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NEWS ITEM

Jawaharlal Nehru University (JNU) researchers worked out new way to eliminate dormant Tuberculosis bacteria present in stem cells

Delhi-based researchers have found that inhibiting lipid synthesis inside stem cells that produce bone cells (mesenchymal stem cells) can help in killing TB bacteria that are found inside the stem cells in a dormant state and safely shielded from the host immune system and TB drugs. While TB bacteria inside the macrophages actively divide, microbes inside stem cells lie dormant and also make the stem cells less likely to replicate thus surviving for an extended period of time. Ex vivo studies with human stem cells and work on mice showed that the two cells are programmed very differently to support active and dormant TB bacteria infection.A team led by Gobardhan Das from the Special Centre for Molecular Medicine at the Jawaharlal Nehru University (JNU) found that TB bacteria are free in the intracellular fluid (cytosol) of the mesenchymal stem cells while they are surrounded by the macrophage cell membrane on being engulfed. This allows the bacteria to promote rapid synthesis of lipids inside the stem cells and hide within the lipid droplets so created. The results were published in Journal of Clinical Investigation. Studies using human mesenchymal stem cells and macrophages and mice model studies helped us understand how TB bacteria hijack the cellular mechanism to stop the stem cells from replicating and turn themselves dormant, says Prof. Das. The bacteria instruct the stem cells to synthesise lipids and hide inside them. The stem cells don't kill microbes that are inside lipid droplets. There was sustained expression of genes controlling dormancy in the bacteria isolated from stem cells while genes that promote replication were expressed in bacteria isolated from macrophages. Mouse mesenchymal stem cells and macrophages too showed similar behaviour. In vitro studies using human stem cells showed the bacteria inhibiting stem cell replication.Inhibiting autophagy is one of the ways by which TB bacteria survive inside host cells. The researchers treated human macrophages and stem cells infected with TB bacteria with an anti-TB drug (isoniazid) and/or rapamycin. While isoniazid eliminated replicating bacteria found in macrophages, rapamycin induced autophagy in stem cells to kill the microbes. Similar results were obtained in mouse models too.

Researchers from IIIT-Hyderabad constructed Indian Brain Atlas

The average Indian brain is smaller in height, width, and volume as compared to the western and eastern population like the Chinese and Korean according to the first-ever 'Indian Brain Atlas' created by researchers of the International Institute of Information Technology-Hyderabad (IIITH). These differences are found even at the structure level like the volume of hippocampus and so on. But overall, the 'IBA 100 is more' comparable to the Chinese and Korean atlases than the distant Caucasian one, according to the research team led by professor from the Centre for Visual Information Technology Jayanthi Sivaswamy. Construction of the Indian human brain atlas was done in collaboration with the Department of Imaging Sciences and Interventional Radiology, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram. IIITH team made a maiden effort at creating an Indian-specific brain atlas involving 50 subjects selected across genders. MRI scans of these subjects' brains were taken at three different hospitals across three different scanners to rule out variations found in scanning machines. After a successful pilot study, the team recruited 100 willing participants in construction of Indian Brain Atlas or 'IBA 100'.

Researchers found that Rewiring and Repairing of Brain done by Immune cells during sleep

Researchers have found that immune cells called microglia, which play an important role in reorganising the connections between nerve cells,

fighting infections, and repairing damage, are also primarily active while we sleep. Microglia serve as the brain's first responders, patrolling the brain and spinal cord and springing into action to stamp out infections or gobble up debris from dead cell tissue. This research shows that the signals in our brain that modulate the sleep and awake state also act as a switch that turns the immune system off and on,"said study lead author Ania Majewska, Professor at University of Rochester in the US. In previous studies, Majewska's lab has shown how microglia interact with synapses, the juncture where the axons of one neuron connects and communicates with its neighbours.The microglia help maintain the health and function of the synapses and prune connections between nerve cells when they are no longer necessary for brain function.The current study points to the role of norepinephrine, a neurotransmitter that signals arousal and stress in the central nervous system.This chemical is present in low levels in the brain while we sleep, but when production ramps up it arouses our nerve cells, causing us to wake up and become alert.The study showed that norepinephrine also acts on a specific receptor, the beta2 adrenergic receptor, which is expressed at high levels in microglia. "This work suggests that the enhanced remodeling of neural circuits and repair of lesions during sleep may be mediated in part by the ability of microglia to dynamically interact with the brain," said study first author Rianne Stowell. The study was published in the journal Nature Neuroscience.

WHO reported the eradication of wild poliovirus strain

Wild poliovirus type 3 has been eradicated, the World Health Organisation said on Thursday, hailing the development as an "historic achievement for humanity" that leaves only one strain of the virus in transmission. The last confirmed case of WPV3 was recorded in northern Nigeria in 2012.Wild poliovirus type 3 has been eradicated, the World Health Organisation said on Thursday, hailing the development as an "historic achievement for humanity" that leaves only one strain of the virus in transmission.All three types of wildpolio can cause paralysis and death, but WHO categorises them separately in terms of eradication because of certain virological differences.An independent panel, chaired by WHO chief Tedros Adhanom Ghebreyesus, concluded that the required criteria have been met to "verify that this strain is truly gone", the United Nations health agency said in a statement.

Study reported that malfunctioning of Microprotein may cause major infections

Researchers have discovered that a microprotein called PIGBOS found in the powerhouse of the cells – mitochondria – contributes to mitigating stress happening within the cells – an advance that may lead to better understanding of disease conditions like cancer. The researchers, including those from the Salk Institute in the U.S., said that while an average protein molecule present in the human body has around 300 chemical units called amino acids, the microproteins had fewer than 100 of the building blocks. The study, published in the journal Nature Communications, noted that PIGBOS was made of 54 amino acid molecules, and indicated that the microprotein could be a target for cell stress based human diseases like cancer and neurodegeneration. Usually to track and find the functions of proteins, researchers attach a jelly fish derived probe called the green fluorescent protein (GFP) to them, which glows and indicates the protein's presence in cells, the study noted. However, the researchers of the current study ran into a roadblock when they tried to mark PIGBOS with GFP as the microprotein was too small relative to the size of the fluorescent tag.They solved the problem using a less common approach called split GFP where they fused just a small part of GFP, called a beta strand, to PIGBOS.PIGBOS interacted with a protein called CLCC1, which, the researchers said, is part of a cell organelle called the endoplasmic reticulum (ER)."PIGBOS is like a connection to link mitochondria and ER together," said study co-author Qian Chu from the Salk Institute.According to Chu and his team, it was unusual to see a mitochondrial protein playing a role in the unfolded protein response.Chu said that the ER is more

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stressed in cancer patients than in a normal person, and added that ER stress regulation could be a good target to tackle the disease.

IIT Bombay Researchers discovered novel quantum materials for technology of clean energy

Researchers from IIT Bombay have discovered special properties in a class of materials called "semi-Dirac metals" that have been recently talked about in the scientific literature. Examples of semi-Dirac metals are systems such as TiO2/V2O3 nanostructures. Through calculations, the researchers have shown that such materials would be transparent to light of a given frequency and polarisation when it is incident along a particular direction. The material would be opaque to the same light when it falls on it from a different direction. There are many known applications for transparent conducting films – the common example being touch screens used in mobiles. These results were published in Physical Review B. "Our results in this paper show a very high optical conductivity of semi-Dirac materials for electromagnetic waves [light waves] of a specific frequency and specific polarisation" says Alestin Mawrie, a post-doctoral fellow at Department of Electrical Engineering, and the first author of the paper. Optical conductivity is a measure of the opacity offered by the material to the passage of light through it. Semi-Dirac metals behave like Dirac metals in one direction and like normal metals in the perpendicular directions (since their microscopic structure is different along the two directions).In this paper, the authors have shown theoretically that the direction-dependence of the microscopical properties gives the material special optical properties.This technology is used in efficient cars, where it is used to keep lights on and to warm seats. Spacecrafts like Voyager which are too far from the sun to use solar energy can make use of thermoelectricity.

NOBEL PRIZE AWARDS: 2019

Physiology and Medicine

Awarded to William G. Kaelin Jr, Sir Peter J. Ratcliffe and Gregg L. Semenza for their discoveries of how cells sense and adapt to oxygen availability.

Physics

Awarded to James Peebles, Michel Mayor and Didier Queloz for contributions to our understanding of the evolution of the universe and Earth's place in the cosmos.

Chemistry

John B. Goodenough, M. Stanley Whittingham and Akira Yoshino for the development of lithium-ion batteries.