

CAPSULE



Massive burst of light
When a massive star dies with a supernova explosion or condensed objects like neutron stars merge in a violent process, they let off bursts of photons lasting a few milliseconds. These are known as gamma ray bursts. Recently, researchers observed the most powerful gamma ray burst that has been recorded until now, as reported in a *Nature* paper.



Beetle horns
Scarab Beetles (dung beetles) have hornlike structures that are among the most pronounced secondary sexual traits in the animal kingdom. These are relatively novel developments evolutionarily. A study published in *Science* finds that these are generated from wing homologues and that other insect traits may have followed similar paths. Homologues are genes that ate similar and have a common evolutionary ancestor.

Infants become susceptible to measles infection earlier than thought

Currently, children in India are vaccinated only at 9-12 months, leaving them open to infection

R. PRASAD

Contrary to the common notion that maternal antibodies against measles protect infants for the first six months of age, a small study involving 25 infants once again shows that antibodies from the mother almost disappear by the end of three months. Hence, infants become susceptible to measles infection at the end of three months and not six months as earlier thought.

Currently, as per the World Health Organization (WHO) recommendation, children in countries like India with ongoing transmission of measles are vaccinated only at 9-12 months of age. In countries with no ongoing transmission, the first dose is administered when the baby is 12-15 months of age. This would mean that babies would remain susceptible to measles infection for a longer period of time before they get vaccinated with the first dose.

The study was carried out on 25 infants in a single tertiary hospital in Toronto, Canada. All the 25 infants had no underlying medical condition and were born at 37 weeks or more of gestation to mothers who were, on av-



Lower protection: Infants born to mothers in countries where measles virus has been eliminated have lower maternal antibodies to start with. ■ JIM GOODSON/CDC

erage, 32 years old. Measles is a highly infectious acute viral illness that can lead to severe complications, such as pneumonia, encephalitis and death. Children younger than five years who get infected with measles have higher rates of complications, hospitalisation and even death.

Antibody levels
The study published in the journal *Pediatrics* found that of the 25 infants studied, 20% (five of 25) infants had antibodies below the protective threshold even by the end of the first month after

birth. And 92% infants had maternal antibodies below the protective threshold by the end of three months. By six months all the babies had antibody levels below the protective threshold.

Based on statistical modelling, the authors found that in Canada the probability of infants getting infected increased with maternal age. This is because pregnant mothers remain protected through vaccination and not through natural infection. They predict that a one-month-old infant has 25% probability of getting infected with measles if the moth-

er is 25 years old but the probability increases to 40% if the mother is 40 years old.

Endemic settings
Babies are considered to be protected against measles through maternal antibodies for the first six months based on studies carried out in measles-endemic settings. In these settings, as in the case of India, many mothers gain immunity through natural infection and are also continually exposed to the virus, leading to "repeated immunologic boosting and more robust antibody levels". But in countries where measles has been eliminated or is close to elimination, mothers gain immunity through childhood vaccination, which has been associated with lower antibody levels compared with natural infection.

Infants born to mothers in countries where measles virus has been eliminated have lower maternal antibodies and these antibodies quickly fall below the threshold of protection leaving them to susceptible to infection before they receive the first measles vaccination dose, the authors note.

However, in the case of India, the virus is in circulation and causes many infections

each year (there were nearly 72,000 cases in India during October 2018-2019, the third highest in the world). Also, the vaccine coverage with two doses is less than 95% to offer protection to infants who are yet to be vaccinated. Hence, infants in India who are too young to receive the first dose of the vaccine are at greater risk of getting infected.

Best strategies

The authors note that pregnant mothers cannot be administered measles vaccine as the vaccine uses live, weakened virus. According to an Opinion piece published alongside the paper, vaccine-induced protection would be less in infants if the vaccine is given earlier than recommended. Also, early vaccination may "alter response" after the second dose of vaccine, leading to "lower levels of the antibody" compared with children who are vaccinated as per schedule.

"Therefore, the best strategy for protecting infants against measles is adequate community protection delivered through high coverage [over 95%] of two doses of measles-containing vaccine," the authors of the paper write.



Vocal skills: Parakeets mimic our sounds and words, and "talk" human language. ■ C.V. SUBRAMANYAM

How we learn new languages: songbirds offer insight

A recent study on zebra finches and owl finches shows a genetic link



SPEAKING OF SCIENCE

D. BALASUBRAMANIAN

We humans have used other animals as models to understand our own biological features and their mechanisms. The common fruit fly has been used for identifying several genes and how mutations in them are related to physiological and biochemical defects. Many of the genes in the transparent worm called *C. elegans* have functional counterparts in humans. Mice, rats and rabbits are somewhat "higher" animals and have offered us even greater insights. Such model organisms are easy to maintain and breed in the lab and can be studied right from their birth, adulthood and through their lifetime in short spans of time.

But when it comes to understanding the brain and the neurological basis of some actions, in particular, how we speak, sing, imitate and learn foreign words and languages, the above models are not the best. Some have tried using our closest ancestors, such as chimpanzees, in order to understand how they speak, sing or learn other words, but alas, with little success. Two psychologists (C & K Hayes) adopted a baby chimpanzee at their home, brought it up as a child and tried to teach this little girl chimp (called Viki) to speak human language. Alas, besides trying to say "mama", "papa", "up" and "cup", Viki could do nothing more. The gradual shaping of her jaw and lips (as she tried hard) allowed her to utter these words, nothing more. It appears that the neural and physiological set up which she had, Viki could only utter chimp sound but not imitate humans. Likewise, another couple (the Gardners) had bred a chimp (called Washoe) at home, and she did a little better than Viki, in that she could do learn a 'foreign' language (not spoken but gestural), namely the American Sign Language (ASL), in which she could learn as many as 350 ASL signs and respond to some questions in this non-verbal language. It would thus appear that the necessary anatomical vocal 'hardware' is inadequate here, though the 'software' to learn is developed somewhat in chimps. We, their descendants, are blessed with the right hardware and software.

Animal models

Thus in looking for animal models for understanding how we speak, sing, imitate and learn 'foreign languages'—and such brain-based activities—we need to go back in evolution and see which animals have been doing these activities, and which parts of their brains are involved in these, and look for similar features in the human brain. And the best animals models used so far are songbirds such as parrots, mynahs, finches, hummingbirds and such. For example, some of us keep parrots as pets at home and find that they not only utter their own words, calls and species songs, but also learn to mimic our sounds and words, and "talk" human language. This shows that, these songbirds have parts in their brain which play a key role not only in the normal vocal development which helps them in learning to speak/sing their own 'species' language (the normal genetically programmed ones from their parents), but also to imitate those of others. This has offered some insight and parallels with our own vocal development of learning to speak, sing and so forth.

An early summary, well worth reading, is from Peter Marler in the journal *American Scientist*; 1970;58:669-673, available online. While all animals, cats or chimps are programmed to learn and vocalise their own species language (grunts, gestures and such), learning and imitating is done by songbirds which arose 250 million years ago, and us humans, who came on earth only 2-3 million years ago.

How songbirds learn

Songbirds learn their species language, just like other animals do, by imitating the sounds of older members of their own species. This they do by modifying their voices such that they match what they have memorised. A newborn songbird starts with a babbling voice and sounds, which in a few weeks, turns to the language of the species; in other words, this "subsong" becomes the "song" of the species language. Note, too, how a newborn human infant babbles, which turns into human language—the language spoken at home by its parents and family members.

F. Nettlebohm, in his review article on the neural basis of birdsong (*PLoS Biology*, 2005; 3(5):759-761; e16) points out that there is a group of discrete brain areas (called nuclei) and their connecting pathways, referred to as the song system or song nuclei. In hummingbird brains (likewise in other songbirds, such as parrots) there are 7 discrete structures which are active during singing, showing that these are the anatomical and functional 'vocal nuclei'. In such vocal learning birds, the brain's forebrain region appears divided into two sub-pathways: in a vocal motor pathway used to produce learned vocalization, and the other, a loop, that allows the modification of these 'songs'. We humans too have similar forebrain pathways (Davis, *J. Ornithol.* 2007; 148(1); 35-44).

An interesting work, in this connection, has appeared from a Japanese group in Hokkaido, this month (Wang et al., *PLoS Biology* 17(11): e3000476;https://doi.org/10.1371/journal.pbio.3000476). They studied the singing pattern of two finches—zebra finches (abbreviated as *Z*) and owl finches (*O*), and studied the genes that are expressed in the song nuclei of each of them. There was about 10% difference in the expression of the genes, leading to different species songs that they sing. Next, they crossed the two species and produced two hybrids (*Zo*, and *Oz*, depending on which male crossed with which female), and recorded their songs. The *Zo* hybrid sang both her parents' species songs, the zebra finch song and also the owl finch song; likewise the hybrid *Oz* sang the owl finch species song, plus the *Z* song! More such inter-species hybrids would offer additional insights, though we cannot do so with humans (ethical considerations)!

The researchers urge immediate work be carried out to bridge the gap between policy and practice. They also call for a broader health strategy, to effectively address this issue.

dbala@hpej.org

Music is humankind's universal language: study

Lullabies and dance songs were ubiquitous and also highly stereotyped

PRESS TRUST OF INDIA

Songs spanning different languages and ethnic groups across the world exhibit common behavioural patterns, according to a first-of-its-kind study which suggests that human culture everywhere is built from common psychological building blocks.

The study, published in the journal *Science*, reports the first comprehensive scientific analysis of the similarities and differences in the types of music produced by various ethnicity around the world.

It looked at more than a century of research on the historical and cultural context of music, or ethnomusicology, of more than 300 societies across the globe.

The researchers from Harvard University in the US collected hundreds of music recordings in libraries and private collections of scientists half way across the world, culminating in around 5,000 song descriptions from 60 cultures spanning 30 distinct geographic regions globally.

They analysed the discography in four different ways—machine summaries, listener ratings, expert annotations

and expert transcriptions. The results of the study revealed that across societies, music is associated with behaviours such as infant care, healing, dance, love, mourning and warfare.

According to the researchers, these behaviours are not too different between societies.

While examining lullabies, healing songs, dance songs, and love songs, they found that songs sharing similar behavioural functions had common musical features.

"Lullabies and dance songs are ubiquitous, and they are also highly stereotyped," study co-author Manvir Singh said.

"For me, dance songs and lullabies tend to define the space of what music can be. They do very different things with features that are almost the opposite of each other," Singh said.

According to Singh, the distinct similarity in the music produced by different societies is evidence that human culture everywhere is built from common psychological building blocks.

The researchers said the study may also help unlock the governing rules of "musical grammar."

Pesticide exposure among tea estate workers could affect their DNA

To prevent further health problems, they need to take precautions

ASWATHI PACHA

In the lush tea gardens of northern West Bengal, hundreds of men and women go about their daily business. But lurking here is a hidden danger they are unaware of—pesticide exposure, which is a growing global concern today. Susmita Dutta from the University of North Bengal, set out to investigate this problem in the tea gardens of Darjeeling foothills as a part of her doctoral research.

Two reports recently published by the team points out that chronic exposure to the mixture of pesticides has led to changes in the DNA and also decreased certain enzyme activity.

Enzyme activity

The team collected blood samples from over 200 individuals which included estate workers, controls who didn't smoke or drink and two more control groups who either smoked or consumed alcohol.

Detailed analysis showed that the estate workers both men and women, irrespective of whether they



Sans protection: The workers were not wearing protective gear such as masks, gloves and boots. ■ PARIMALA RAO

smoked or consumed alcohol, showed decrease in enzyme activity, especially enzymes AChE and BuChE.

"AChE is known to be target of most organophosphates. AChE terminates synaptic (neuron to neuron) transmission, preventing continuous nerve firings at nerve endings. Organophosphorous pesticides bind to this site and inactivate the enzymes. In the long run, these may even cause other neurological complications. Some studies have pointed out that herbicide and fungicide exposure is associated with Parkinson's disease too," explains Dr.

Dutta, the first author of the paper published in *Biomarkers*.

Another paper published by the team in *Mutation Research - Genetic Toxicology and Environmental Mutagenesis*, shows that pesticide exposure led to DNA damage.

Comet assay

The team used a special study called comet assay which helps assess DNA damage and found that individuals exposed to pesticides had significantly higher value of certain parameters which suggest damage compared to control subjects.

Study of one lakh individuals finds why India's children are anaemic

The research revealed an inverse relationship between mother's education and incidence of childhood anaemia

ASWATHI PACHA

Last month, during the festive season, an ad campaign urged Indian women to invest in iron-rich food and focus on whether they were anaemic. Around the same time, a *Lancet Global Health* report noted that 23% of Indian men suffered from anaemia. Adding to these findings, now a paper published in *Scientific Reports* points out that about 58.5% of children below five years of age in India are anaemic.



Nutrition imbalance: Overall, vitamin A and iron intake was lower than the recommended level. ■ B. JOTHI RAMALINGAM

maternal age, type of residence are the main reasons behind the incidence of childhood anaemia.

"Maternal education plays a very important role in reducing the incidence of childhood anaemia in any society and indeed in India. It increases the chances of mothers appreciating the is-

ssues involved and taking the correct and appropriate steps towards preventing it. Our study revealed an inverse relationship between the mother's education and incidence of childhood anaemia, in India.

In other words, as the mother's education level increases, the tendency of the

child to be anaemic decreases significantly," explains Nkechi Onyeneho in an email to *The Hindu*. She is the first and corresponding author of the paper published in *Scientific Reports*.

The report notes that even the richest households had anaemic children. While 52.9% of children in the rich households were marked anaemic, the number was 63.2% in the poorest households. Overall, vitamin A and iron intake was also lower than the recommended level.

Meaningful intervention

Dr. Onyeneho explains that nutritional and iron deficiencies top the list of factors that predispose children to anaemia in India and these should be prioritised in any intervention. "From our previous study of intergenera-

tional anaemia, we observed that in addition to maternal influence on childhood anaemia, paternal and overall household influences must be considered for a more comprehensive policy framework for intervention at the household level," she adds.

Premature delivery

Previous studies from across the globe have shown that severe anaemia in mothers and premature delivery can also lead to childhood anaemia and so the mother's health needs to be addressed as well.

Dr. Onyeneho says that the most shocking find for her was the inverse relationship between the age of mothers and the incidence of anaemia in children. The study showed that children of younger mothers are more

anaemic. "While one may understand the powerlessness of mothers 15-19 years [old] in ensuring the children get the right food. It also reveals the power dimension in the household allocation and use of resources." The team has now planned to study gender power relations in household and how it influences childhood anaemia in India.

The paper notes that though India has an anaemia control programme which recommends iron intake and folic acid supplements, the results show that the programme has not been a success.