds, according to the study published on Wednesday in the journal *Plos One* by scientists from six universities in France and Alabama. The authors from the Grenoble Alpes University studied the acoustics of 1,335 baboon sounds and the animals' tongue anatomy. Researchers suggest that the human vocal system developed from abilities already present in ancestors such as the Guinea baboon. The scientists also found similar muscles in baboon tongues as human tongues which are key to our ability to make vowel sounds. "The evidence developed in this study does not support the hypothesis of the recent, sudden, and simultaneous appearance of language and speech in modern *Homo sapiens*," the study says. "It suggests that spoken languages evolved from ancient articulatory skills already present in our last common ancestor ... about 25 million years ago."

Study says Hindu Kush – Himalayan Water Supplies may be affected by ongoing Climate change: More than a glacial retreat in the Hindu Kush-Himalaya region (HKH), the shifts in rain and snow due to climate change are likely to have an impact on regional water supplies and groundwater recharge, a study said. The study was conducted by two Kathmandu-based experts from International Centre for Integrated Mountain Development (ICIMOD). It showed that at lower elevations, glacial retreat is unlikely to cause significant changes in water availability over the next couple of decades, but other factors, including groundwater depletion and increasing human water use, could have a greater impact. Higher elevation areas could experience altered water flow in some river basins if current rates of glacial retreat continue. "The shifts in the location, intensity, and variability of rain and snow due to climate change impacts will likely to have a greater impact on regional water supplies and groundwater recharge than glacial retreat," the study said. The Hindu Kush-Himalaya is one of the most dynamic, diverse, and complex mountain systems in the world, with several rivers and glacial systems making the region a "Third

Pole" of the earth, providing fresh water resources to more than 210 million people in the mountains and 1.3 billion people downstream. Scientific evidence shows that most glaciers in the Hindu Kush-Himalaya region are shrinking, but the consequences of this melt for the regional water systems, especially groundwater, is not clear.

### **OPPORTUNITIES (Post-doctoral Fellowships)**

**IISER, Mohali:** IISER Mohali invites applications at the level of Postdoctoral Research Associates. Interested applicants who have either a PhD degree or have submitted their PhD thesis can apply for these positions. It is preferred that the candidate has some overlap with the research interests of one or more faculty members at the Institute. This is a rolling advertisement and the applications will be reviewed from time to time. The salary for Postdoctoral Research Associates will be as per the MHRD norms. Applications should be sent by email [todeanfaculty@iisermohali.ac.in](mailto:todeanfaculty@iisermohali.ac.in) with the subject clearly stating "Application for Postdoctoral position at IISER Mohali".

**IIT – Bhubaneswar:** Candidates preferably below 35 years having a Ph.D. Degree and willing to carry out advanced research in the fields of Basic Sciences; Earth, Ocean & Climate Sciences; Electrical Sciences; Infrastructure; Mechanical Sciences; Humanities, Social Sciences & Management may apply for this position. For further information please contact to Assistant Registrar (Academic Affairs), Contact No – 0674-2576019, E-mail id – [ar.acad@iitbbs.ac.in](mailto:ar.acad@iitbbs.ac.in)

**IIT – Jodhpur:** Candidates with consistently good academic record and interdisciplinary research potential, as full-time Institute Post-Doctoral Fellowships (PDFs) to carryout research in the following areas at the Institute: Computer Science & Engineering, Electrical Engineering, Mechanical Engineering, Biology and others may apply. For more details visit the website <http://iitj.ac.in/PDFs>.

**IIT – Gandhinagar:** Indian institute of Technology Gandhinagar is seeking applications for postdoctoral positions in Cognitive Science. Candidates of any nationality with a PhD degree ('all but defense' are eligible) in any discipline related to Cognitive Science can apply. We will also consider applications of exceptionally meritorious candidates who would like to switch their focus of research from another discipline into Cognitive Science. For more details visit the website <http://cogs.iitgn.ac.in/>

**Indian Institute of Science:** Applications are invited for a Research Associate/Post-Doctoral Fellow to work on a Wellcome Trust DBT-India Alliance funded project at the laboratory of Dr. Sridharan Devarajan, at the Centre for Neuroscience at IISc, Bangalore. Please send a CV with two references by e-mail to [sridhar@cns.iisc.ernet.in](mailto:sridhar@cns.iisc.ernet.in). Short listed candidates will be called for an interview.

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