SNAPSHOTS

Ancient food
Our taste for starchy foods began in the Middle Stone Age, nearly 1,70,000 years ago, a new study published in *Science* finds. Researchers identified whole, charred remains of the plants from the genus *Hypoxis* in Border Cave in South Africa. This must have been key in facilitating the mobility of humans then.

New treatment
Researchers have shown that a novel protein derived from blood cells that aid in clotting can be used as a therapy to improve outcomes following heart attack. The study said infusing this protein into subjects that have had heart attacks has many benefits. However, further research is needed.

River ice cover loss
The annual river ice cover will decline by about six days for every one degree Celsius increase in global temperatures, posing economic and environmental consequences, according to a study published in the journal *Nature*. This is the first study to look at the future of river ice on a global scale.

No eyes, can see!
A cousin of the starfish that resides in the coral reefs of the Caribbean and Gulf of Mexico lacks eyes, but can still see, according to a study in *Current Biology*. This creature expands the boundaries of the sense of sight The red brittle star, *Ophiocoma wendtii*, is the second creature to have this sense.

Black hole feed
Astronomers have identified gas haloes around some of the earliest galaxies which must have fed the supermassive black holes at the centres of these galaxies. They used the ESO's Very large Telescope. Looking back in time nearly 12.5 billion years, this finding may explain how these black holes grew in size so rapidly.

Contrasting water-wetting behaviour used for anti-counterfeiting measure

The smart interface embedded with two water wettabilities can hide or reveal information

R. PRASAD

Researchers at the Indian Institute of Technology (IIT) Guwahati have developed a new approach to anti-counterfeiting measures. They have developed a smart interface embedded with two different water wettabilities – extremely water repelling (superhydrophobic) and extremely water loving (superhydrophilic) – which can hide information or make it visible under certain definite conditions. Adding a layer of complexity, the researchers used a molecular printer to imprint a pattern of micron size (500 x 500 microns) that will become visible only when dipped in water or when moist air is blown.

The team led by Uttam Manna from the Department of Chemistry and Centre for Nanotechnology at IIT Guwahati first dip-coated a glass surface for 10 minutes in a mixture of two chemicals and air-dried it to make it hydrophobic.

Play of light: The pattern which is highly water-loving permits water to get in thus allowing light to pass through easily. This makes the pattern visible when it is wet, say Uttam Kumar Manna (left) and Supriya Das (centre).

Reactive coating

The coating is not only hydrophobic but is also reactive. Taking advantage of the reactive surface of the coating, the researchers used a chemical (glucamine) to write letters on the coated surface. The glucamine-treated region becomes selectively and extremely water-loving (superhydrophilic) and hence becomes visible to the naked eyes when dipped in water or when moist air is blown.

Since the rest of the hydrophobic region of the coated surface is still chemically reactive, they modified it using another chemical (octadecylamine) to make the surface chemically inert. "At the same time, the octadecylamine makes the surface extremely water-repelling (superhydrophobic). So we introduced two extremely different water wetting behaviours to the surface to make only the pattern visible when immersed in water while the rest of the surface remains opaque as it is highly water-repelling," Prof. Manna says.

The printed letters or pattern become visible when dipped in water or when most air is blown. It once again becomes invisible when the pattern becomes dry. The transient and reversible identification of the hidden information was tested 100 times by exposing the pattern to mouth mist. The pattern becomes visible in 99% humid air.

"The pattern which is highly water-loving allows water to get in thus allowing light to pass through without much scattering. This makes the pattern visible when it is wet," explains Supriya Das from IIT Guwahati and first author of a paper published in the journal *ACS Applied Materials & Interfaces*. "The rest of the region is highly water-repelling so there is trapped air that scatters light and hence remains opaque."

"We initially tested the concept using a glass surface and then tested it using a filter paper. Since it is surface-independent, we can achieve similar results even when plastic, cloth or any other materials are used," he says.

Using micropatterns

Initially, the researchers use a pen containing glucamine chemical to write letters on the coated surface. To make the invisible text more complex and restrict it to a small region the IIT team turned to Dr. Michael Hirtz and his team at the Institute of Nanotechnology & Karlsruhe Nano Micro Facility at the Karlsruhe Institute of Technology in Karlsruhe, Germany. Dr. Hirtz produced micropatterns using a molecular printer.

The team found the patterned coating to be physically durable even when exposed to a very high (100 degree C) and very low temperature (10 degree C). Using an adhesive tape the researchers tested the durability when exposed to wear and tear. Though the top portion of the pattern was abraded during the peeling of the adhesive tape, the pattern continued to exhibit the same properties and became visible when exposed to water.

WHO prequalifies Serum's low-cost pneumococcal vaccine

The vaccine will cost only $2 per dose, which is 30% cheaper than the Gavi price

R. PRASAD

Pneumococcal vaccine developed by the Pune-based Serum Institute of India has been pre-qualified by the World Health Organisation (WHO) in the third week of December 2019. The prequalification of the vaccine by WHO was based on the results of a phase-3 trial (the final phase of human clinical trial) carried out in 2,250 children in Gambia, a small West African country.

According to a November 2019 UNICEF report, pneumonia caused 1,27,000 deaths in India in 2018, the second highest number of child mortality under the age of five in the world. In India, pneumonia and diarrhoea cause the most deaths in children under five years.

The pneumococcal vaccine PNEUMOSIL is a conjugate vaccine to help produce stronger immune response to a weak antigen. Serum Institute had optimised an efficient conjugate vaccine manufacturing processes for its meningitis A vaccine (MenAfriVac), which was used for manufacturing the pneumococcal vaccine. This helped the company reduce the manufacturing cost of pneumococcal vaccine.

Low cost vaccine

"We intent making the vaccine available to low- and middle-income countries for about $2 per dose, while countries pay nearly $3 when the vaccine is co-funded by Gavi," says Dr. Rajeev Dhere, Executive Director of Serum Institute. "This will make the vaccine 30% cheaper than the Gavi price and dramatically lower for countries that do not get the vaccines through Gavi."

The company already has a licence to manufacture and export the vaccine. The company has just completed the phase-3 trial in India and will soon be submitting the data to the Drugs Controller General of India (DCGI) for licensing.

In 2017, pneumococcal conjugate vaccine was included in the under India's Universal Immunisation Programme (UIP). It has been introduced in a phased manner starting with Himachal Pradesh, parts of Bihar, Uttar Pradesh, Madhya Pradesh and Rajasthan. A vaccine manufactured by a multinational company is being used for immunisation.

The efficacy of the Serum vaccine was tested against an already approved pneumococcal vaccine (Synflorix). In the Gambia trial, three doses of the vaccine were given to 2,250 infants at 6, 10, and 14 weeks and a booster dose was given to 675 infants at nine months age. "The efficacy of our vaccine was comparable with the existing approved vaccine tested during the trial," says Dr. Dhere. "It was based on the clinical trial data that the WHO prequalified the vaccine."

Offers wider protection

There are about 90 serotypes of pneumonia-causing bacteria (*Streptococcus pneumoniae*). The disease serotypes vary from one region to another. The 10 serotypes that are widely prevalent and responsible for causing pneumonia in Latin America, Africa and Asia, including India have been chosen for Serum's pneumococcal vaccine so that the vaccine confers greater protection.

Better vaccine: The Serum's pneumococcal vaccine is better than the currently available 10-valent vaccine.

Compared with existing 10-valent vaccine, Serum's vaccine contains two serotypes that are present in 13-valent pneumococcal vaccine. "The two serotypes present in the 13-valent vaccine have been included in our 10-valent vaccine to offer wider coverage of serotypes seen in Africa and Asia," says Dr. Dhere. This makes Serum's pneumococcal vaccine better than the currently available 10-valent vaccine.

Clinical trials

Phase-1 and phase-2 trials were earlier carried out in India. A phase-3 trial on 600 infants carried out in different places in India has just been completed. The trial tested the efficacy of the vaccine when given at 6, 10, and 14 weeks without a booster dose. "Since the phase-3 trial data from Gambia were already available before the trial could begin in India, the DCGI permitted the trial to be carried out on fewer children and without the booster dose," says Dr. Dhere. The trial was carried in collaboration with PATH with funding from the Bill & Melinda Gates Foundation.

Currently, Serum is conducting another trial in Gambia and India where the vaccine is given at 6 and 10 weeks and a booster dose at nine months of age. Using the two primary dose and a booster dose will help reduce the cost of immunisation. The two primary and booster dose schedule provides almost the same immune response as the three primary and a booster dose schedule.

"The three primary doses coincide with the pentavalent immunisation schedule, while the booster dose at nine months coincides with the first dose of measles vaccine," says Dr. Dhere.

How humans affect genetic connectivity of four mammals

Four wide-ranging mammals — jungle cats, leopards, sloth bears and tigers — were studied in central India

ASWATHI PACHA

Changing landscapes, habitat loss, fragmentation, and global climate change have been listed as the main reasons for biodiversity decline worldwide. Now, a new study from the National Centre for Biological Sciences (NCBS), Bengaluru, has added to the growing knowledge that anthropogenic activities can impact genetic connectivity or the movement among habitat patches usually resulting in mating and genetic exchange.

"In several mammalian carnivores, juveniles disperse away from their mother's territory to establish their own territory. Males are known to travel longer distances than females. Isolation of habitat patches (due to habitat destruction and fragmentation) can restrict animal movement among habitat patches and thus reduce genetic exchange and increase the probability of extinction. Hence maintaining connectivity is critical to ensure long term persistence of a species," Prachi Thatte explains. Dr. Thatte is the first author of the paper published in *Diversity and Distributions* and now works with WWF-India on connectivity conservation

Dangerous trend: Isolation of habitat patches can restrict animal movement thus reducing genetic exchange and increasing extinction probability ▪ SHIV KUMAR PUSHPAKAR

Four wide-ranging mammals –Jungle cats, leopards, sloth bears, tigers –were investigated for the genetic differentiation in central India, which is a critical landscape for several species. The DNA extracted from faecal samples were used for understanding genetic connectivity. The samples were collected from nine protected areas during the period 2012-2017.

The team looked at how land-use, human population density, nearby roads and traffic affected the genetic structure. The paper notes that tigers were impacted the most by high human footprint. "Although known to travel long distances and move through agricultural fields to some extent, tigers in central India do not have equally high genetic exchange throughout the landscape. Some protected areas like Bandhavgarh tiger reserve seem to be getting relatively isolated (the 2014 tiger census report also shows the same)," explains Dr. Thatte.

Jungle cats were found to be the least impacted. "That is likely because in central India, they occupy a variety of habitats including forests, scrublands, grasslands and even irrigated agricultural fields close to the forests," she explains.

Despite being the least impacted by human activity, the team encountered several jungle cat road-kills while carrying out fieldwork. She explains that with increasing infrastructure and traffic, systematically studying the impact of roads on smaller species like jungle cat and jackals and ensuring the presence of mitigation structures like underpasses and overpasses would be crucial to ensure that we don't fragment the currently well-connected populations.

IIndia has also started paying attention to wildlife corridors and encouraging engineering reforms to promote wildlife movements. Last year, the Ministry of Environment along with the Wildlife Institute of India released a document that lays out the regulatory requirements for developing roads, railways, powerlines while recognising the impacts on wildlife and people. NHAI and all PWDs have been instructed to follow the guidelines.

Bitter fact: Challenges of overweight, obesity and even early non-communicable disease are no longer just faced by adults. ▪ A. M. FARUQUI

The double burden of malnutrition: need for urgent policy action

India has addressed the problem but more needs to be done

SOUMYA SWAMINATHAN
PURNIMA MENON

Last year was a remarkable one for nutrition in India. After years of slow and somewhat tentative action to acknowledge, understand and act on the challenge of undernutrition, India's National Nutrition Mission brought focus and ambition and a range of actions followed. National and State governments were mobilised, district administrators engaged, the private sector mobilised in its own way, while civil society continued to push for accountability and action.

As researchers committed to evidence-informed policies and programmes, we welcome India's nutrition efforts. We call for even stronger systems to support the use of data and science to inform India's efforts, to track progress and to learn from both successes and failures.

The mission of using evidence to inform policy in nutrition in India goes back to the days of India's 'father of nutrition', Dr. C. Gopalan, someone whom both of us had the privilege of knowing and working with closely. He invested in connecting science with the policy world, but he also served in a world where information systems limited the reach and connect between science and policy. Today, that world has changed, information flows have been dramatically reshaped by technology - the science and evidence community must use these new tools, new networks and new ways to engage the public and the policy community on critical issues such as nutrition.

Key challenges

What are some challenges that face India on the nutrition front as we approach the decade of action for the SDGs?

First, work led by ICMR and published recently in the *Lancet Global Health* shows that progress in maternal and child undernutrition varies tremendously by State. It also highlights how malnutrition contributes the most to child deaths as well as disability in adults. Saving lives of children under five in India will require a steady focus on nutrition.

Second, new data on malnutrition among children from the Comprehensive National Nutrition Survey highlights how challenges of overweight, obesity and even early non-communicable disease, are no longer adult challenges. About 10% of children under 19 years have pre-diabetes. Coherence is needed in areas of public policy across multiple ministries - incentivising the cultivation and consumption of a range of food commodities; using the levers of government financing to buy better nutrition (not just more calories) in programmes such as the PDS, ICDS and school meals; ensuring optimal healthcare of adolescents, pregnant women and young children; restricting the marketing of unhealthy foods and drinks; and expanding efforts to improve nutrition literacy.

Third, India's adults also bear a tremendous double burden of malnutrition. Recent work from IFPRI and Emory University, has highlighted how economic progress is a double-edged sword - reducing underweight among women while also exacerbating the challenge of overweight among others. Today, some districts in India have levels of overweight that are as high as 40%.

Fourth, a range of studies published by researchers in India and abroad, demonstrate that social determinants related to gender, education, sanitation and poverty are key drivers of stunting and undernutrition. Early-life undernutrition is an important risk factor for later-life adult disease, along with food environments, physical activity and preventive healthcare.

Programmes and policy

Today, India's efforts in tackling malnutrition have already come a long way - a range of programmes and policies have been launched against child undernutrition (POSHAN Abhiyaan), anaemia (Anaemia Mukt Bharat) and healthy eating (Eat Right India). However, malnutrition does not exist in isolation - individuals, households and communities share multiple forms of malnutrition. Therefore, it is imperative that policy efforts also come together under a common umbrella and an overarching body is needed to ensure convergence.

Given the diversity and complexity of the challenge, we call for an even sharper evidence-based and data-driven approach to diagnosing the challenge of malnutrition in India's states, districts and communities. We call for a nuanced understanding of the risk factors that contribute the most to the multiple burdens. And we call for the use of data on the reach of programmes and interventions to identify critical gaps and fuel rapid action.

The underlying data that is now available to undertake these assessments, such as the Comprehensive National Nutrition Survey, must be made available to the scientific community. Silos in data systems should be broken and community health-workers and anganwadi workers provided feedback on areas of good performance and where improvement is needed.

On actions, a range of evidence-informed options are available to India as they are to the global community - the World Health Organization's updated Essential Nutrition Actions Across the Life Course, is a critical guide that must be adapted to India's needs.

Addressing the double burden of malnutrition will take an unrelenting focus in coming years - the challenge is complex, the actions needed must come from different sectors, and data and accountability mechanisms must absolutely inform what happens next. The consequences of poor nutrition are too broad, too deep and too costly for society to ignore.

(Soumya Swaminathan is Chief Scientist at the World Health Organization and is based in Geneva, and Purnima Menon is Senior Research Fellow with the International Food Policy Research Institute, and is based in New Delhi, India.)