

NEWS ITEM

Researchers from TIFR examined liver regulation of fat secretion

Lipid droplets accumulate in the liver during fasting, as in during sleep. Yet, the liver controls the release of these lipid droplets into the blood, thereby preventing excessive deposition of very low density lipids (VLDL) into the blood stream which could lead to heart disease. While this role of the liver is well known, the question of how it happens has not been addressed until recently. This question was taken up by Roop Mallik's group at the Tata Institute of Fundamental Research, Mumbai. In a paper published in Proceedings of the National Academy of Sciences, US (PNAS), the researchers led by Dr Mallik show that the motor protein kinesin transports lipid droplets to the endoplasmic reticulum within the liver cells, from where it is secreted into the blood. During fasting, kinesin is removed from the lipid droplets, and this ensures they do not reach the endoplasmic reticulum, nor are they secreted into the blood. This tempers the secretion of lipids from the liver during fasting and protects the organs. In their first experiment, the group of researchers extracted lipid droplets from cells and watched them move in a test tube. There they found that when they added specific compounds that blocked the motor protein kinesin, the droplets stopped moving. This is how we found for the first time that kinesin is a key factor, says Dr Mallik. They published these results in the journal Nature Methods. Following this study, they experimented with rats and found the connection between regulation of lipid transport within the liver cells and that of the motor protein kinesin.

IGIB's novel approaches may lower the Tuberculosis induced tissue damage

It is generally believed that TB bacteria make the host cells accumulate triglyceride and become lipid-rich as bacteria prefer lipids for their nutrition. Now, using human macrophage cells researchers at the Institute of Genomic and Integrative Biology (CSIR-IGIB) have shown that when TB-infected macrophages undergo necrosis (where the cell ruptures when it dies) lipids and bacteria contained in the cells are released. The neighbouring cells — both healthy and TB-infected — take up the lipids thus leading to lipid accumulation. Our study brings a new facet to the way the field has been thinking

about pathogenesis where it was believed that because the bacteria prefer lipids for their nutrition, they make the host cell become lipid-rich. Our work points to the relevance of the incident pathology — necrosis in a granuloma result in the development of lipid-rich foamy macrophages [presence of cells with large lipid-filled vacuoles], says Dr. Sheetal Gandotra from the Cardio Respiratory Disease Biology Unit at IGIB and corresponding author of a paper published in the journal Frontiers in Immunology. The ability to induce necrosis is peculiar to virulent TB bacteria. The avirulent Mycobacterium bovis strain used in BCG vaccine is unable to cause necrosis; it triggers a programmed cell death (apoptosis) instead. Like the BCG strain, When macrophages encounter TB bacteria they mount an inflammatory response wherein certain factors are secreted to help recruit other cells of the immune system to kill the bacteria. As a result of the inflammatory response more macrophages are recruited to the site of infection thus exposing them to infection. Human blood monocyte-derived macrophages, too, showed increased inflammatory response when triglyceride accumulation was increased. Central to the storage of triglycerides in macrophages is the DGAT1 enzyme (diacylglycerol o-acyltransferase). When the DGAT1 gene is silenced in the macrophage cell lines, the macrophages' ability to accumulate triglycerides is compromised.

Bacteria develop resistance even without exposure to antibiotics

The IISER Pune team found E. coli coped better when exposure to complex, unpredictable environment continued for 100 days. The environment where bacteria such as E. coli thrive can be complex with different stresses being present at the same time and changing unpredictably at different time scales — daily or seasonal. Researchers at Pune's Indian Institute of Science Education and Research (IISER) found exciting results when they replicated these conditions in the lab — E. coli developed resistance to antibiotics and heavy metals even when the bacteria were not exposed to them. When exposed to a combination of stresses — salt, pH and oxidative stress — that varied unpredictably on a daily basis, E. coli did not show statistically

significant adaptability at the end of 30 days (170 generations). But bacteria did show improved fitness and better growth rate at the end of 100 days. Thirty days produce 170 generations of *E. coli* while 100 days produce 900 generations. To make the environment complex, the researchers led by Sutrith Dey from IISER Pune's Biology Division exposed the bacteria to one or two factors (says pH and salt) that were kept normal while one or two factors were abnormal and caused stress. Unpredictability was brought in by randomly changing the three factors that caused stress on a daily basis. Totally, 30 combinations that make the environment complex and unpredictable were used for the study. At the end of 30 days when compared with ancestors [or controls], the bacteria exposed to complex, unpredictable environment did not develop statistically significant advantage in terms of improved fitness," says Shraddha Karve from IISER Pune's Biology Division and first author of a paper published in the *Journal of Evolutionary Biology*. But what came as a surprise was that the bacteria evolved the ability to tolerate novel stresses that they were not exposed to, such as antibiotics (norfloxacin) and heavy metals (cobalt and zinc)," says Dr. Karve. "We repeated the experiment all over again as the result was so surprising, and we got the same outcome."

Entire genomic sequencing of Koala bear unearthed

The koalas of Australia are not just famous for their cuteness. They have been an unsolved mystery among scientists for their strange eating habits — they enjoy the leaves of eucalyptus that would be toxic or even fatal to most mammals — and their exceptional parental care. Now an international team of scientists has successfully sequenced the marsupial's whole genome and answered burning questions about the critter. The study published in *Nature Genetics* was authored by 54 scientists from seven countries and the whole genome was found to consist of over 26,000 genes. The genome provides a springboard for the conservation of this biologically unique species," said co-lead author Katherine Belov from the University of Sydney in a release. Researchers found expansions within a particular gene family (P450 gene) and reported that these genes help the koala detoxify the eucalyptus leaves. These genes were found to be expressed in many tissues, especially the liver, indicating its role in detoxification. The koala

has evolved an excellent toolkit to deal with eating highly toxic eucalyptus, one made up of lots of copies of the same (or very similar) tools, explained Dr. Will Nash, one of the authors from Earlham Institute, UK, in the release. Researchers also found novel lactation proteins in the koala bears. They reported that these proteins protect the young ones in the pouch and help it develop a strong immune system. We characterised the main components of the mothers' milk — which is crucial for koala joeys — born the size of a jellybean and weighing half of one gram, said Dr. Belov. "We identified genes that allow the koala to fine-tune milk protein composition across the stages of lactation, to meet the changing needs of their young.

Pivotal role of proteins in implantation of embryo examined

The team led by Dr. Deepak Modi from ICMR's National Institute for Research in Reproductive Health (NIRRH) has discovered that the endometrium is not a passive tissue which readily promotes embryo implantation but undergoes extensive remodelling brought about by the embryo at the time of implantation. They discovered that a protein OVGP1 is induced in the endometrium precisely at the time when the embryo has to implant. That the embryo can implant only during a narrow window is well known. Studies carried out in mouse models showed that OVGP1 protein is expressed for a brief period that coincides with the time of implantation. It is known that the pregnancy hormone — human chorionic gonadotropin (hCG) produced and released by embryos is crucial for the implantation process. The role of hCG hormone in inducing the endometrium to produce the OVGP1 protein became clear when the researchers studied the role of different hormones on endometrial cell lines. The cell lines were exposed to progesterone, estrogen and human chorionic gonadotropin hormone. We found the hCG hormone induced the expression of OVGP1 protein. Progesterone and estrogen, too, had a role, though minor, whereas hCG had a major role in the expression of OVGP1. This tells that embryos signal the endometrium to express OVGP1, says Dr. Modi, who is the corresponding author of a paper published in the *Journal of Assisted Reproduction and Genetics*. To study how the protein helps in the implantation process, the researchers silenced the expression of the protein in the endometrium cell lines. They found that the expression levels of integrin

proteins, which are essential for implantation, were significantly reduced in OVGP1 silenced cells.

Amazon forests found to discover 7 novel wasp species

An international team of researchers have discovered seven new wasp species belonging to the genus *Clistopyga* from Peru, Venezuela and Colombia. A recent report published in *Zootaxa* describes their morphology, such as colouration, wing size and other distinct features. The most notable among them is *Clistopyga crassicaudata*, named after its distinctly thickened ovipositor. The ovipositor is a tube-like organ present in many insects that helps in laying eggs and also in injecting venom. The researchers say that these new species could be parasitoid wasps, which lay their eggs near a host, which the larvae then feeds on and, eventually, kills. The biology of these seven new species is really unknown but other species of this genus, and other genera of Ichneumonidae lay their eggs into spiders or egg-sacs, explained Dr. Santiago Bordera from the University of Alicante, Spain, in an email to *The Hindu*. The female wasps inject venom into spiders, paralyse them, and then lay their eggs on them. The hatching larvae feed on the paralysed spiders and their eggs.

Drugs for multiple sclerosis have the potentiality to fight pancreatic cancer

An FDA-approved drug currently used for treating multiple sclerosis has been found to be effective for pancreatic cancer. Researchers from Rajiv Gandhi Centre for Biotechnology (RGCB), Thiruvananthapuram, in collaboration with Regional Cancer Centre in the city and NIMHANS, Bengaluru, found that the drug was also able to increase the efficacy of gemcitabine, the current standard drug for pancreatic cancer. The results of the study have been recently published in *Theranostics*. The drug used to treat multiple sclerosis was found to act through a receptor called S1PR1 that is involved in lipid signalling and which regulates numerous cellular events such as cell growth, migration and vascular integrity. The precise role of the receptor in pancreatic cancer is still not clear and our study has brought out its importance. We found that the [multiple] sclerosis drug can bind to the receptor and alter the key cellular events and prevent the progression of pancreatic cancer, explains Dr. K.B. Harikumar, from the Cancer Research Program at RGCB and corresponding author of the paper. The

sclerosis drug was also found to be a potent inhibitor of NF-kappaB, a transcription factor that helps in tumour progression. The effectiveness of the multiple sclerosis drug when used together with the current pancreatic cancer drug was checked in mice models. The combination drug treatment was able to control various signalling molecules, thereby decreasing cancer cell proliferation and increasing apoptosis. It also helped produce higher levels of reactive oxygen species and inhibited the migration of the cancer cells. They also studied the genes involved in inflammation and immunity in pancreatic cancer and found that the combination drug regime activated a tumour-suppressor gene and downregulated another that is involved in drug resistance and decreased immunity.

Goa Mushroom's Pigments as a potential source against cancer

The mycological laboratory of the Department of Botany, Goa University on Wednesday reported the discovery of a new pigment from local wild mushrooms. We are proud to report a new sulphur-rich melanin biopigment of immense bioindustrial, biomedical (anti-cancer, anti-tumour) and biotechnological potential from local *Roegneria alamosa* (wild variety of Goan mushrooms that grows on termite hills) or *Termitomyces* species, said Dr. Nandakumar Kamat, Assistant Professor of Botany, department of Goa University here on Wednesday. Our paper was published on July 9 in *Mycology: International Journal Of Fungal Biology* affiliated to Mycological Society of China, and published by Taylor and Francis, U.S.. This discovery shows the chemical nature of the brown or black colour that you see in these wild edible mushrooms, explained Dr. Kamat, with more than two decades of research experience on mushrooms. More than 50 teams are working on these mushrooms, globally, but we in Goa got the lead now. People of Goa who consume these mushrooms are actually eating sulphur-rich melanin. We declare it as world's first sulphur-rich edible melanin. Its structure is similar to black pigment found in human hair, said an excited Dr. Kamat.

Evolution of Insect immune shield to counter bacterial attacks?

Much like humans, insects too develop an immune-memory in response to infection, a team at the National Centre for Biological Sciences (NCBS), Bengaluru has found. In humans, for

instance, natural infection or vaccination can lead to the formation of important immunological memory in the human immune system. In other words, once infected, the immune system becomes ready to deal with that particular antigen because of immune-memory. For long, it has been a point of debate whether insects have such a memory that can protect them against future infections. The present study shows that such a memory can evolve over generations in red flour beetles (*Tribolium castaneum*) infected with *Bacillus thuringiensis* (Bt). The results of the study were recently published in Proceedings of the Royal Society B. The study was conducted in Deepa Agashe's lab at NCBS and the experiment was designed by Imroze Khan, first author of the paper, and Dr. Agashe, the principal investigator. The team infected nearly 5,000 to 6,000 beetles in every generation. "Every insect had to be pierced at the right point and injected with a standard number of bacterial cells. It took a year to standardise this process," says Dr. Khan, who is now a faculty at Ashoka University, Delhi. With a generation being approximately 45 days long, the study of 10 generations stretched over two years. "Every day Arun Prakash [one of the authors] and I had to infect 1,000 insects," he adds when asked what was the most challenging part of the study. The beetle populations were exposed to a single large dose of live Bt antigens or exposed to dead bacteria followed by live infection. In the past few years, multiple studies showed that insects do show some form of immune-memory, but how such memory evolves remained a puzzle. "We now have some clues about how fast and how reliably memory could evolve, what might be the mechanisms involved and when might immune-memory versus resistance be favoured by natural selection, says Dr Agashe.

SCIENTIFIC NEWS

NASA braces to pull out data from energy deficit Kepler

Scientists at NASA are preparing to download the latest bit of data stored in its planet-hunting Kepler space telescope as the spacecraft is now running very low on fuel. The US space agency has placed the spacecraft in a no-fuel-use safe mode to save the remaining fuel so that data extraction can be completed, NASA said on Friday. On August 2, the Kepler team will command the spacecraft to awaken from its no-fuel-use state and manoeuvre the spacecraft to the correct orientation and downlink

the data. Once the data has been downloaded, the expectation is to start observations for the next campaign with any remaining fuel. But as of now, returning the data back to Earth is the "highest priority" for the remaining fuel. Since May 12, Kepler has been on its 18th observation campaign, staring at a patch of sky towards the constellation of Cancer it previously studied in 2015. The data from this second look will provide astronomers with an opportunity to confirm previous exoplanet candidates and discover new ones. Launched in 2009, the Kepler mission is specifically designed to survey our region of the Milky Way galaxy to discover hundreds of Earth-size and smaller planets in or near the habitable zone and determine the fraction of the hundreds of billions of stars in our galaxy that might have such planets.

IISc soon inceptionalizing science incubation centres

The Indian Institute of Science, founded in 1909 by Jamsetji Tata and former Maharajah of Mysore Krishnaraja Wadiyar IV, plans to open a research park at its Bengaluru facility within the next three years to incubate sci-tech companies. Currently the Society for Innovation and Development is incubating about 15 companies, said Prof. G.K. Ananthasuresh, chairman of the Centre of Biosystems Science and Engineering. "We want to scale it up ten times and the tenders for setting up the facility has already been issued." The institute has collaborations with companies such as Tata Consultancy Services, Volvo, Google Inc., General Motors, Microsoft Research, IBM Research, Boeing, Robert Bosch Foundation and Pratt & Whitney. It also works with the Indian Space Research Organisation, Aeronautical Development Agency and Centre for Development of Advanced Computing. Of about 12 companies incubated by the Society for Innovation and Development arm, an inter-disciplinary body, include simulators used for endoscopy, microsatellites to access the Internet at lower costs, a medical diagnostic kit and a superwave technology to extract oil from sandalwood. Many of these companies employ core technology. There are deep science and deep technology involved and the impact they can create is big, Prof. Ananthasuresh said in an interview. An air-conditioned blanket invented by scientists in the institute enables one to cool "in cycles," he said. "It is a layered blanket and one does not have to cool the whole room. It is a personalised air-conditioner," he said.

Neanderthal Humans hunts in groups, speared down prey in short range, examined study

Neanderthals were capable of sophisticated, collective hunting strategies, according to an analysis of prehistoric animal remains from Germany that contradicts the enduring image of these early humans as knuckle-dragging brutes. The cut marks — or “hunting lesions” — on the bones of two 1,20,000-year-old deer provide the earliest “smoking gun” evidence such weapons were used to stalk and kill prey, according to a study the journal *Nature Ecology and Evolution*. Microscopic imaging and ballistics experiments reproducing the impact of the blows confirmed that at least one was delivered with a wooden spear at low velocity. “This suggests that Neanderthals approached animals very closely and thrust, not threw, their spears at the animals, most likely from an underhand angle,” said Sabine Gaudzinski-Windheuser, a researcher at Johannes Gutenberg-University Mainz, Germany. Neanderthals lived in Europe from about 300,000 years ago until they died out 30,000 years ago, overtaken by our species. It was long thought that these evolutionary cousins — modern Europeans and Asians have about 2% of Neanderthal DNA — were not smart enough to compete, and lacked symbolic culture, a trait supposedly unique to modern humans. 3,00,000-to 4,00,000-year-old wooden staves found in England and Germany are the oldest known spear-like implements likely used for killing prey. But there was no physical evidence as to their use, leaving scientists to speculate. They have also turned up thousands of stone artefacts, attesting to a flourishing Neanderthal presence in what was a forest environment during an interglacial period 135,000 and 115,000 years ago. The old deer bones examined for the study were unearthed more than 20 years ago, but new technologies helped unlock their secrets: which injuries were lethal, what kind of weapon was used, and whether the spears were thrown from a distance or thrust from close up.

Central University of Hyderabad enhances harpin biopesticide bioavailability

Researchers at the University of Hyderabad have found that harpin biopesticide brought about 80-90% reduction in severity of fungal infection in tomato plants when it is encapsulated in chitosan nanoparticles. The fungal infection was caused by *Rhizoctonia solani*. The reduction in disease severity is only about 50-55% when the biopesticide is used without loading it in nanoparticles. The results were

published in the journal *Carbohydrate Polymers*. Though harpin is used against several bacterial, fungal and viral infections, poor bioavailability is a major hurdle when harpin protein, taken from the bacteria *Pseudomonas syringae* pv. *syringae*, is just sprayed on the leaves like any other pesticide. To address the issue of poor bioavailability of harpin arising from the inability to permeate into plants, the researchers led by Prof. Appa Rao Podile from the Department of Plant Sciences turned to nanotechnology. They used the biocompatible and biodegradable chitosan in nanoparticle size to encapsulate the biopesticide. Chitosan nanoparticles are capable of getting into the plant through the stomata (pores on the leaves through which gas exchange takes place) and then diffuse through the cell wall to enter the cells. The team found that chitosan nanoparticles containing harpin pass through the cell wall and end up in the chloroplast of tomato plants. As a result, bioavailability of harpin inside tomato plants increases sharply when loaded in chitosan nanoparticles. Also, less amount of harpin will have to be sprayed on leaves when it is contained in nanoparticles. Chitosan by itself has another advantage. “Chitosan’s antifungal property and its role in triggering plant defence responses are already well known. Laboratory studies found harpin was released from the nanoparticles in two phases. The biopesticide adsorbed on the nanoparticles gets released in a burst in the first 48 hours followed by slow release up to 120 hours,” says Dr. Sandhya Rani Nadendla from the Department of Plant Sciences at UoH and first author of the paper. The team is planning to test harpin-containing chitosan nanoparticles on a large-scale on four different crops and at least two pathogens per crop. Two of the crops to be tested will be grown in fields and two others will be greenhouse crops.

Mini Neanderthal brains grown in U.S. lab

Scientists have successfully grown pea-size versions of Neanderthal brains, an advance that may help better understand the species that went extinct about 40,000 years ago. Cultivating and studying these mini brains may reveal why Neanderthals died out and *Homo sapiens* went on to conquer much of the planet, researchers said. Genetic differences between Neanderthal and human brains may explain their demise and our success, said Alysson R. Muotri, director of the University of California, San Diego, U.S. Researchers compared the genome of

Neanderthals with that of modern humans. Out of 200 candidate genes that showed significant differences between the two species, the researchers focussed on a gene expression regulator known as NOVA1. To grow mini Neanderthal brains, they used the gene-editing tool known as CRISPR to Neanderthalise human pluripotent stem cells that can develop into any cell in the body. Then, using their in-house protocol, we coaxed the stem cells to become a brain organoid,, Mr. Muotri said.

IIT-Delhi, IIT-Bombay and IISc Bangalore get Institution of Eminence status

The Union Human Resource Development Ministry has granted the Institution of Eminence (IoE) status to IIT Delhi, IIT Bombay and IISc Bangalore today. Along with them, in the private sector, the Manipal Academy of Higher Education, BITS Pilani and Jio Institute granted institution of eminence tag. The UGC had received 103 applications including JNU and Delhi University for IoE status. The Union HRD Minister, Prakash Javadekar, tweeted the names of IIT Bombay and IIT Delhi who will receive government funding as the private sector institutes which are granted the status of Institutes of Eminence will get the government grants of Rs 1000 in next five years. The IoEs are proposed to have greater autonomy in comparison to other higher education institutions. For instance, they will be free to decide their fee for domestic and foreign students and have a flexible course duration and structure. Moreover, their academic collaborations with foreign institutions will be exempt from approvals of government or UGC except institutions based in MEA and MHA's list of negative countries. Once identified,

the target for the IoEs would be to break into the top 500 bracket in one internationally reputed ranking framework in 10 years and come up in the top 100 over time.

POST DOC OPPORTUNITIES:

1. 50 Postdoc Research Fellows: ICMR CENTENARY – Scheme - Indian Council of Medical Research (ICMR) and Division of Human Resource Planning and Development (HRD) invite applications under ICMR CENTENARY – Scheme. For correspondence - **Dr N.C. Jain, Scientist-G & Head, Email: drencejain@gmail.com**

2. Post Doctoral Fellowships at IIT Palakkad - Post Doctoral Positions are available in the areas of Civil Engineering, Computer Science and Engineering, Electrical Engineering, Mechanical Engineering, Chemistry, Mathematics, Physics & Humanities and Social Sciences. Please refer iitpkd.ac.in

3. Institute for Stem Cell Biology and Regenerative Medicine - The primary interest of the Raghavan lab is to elucidate how epithelial homeostasis is maintained in development and perturbed in disease states. Please refer instem.res.in

4. IIT Ropar invites applications for Institute Post Doctoral Fellowship in the various Departments/ Centres. Please refer <http://www.iitrpr.ac.in>

5. 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. Please refer www.iiserpune.ac.in

