

SNAPSHOTS



Two species

Red pandas of Asian high mountains are two distinct species - Chinese red pandas and Himalayan red pandas - according to a comprehensive genetic study on these endangered mammals. Scientists found substantial divergences between the two species in three genetic markers in an analysis of DNA from 65 of the animals.



Larvae and cake

Scientists at Ghent University in Belgium are experimenting with larva fat to replace butter in waffles, cakes and cookies, as it is more sustainable, according to them. The researchers soak Black soldier fly larvae in a bowl of water, put it in a blender to create a smooth greasy dollop and then use a kitchen centrifuge to separate out insect butter.



Habitable planet

University of Cambridge researchers studied the exoplanet K2-18b which is 124 light years away, finding it habitable. The exoplanet is 2.6 times the radius and 8.6 times the mass of Earth, and orbits its star within the habitable zone, where temperatures could allow liquid water to exist. The conditions beneath its atmosphere are unknown.



Eat less, live more

A study published in *Cell* finds that restricting calorie intake delays onset of age-related diseases, reduces levels of inflammation throughout the body. The benefits of calorie-restriction were known earlier, but the new study also says that this can protect against ageing in cellular pathways. The study compared rats that ate 30% less than normal.



Venus' asteroid

The very first asteroid whose orbit lies entirely within that of Venus has been discovered. Named 2020AV2, this asteroid was found to be unstable. Within a million years this would either collide with Venus or get scattered to an Earth-crossing path. The discovery was published in *The Monthly Notices of Royal Astronomical Society Letters*.

Presence of colistin-resistant bacteria of food origin in the gut is cause for worry

Colistin is the last-resort antibiotic used to treat highly drug-resistant bacterial infections

R. PRASAD

A small study involving 65 stool samples taken from patients from a single hospital in Chennai found 51% of them harbour colistin-resistant bacteria. This reflects the presence of such bacteria in the gut as stool samples represent gut colonisation. This is the first study from India which has found indirect evidence of colistin-resistant bacteria in the gut and was published in the journal *Diagnostic Microbiology & Infectious Disease*.

Colistin is the last-resort antibiotic used to treat highly drug-resistant bacterial infections.

Colistin-resistant bacteria can be of hospital origin or food origin. Colistin-resistant bacteria of hospital origin do not respond to any of the antibiotics, including carbapenem while colistin-resistant bacteria of food origin will respond to carbapenem.

Stool samples

Of the 65 stool samples studied, 33 samples were found to have colistin-resistant bacteria, the team led by Dr. Abdul Ghafur, consultant in infectious diseases at Chennai's Apollo Cancer Institute found. And of the 33 samples that had bacteria resistant to colistin, 77% were found to be food-acquired and the remaining 23% had an antibiotic resistance pattern suggestive of hospital origin.

In a paper published in the *Journal*



Insidious presence: In 2018, colistin-resistant *Klebsiella* bacteria were found to be widely present in poultry and raw vegetables. ■ H. VIHUU

of *Global Antimicrobial Resistance* in 2018, Dr. Ghafur and his team found that colistin-resistant *Klebsiella* bacteria were widely present in poultry and raw vegetables. The main cause of colistin resistance in food is due to the rampant use of colistin in poultry. Since poultry litter is used as manure to grow vegetables, colistin-resistant bacteria are found in vegetables as well.

Usage in poultry

"Most of the colistin-resistant *Klebsiella* bacteria in the gut is from food and not hospital-acquired," says Dr. Ghafur. "Colistin usage in poultry

plays a bigger role than its usage in hospitals for the bacteria to develop widespread colistin resistance."

Dr. Ghafur adds: "So even if hospital usage of colistin is rational and scientific that will hardly make any difference in the generation of colistin resistance. The only way out is to control the use of colistin in poultry."

How resistance is conferred

In clinical practice, it is the mutation in the mcrB gene or other chromosomal genes that confers colistin resistance to *Klebsiella* bacteria. In their 2018 study, the authors found mcrB gene mutation in food *Klebsiella*

bacteria.

Till date, there is no evidence to suggest that the mcrB gene mutation spreads from food to human *Klebsiella* bacteria. The only colistin resistance mechanism that is known to spread from food to human *Klebsiella* bacteria is through mcr gene transfer.

However, only a minority (less than 3%) of colistin-resistant *Klebsiella* bacterial infections in humans is contributed by the mcr gene. "Majority of infections by colistin-resistant *Klebsiella* in humans are due to mutations in the mcrB gene or other chromosomal genes," Dr. Ghafur says.

The gene and its mutation

The mcr gene is located in the plasmid and so can spread quickly to other bacteria. The mcrB gene mutation too can spread quickly but through insertion sequences.

The cause of colistin resistance in majority of bacteria of food origin in human gut is due to mcrB gene mutation.

"Our study provides additional evidence to the hypothesis that colistin resistance due to mcrB mutation in food *Klebsiella* has the potential to spread to human *Klebsiella* in the gut and hence may contribute colistin-resistant infections in humans," he says.

In light of that, the finding that a large number of individuals carry colistin-resistant bacteria of food origin in the gut is therefore worrying.



Touch of healing: A display of art works in the premises of a hospital in Mysuru (2009). ■ FILE PHOTO

Health outcomes of displaying art in hospitals

Art creates an atmosphere where patients feel safe, socialise, connect with the world outside



SPEAKING OF SCIENCE

D. BALASUBRAMANIAN

Many hospitals, particularly private and corporate ones, hang attractive pictures and art pieces in their entrance halls and patient waiting rooms. Most people, in fact even some of the owners themselves, think this is just to drum-beat their "class." In contrast, most if not all, public or government hospitals do nothing of this kind and leave their walls blank or fill them with notices. Their rooms and corridors are hideous. This is true of even prestigious institutes of medical sciences across the country. Given this, it may come as a surprise (even to some of the owners of these hospitals) that displaying art in hospitals, patient waiting rooms and wards is good for patients, doctors, nurses and other caregivers.

A highly cited research report published three years ago by a group of Danish researchers (Nielson et al, "How do patients actually experience and use art in hospitals? The significance of interaction: a user-oriented experimental case study"; *International Journal of Qualitative Studies on Health and Well-being* 2017;12(1) 1267343 shows how patients experience an overall feeling of approachability and care.

They studied patients confined for a period of several weeks in a common care hall. During the first week, the walls of the hall were bare and blank. Each patient was immersed in his own medical condition, not talking to the others in the hall. On the eighth day, a series of artwork - paintings, pictures and photographs were displayed on the walls of the common care hall. Most of the patients began looking at and studied them, diverted their attention from earlier self-absorption, began analysing and interpreting these exhibits in his own way, started talking to others in the hall and made friends, moving on to non-clinical topics, exchanged critiques and socialised more. They listened to the nurses, doctors and other caregivers with greater attention, and their cure improved!

Safe environment

The researchers conclude that art creates an environment and atmosphere where the patient can feel safe, socialise, maintain connection with the world outside the confines of the hospital and supports their identity. The presence of visual art in hospital contributes to health outcomes. One would expect that this would be particularly true of patients confined to intensive care units where medical instruments are cluttered around.

Now, this study has been done in a European society. Will this work in a place like India and in public and government hospitals? There is no reason why it cannot, but the planning and strategy will have to suit local conditions. People are people: they like to interact, need attention, not just for medical attention, but as persons, sociologically as well.

Towards this, designers, sociologists, and sensitive artists need to get together with the doctors in the hospitals, choose the kind of art display, and the space available. The conditions and the overburdening patient space, the overworked doctors and caregivers, the local culture and other factors, will have to be budgeted in, but it can be done. And it should be done since, as mentioned above, visual art in a hospital contributes to health outcomes as an extended from of health care.

Helps caregivers

Now, does art in hospitals help the doctors and nurses there? What can they learn from looking at art? Does this help them become better professionals? Indeed so, the book by Ann Sloan Devlin: "Transforming the Doctor's office: Principles from Evidence-Based Design" offers some clues, and the article by Dr Robert Glatter: "Can studying art help medical students become better doctors?" makes convincing arguments for introducing art as a course for medical students, apart from the usual ones and beyond *Gray's Anatomy*. Indeed, this has been introduced in some medical schools and young students have appreciated it and find that it broadens their diagnostic still. One of them remarked: "I have been looking so far at the center of the picture as the main part, but I came to realize that there is a wealth of data on the sides too!"

Given this, our medical colleges can try this and bring a practising artist periodically to come, explain and discuss his/her art work, and invite responses from the students. Such periodic get-togethers, even if not part of the curriculum, will help broaden the minds and help in the skill of how to interpret and get more out of the images from scans obtained from machines. One private medical institute in Hyderabad has put this in practice for its clinical and research fellows and doctors. It has placed paintings and other art pieces in its patient waiting rooms, walls on each floor, children's care centre, low-vision aid clinics, thus practising and anticipating what the Danish group above has suggested in 2017. It has also set apart a major area of an entire floor dedicated as an art gallery, and invites artists, musicians, writers, NGOs, and similar scholars for lectures and interaction with its doctors and scientists, but also with the interested citizens attending the events.

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Zebrafish reveal how to run faster

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The tiny freshwater zebrafish, a favourite in aquariums, has now helped researchers understand the neural mechanism involved in fast movement. The fish needs to swim to battle the drift of the streams and the question of how they do this intrigued the researchers from the National Centre for Biological Sciences (NCBS), Bengaluru.



Nerves to behaviour: When drugs that activate dopamine receptors were added to the water, the fish swam much faster.

Speed control

The team, consisting of Urvasi Jha and Vatsala Thirumalai studied a reflexive behaviour called optomotor response in freely swimming zebrafish larvae. They were able to pinpoint how speed was controlled during this behaviour at the level of single nerve cells.

The team evoked the optomotor response in the laboratory by moving black and white bars on a little screen placed under the fish. When fish were placed in normal water, they swam to keep up with the moving bars. However, when drugs that activate dopamine receptors were added to the water, the fish swam much faster and even got ahead of the moving bars. They noticed that the fish swam faster by bending the tail more from side to side. The results were published in *Current Biology*.

Tail movement is caused by motor neurons sending electrical impulses to the muscle. By recording the electrical activity of single motor neurons, they showed that the in-

creased tail bending was due to dopamine's direct actions on motor neurons. These results are exciting because they show that motor neurons, which are thought to mostly relay the command coming to them, are capable of altering the behavioural output.

Ideal model organism

Ms. Jha, the first author of the paper, explains that zebrafish served an ideal model organism as it allowed in-depth studies from the level of behaviour to single neuronal levels. "We have currently studied only the motor neurons, and it would be interesting to see if dopamine affects the properties of other neurons in the spinal cord too. Another follow up study can be to investigate what exact information dopamine is encoding," she adds.

"We have shown that there is a lot of plasticity within the spinal cord. We now know that even after the brain has issued the command for a movement, changing the properties of motor neurons can alter the final behavioural outcome," says Prof. Thirumalai.

Shanghai lab that first sequenced coronavirus genome shut down

R. PRASAD

A Shanghai-based lab - Shanghai Public Health Clinical Center & School of Public Health - at Fudan University which was the first to sequence the whole genome of the novel coronavirus (SARS-CoV-2) and publicly share the data on January 11 was shut down on January 12 for "rectification".

"The centre was not given any specific reasons why the laboratory was closed for rectification. [We have submitted] four reports [asking for permission] to reopen but we have not received any replies," a source with the Shanghai lab told the *South China Morning Post*.

It was not clear whether the closure was related to the publishing of the sequencing data before the authorities, adds the newspaper.

Isolating the virus

In the first week of January, Yong-Zhen Zhang's team from the Shanghai lab in collaboration with handful of institutions isolated the virus from a 41-year-old worker in the seafood market in Wuhan. He was admitted to Wuhan Central Hospital on 26 December 2019 while experiencing a severe respiratory syndrome that included fever, dizziness and a cough.

The genome sequence was posted on an open-access site, virological.org on



Welcome revelation: Scientists and others worried about China's lack of transparency after the outbreak started were relieved when the genome data was shared. Image used for illustrative purposes only. ■ REUTERS

January 11 and also deposited on GenBank. In a brief note accompanying the genome sequence data, the consortium said that other researchers were "free to download, share, use, and analyse the data".

First test kits

It was based on this genome sequence data that researchers developed the first test kits to diagnose the virus. On February 3, the collaboration led by Prof. Zhang's published the findings in a paper in *Nature*.

According to the newspaper, China's National Health Commission announced hours after the release by Prof. Zhang's team that it would share the genome sequence with WHO.

According to the *South China Morning Post*, the Shanghai centre reported its discovery to the National Health Commission on January 5. The Centre also recommended "relevant prevention and control measures" be taken since the patient from whom the

sample was collected had suffered very severe symptoms and the virus resembled the ones previously seen in bats.

The newspaper says that the researchers publicly shared the genome data on January 11 after they realised that the "authorities had taken no obvious action to warn the public about the coronavirus".

Lack of transparency

Scientists and others worried about China's lack of transparency after the outbreak started in December 8 were relieved when the genome data was shared. On January 11, Director of Wellcome Trust Jeremy Farrar tweeted saying: "Potentially really important moment in global public health - must be celebrated, everyone involved in Wuhan, in China & beyond acknowledged, thanked & get all the credit. Sharing of data good for public health, great for those who did the work. Just needs those incentives & trust."

NCBS method to detect virus associated with a rare skin cancer

Team adapts gene editing tool to detect the presence of Merkel cell polyoma virus in the tumours

SHUBASHREE DESIKAN

A team from National Centre for Biological Sciences, Bengaluru, has developed a diagnostic system to detect the presence of Merkel cell polyomavirus in Merkel cell carcinoma tumours. Merkel cell carcinoma is a rare and aggressive type of skin cancer. The researchers have developed a test using the CRISPR-CAS12 technology that can identify the virus in the tumour and give off a fluorescence to indicate the presence of the virus. This is an important development, both, from the point of view of diagnostics and giving a prognosis for the condition. Merkel cell carcinoma is associated with old age, ex-

cessive exposure to ultraviolet light and a weak immune system.

Crucial association

A virus that is part of the normal skin flora - the Merkel cell polyomavirus - can get integrated in the human genome and undergo a mutation which causes it to promote the cancer. In studies, in about 60-80% of Merkel cell carcinoma patients, the tumours were found to test positive for the virus. It is important to know this from the point of view of targeting treatment as well as for giving a prognosis. Earlier studies have shown that the Merkel cell carcinoma caused by the virus is less aggressive and

We find that if Merkel cell polyoma virus is present at even femto-moles we can detect viral DNA and thereby diagnose the cancer.

REETY ARORA
NCBS, Bengaluru

progresses slower than that caused by excessive exposure to ultraviolet light.

"Our test, though presently in initial stages, combines the exciting new CRISPR technology with diagnostics and viral detection and holds promise for use in clinics [sometime] in the future" says Reety Arora from NCBS in an email to *The Hindu*. She is the corresponding author of

a paper on the work published in *Frontiers in Molecular Biosciences*.

DETECTR system

The team adapted a system named DETECTR (DNA endonuclease-targeted CRISPR trans reporter) to help them in this endeavour. The system consists of three components: identifier, switch and reporter. The identifier is a "guide RNA" which can recognise and bind to a section of the Merkel cell polyoma virus. The switch is a DNA-cutting enzyme known as Cas-12a which gets attached to the guide RNA after it finds its target DNA. The reporter consists of a single stranded DNA tagged with a fluores-

cent molecule.

When the guide RNA attaches itself to the viral DNA segment, the attached Cas-12a enzymes get activated and start cutting the "target" virus DNA. They also are enabled to cut up the single-stranded DNA tagged with fluorescent molecule.

This then causes the fluorescent molecules to glow, which can be detected. Also, the strength of the glow depends on the number of activated Cas-12a molecules, which in turn depends on the number of virus DNA copies recognised in the tumour DNA. This therefore gives a measure of the number of viruses in the tumour.

"We tested the amount of

MCV DNA that can be detected by our system. And we find that if MCV is present at even femto-moles (10 to the power of minus fifteen moles) we can detect MCV DNA [and thereby diagnose]," says Dr Arora.

"Our future plans include developing this as a diagnostic test and hopefully in a colourimetric format," she says. A colourimetric test would use an indicator that is visible to the naked eye, hence, it will eliminate the need for a fluorescence reader to see the test results.

"This way, we won't need any special equipment or training to perform the test and the test will be easy to use in clinics," she adds.