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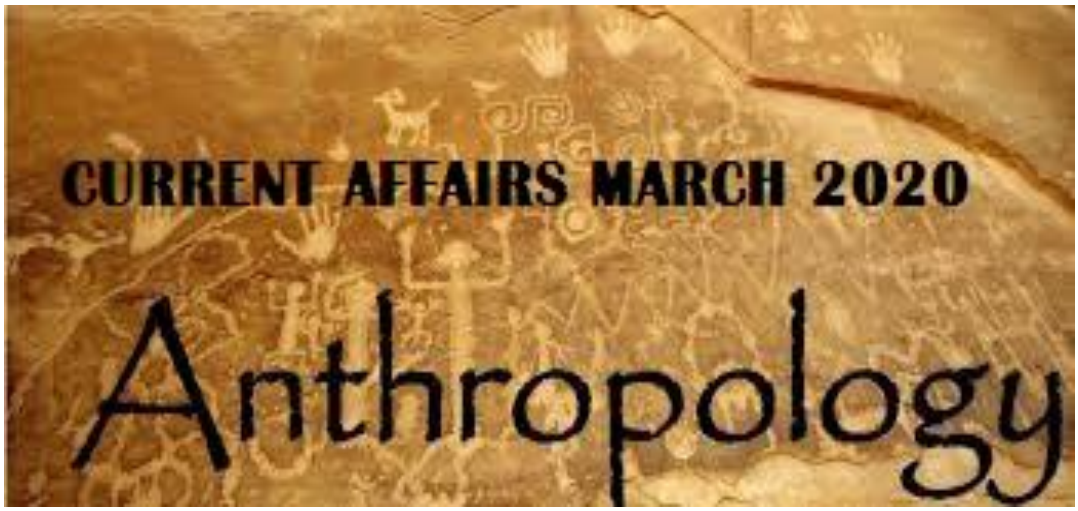

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PAPER -1

1. Canadian scientists develop new antibiotic that prevents cell division.

Older antibiotics like penicillin kill bacteria by preventing their cell wall from being built in the first place

A new group of antibiotics has been discovered by scientists at McMaster University in Ontario, Canada, that can be useful in the battle against antimicrobial resistance (AMR).

Corbomycin and complestatin work by prevent the bacterial wall from being broken down, thus stopping the division of bacterial cells.

This, the scientists said, was in contrast to older antibiotics like penicillin that kill bacteria by preventing the wall from being built in the first place.

"Bacteria have a wall around the outside of their cells that gives them shape and is a source of strength," study author Beth Culp, a PhD candidate at McMaster University, was quoted as saying in media reports.

For their research, the scientists studied a class of antibiotics called glycopeptides that are produced by bacteria found in the soil. They studied the genes of those members that lacked known resistance mechanisms.

"We hypothesised that if the genes that made these antibiotics were different, maybe the way they killed the bacteria was also different," Culp was quoted as saying.

Using cell imaging techniques, the group found that the antibiotics functioned by attacking the bacterial cell wall. They came across the new corbomycin and the lesser-known complestatin.

The researchers were able to demonstrate that these antibiotics were able to block infections in mice by a group of drug-resistant bacteria known as *Staphylococcus aureus*. This class of bacteria is known to cause serious infections.

AMR is a global public health threat, according to the World Health Organization. Misuse of antibiotics in humans, animals, and aquaculture contributes to AMR. Also, poor management of waste from farms, factories, healthcare settings and households adds to the problem.

On July 26, 2019, Madhya Pradesh became the second state in India after Kerala to develop an action plan to manage AMR.

Experts from 10 African countries met in Lusaka, Zambia on January 22-24, 2020, to figure out ways to tackle AMR. Asia and Africa will account for 88.8 per cent of deaths from AMR in the future.

2. Fish fossil show how fins evolved into human hands.

What?

Researchers have revealed new insights into how the human hand evolved from fish fins based on their analysis of an ancient fossil of Elpistostege watsoni , which lived about 380 million years ago found in Miguasha, Canada.

Palaeontologists, including those from Flinders University in Australia, said the fish specimen has yielded the missing evolutionary link in the transition from fish to four legged animals.

When?

During the Late Devonian period, millions of years ago, as fish began to foray in habitats such as shallow water and land.

Key findings:

1. 1.57 m long fossil shows the complete arm — pectoral fin — skeleton for the first time in any elpistostegalian fish.

2. The articulating digits in the fin are like the finger bones found in the hands of most animals.

3. It pushes back the origin of fingers in vertebrates to the fish level.

4. The origin of digits relates to developing the capability for the fish to support its weight in shallow water or for short trips out on land.

3. How millets sustained Mongolia's empires

Summary:

Researchers examined stable isotopes from bone collagen and dental enamel to reconstruct the diets of ancient Mongolians. Findings challenge the popular notion of a completely nomadic prehistoric population, linking grain cultivation with the success of the Xiongnu Empire (c. 200 BCE-150 CE) and showing continual grain consumption during the Mongol Empire of the Khans (c. 1200-1400 CE).

The historic economies of Mongolia are among the least understood of any region in the world. The region's persistent, extreme winds whisk away signs of human activity and prevent the buildup of sediment which archaeologists rely on to preserve the past. Today crop cultivation comprises only a small percent of Mongolia's food production, and many scholars have argued that Mongolia presents a unique example of dense human populations and hierarchical political systems forming without intensive farming or stockpiling grains.

The current study, led by Dr. Shevan Wilkin of the Max Planck Institute for the Science of Human History provides, for the first time, a detailed glimpse into the diets and lives of ancient Mongolians, underscoring the importance of millets during the formation of the earliest empires on the steppe.

Isotopic analysis and the imperial importance of millets

Collaborating with archaeologists from the National University of Mongolia and the Institute of Archaeology in Ulaanbaatar, Dr. Wilkin and her colleagues from the MPI SHH sampled portions of teeth and rib bones from 137 previously excavated individuals. The skeletal fragments were brought back to the ancient isotope lab in Jena, Germany, where researchers extracted bone collagen and dental enamel to examine the ratios of stable nitrogen and carbon isotopes

within. With these ratios in hand, scientists were able to reconstruct the diets of people who lived, ate, and died hundreds to thousands of years ago.

Researchers tracked the trends in diet through the millennia, creating a "dietscape" which clearly showed significant differences between the diets of Bronze Age peoples and those who lived during the Xiongnu and Mongol Empires. A typical Bronze Age Mongolian diet was based on milk and meat, and was likely supplemented with small amounts of naturally available plants. Later, during the Xiongnu Empire, human populations displayed a larger range of carbon values, showing that some people remained on the diet common in the Bronze Age, but that many others consumed a high amount of millet-based foods. Interestingly, those living near the imperial heartlands appear to have been consuming more millet-based foods than those further afield, which suggests imperial support for agricultural efforts in the more central political regions. The study also shows an increase in grain consumption and increasing dietary diversity through time, leading up to the well-known Mongolian Empire of the Khans.

Rethinking Mongolian prehistory

The new discoveries presented in this paper show that the development of the earliest empires in Mongolia, like in other parts of the world, was tied to a diverse economy that included the local or regional production of grain. Dr. Bryan K. Miller, a co-author who studies the historical and archaeological records of Inner Asian empires, remarks that "these regimes were like most empires, in that they directed intricate political networks and sought to amass a stable surplus -- in this case a primarily pastoral one that was augmented by other resources like millet."

"In this regard," Dr. Miller adds, "this study brings us one step closer to understanding the cultural processes that led humanity into the modern world."

The view that everyone in Mongolian history was a nomadic herder has skewed discussions concerning social development in this part of the world. Dr. Wilkin notes that "setting aside our preconceived ideas of what prehistory looked like and examining the archaeological record with modern scientific approaches is forcing us to rewrite entire sections of humanity's past." Dr. Spengler, the director of the archaeobotany labs at the MPI SHH, emphasizes the importance of this discovery, noting that "this study pulls the veil of myth and lore off of the

real people who lived in Mongolia millennia ago and lets us peak into their lives."

4. Apes' inner ears could hide clues to evolutionary history of hominoids

New findings highlight the potential of the inner ear for reconstructing the early branches of our family tree

Summary:

Studying the inner ear of apes and humans could uncover new information on our species' evolutionary relationships, suggests a new study.

Studying the inner ear of apes and humans could uncover new information on our species' evolutionary relationships, suggests a new study published today in *eLife*.

Humans, gorillas, chimpanzees, orangutans and gibbons all belong to a group known as the hominoids. This 'superfamily' also includes the immediate ancestors and close relatives of these species, but in many instances, the evolutionary relationships between these extinct ape species remain controversial. The new findings suggest that looking at the structure (or morphology) of the inner ears across hominoids as a whole could go some way to resolving this.

"Reconstructing the evolutionary history of apes and humans and determining the morphology of the last common ancestor from which they evolved are challenging tasks," explains lead author Alessandro Urciuoli, a researcher at the Institut Català de Paleontologia Miquel Crusafont (ICP) in Barcelona, Spain. "While DNA can help evolutionary biologists work out how living species are related to one another, fossils are typically the principle source of information for extinct species, although they must be used with caution."

The bony cavity that houses the inner ear, which is involved in balance and hearing and is fairly common in the fossil record, has proven useful for tracing the evolution of certain groups of mammals. But until now, no studies have explored whether this structure could provide insights into the evolutionary relatedness among living and extinct hominoids.

To address this, Urciuoli and his team used a 3D imaging technique to capture the complex shapes of the inner ear cavities of 27 species of monkeys and apes, including humans and the extinct ape Oreopithecus and fossil hominin Australopithecus. Their results confirmed that the shape of these structures most closely reflected the evolutionary relationships between the species and not, for example, how the animals moved.

The team next identified features of these bony chambers that were shared among several hominoid groups, and estimated how the inner ears of these groups' ancestors might have looked. Their findings for Australopithecus were consistent with this species being the most closely related to modern humans than other apes, while those for Oreopithecus supported the view that this was a much older species of ape related in some respects with other apes still alive today.

"Our work provides a testable hypothesis about inner ear evolution in apes and humans that should be subjected to further scrutiny based on the analysis of additional fossils, particularly for great apes that existed during the Miocene," says senior author David Alba, Director of the ICP. The Miocene period, which extends from about 23 to five million years ago, is when the evolutionary path to hominoids became distinct.

Urciuoli adds that, in years to come, disentangling the kinship relationships between Miocene apes will be essential for improving our understanding of the evolution of hominoids, including humans and our closest living relatives, the chimpanzee and bonobo.

5. Siberian Neanderthals originated from various European populations

Summary:

At least two different groups of Neanderthals lived in Southern Siberia researchers have now shown that one of these groups migrated from Eastern Europe.

At least two different groups of Neanderthals lived in Southern Siberia and an international team of researchers including scientists from Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) have now proven that one of these groups migrated from Eastern Europe. The researchers have now published their

findings in the journal *Proceedings of the National Academy of Sciences* of the United States of America (*PNAS*).

Neanderthals were widespread in Europe and also migrated to Southern Siberia, but the origins of these Siberian Neanderthals and when they migrated was not known.

An international team of researchers including archaeologist Thorsten Uthmeier, professor of Prehistory and Protohistory at FAU, have now examined tools found in the Chagyrskaya cave in the Altai mountains in Russia in order to find the answer.

Parallels to sites in Central and Eastern Europe

The site has been excavated since 2019 as part of a DFG research project in conjunction with the Siberian Branch of the Russian Academy of the Sciences in Novosibirsk. In addition to stone tools and bones from hunting remains, two main find layers yielded numerous Neanderthal fossils. After discovering that the stone tools did not resemble any of the tools from groups living in the Altai during the same period, the team searched for comparable finds in a larger radius.

Geometric morphological analyses of 3D models of scanned tools showed that the stone tools found in the Chagyrskaya cave were very similar to artefacts from the Micoquien, which is the name given to the corresponding stone tool industry in Central and Eastern Europe. The comparative scans originate among others from find sites in Bavaria including FAU's own Sesselfelsgrotte cave, in which most of the artefacts used in the comparison were found.

The researchers were able to reconstruct the route of migration of the Siberian Neanderthals using DNA analyses of Neanderthal bones and sediments from the Chagyrskaya cave. The route led the groups during the course of several generations via Croatia and the North Caucasus to the Altai.

Several groups of Neanderthals migrated to Siberia

The DNA analyses also showed that the Neanderthals from the Chagyrskaya cave differ significantly in terms of their DNA from a second Altai group found in the Denisova cave. This discovery fits with the observation that the Denisova Neanderthals were apparently not familiar with tools from the Micoquien. The

research team therefore presumes that several groups of Neanderthals migrated to Siberia.

The interdisciplinary examinations of the Neanderthals found in the Chagyrskaya cave, in which Bavarian find sites investigated by FAU play an important role, clearly show that the wave of migration of groups of this species of human 60,000 years ago originated in Central and Eastern Europe.

At the same time, the researchers from Novosibirsk led by Professor Ksenia Kolobova and from FAU found rare evidence that artefacts are culturally informative indicators of population movements.

6. Cosmic impact caused destruction of one of world's earliest human settlements

Summary:

Before the Taqba Dam impounded the Euphrates River in northern Syria in the 1970s, an archaeological site named Abu Hureyra bore witness to the moment ancient nomadic people first settled down and started cultivating crops. A large mound marks the settlement, which now lies under Lake Assad.

Before the Taqba Dam impounded the Euphrates River in northern Syria in the 1970s, an archaeological site named Abu Hureyra bore witness to the moment ancient nomadic people first settled down and started cultivating crops. A large mound marks the settlement, which now lies under Lake Assad.

But before the lake formed, archaeologists were able to carefully extract and describe much material, including parts of houses, food and tools -- an abundance of evidence that allowed them to identify the transition to agriculture nearly 12,800 years ago. It was one of the most significant events in our Earth's cultural and environmental history.

Abu Hureyra, it turns out, has another story to tell. Found among the cereals and grains and splashed on early building material and animal bones was meltglass, some features of which suggest it was formed at extremely high temperatures -- far higher than what humans could achieve at the time -- or that could be attributed to fire, lighting or volcanism.

"To help with perspective, such high temperatures would completely melt an automobile in less than a minute," said James Kennett, a UC Santa Barbara emeritus professor of geology. Such intensity, he added, could only have resulted from an extremely violent, high-energy, high-velocity phenomenon, something on the order of a cosmic impact.

Based on materials collected before the site was flooded, Kennett and his colleagues contend Abu Hureyra is the first site to document the direct effects of a fragmented comet on a human settlement. These fragments are all part of the same comet that likely slammed into Earth and exploded in the atmosphere at the end of the Pleistocene epoch, according to Kennett. This impact contributed to the extinction of most large animals, including mammoths, and American horses and camels; the disappearance of the North American Clovis culture; and to the abrupt onset of the end-glacial Younger Dryas cooling episode.

The team's findings are highlighted in a paper published in the Nature journal *Scientific Reports*.

"Our new discoveries represent much more powerful evidence for very high temperatures that could only be associated with a cosmic impact," said Kennett, who with his colleagues first reported evidence of such an event in the region in 2012.

Abu Hureyra lies at the easternmost sector of what is known as the Younger Dryas Boundary (YDB) strewnfield, which encompasses about 30 other sites in the Americas, Europe and parts of the Middle East. These sites hold evidence of massive burning, including a widespread carbon-rich "black mat" layer that contains millions of nanodiamonds, high concentrations of platinum and tiny metallic spherules formed at very high temperatures. The YDB impact hypothesis has gained more traction in recent years because of many new discoveries, including a very young impact crater beneath the Hiawatha Glacier of the Greenland ice sheet, and high-temperature meltglass and other similar evidence at an archaeological site in Pilauco, located in southern Chile.

"The Abu Hureyra village would have been abruptly destroyed," Kennett said. Unlike the evidence from Pilauco, which was limited to human butchering of large animals up to but not younger than the YDB impact burn layer, Abu Hureyra shows direct evidence of the disaster on this early human settlement. An impact or an airburst must have occurred sufficiently close to send massive heat and molten glass over the entire early village, Kennett noted.

The glass was analyzed for geochemical composition, shape, structure, formation temperature, magnetic characteristics and water content. Results from the analysis showed that it formed at very high temperatures and included minerals rich in chromium, iron, nickel, sulfides, titanium and even platinum- and iridium-rich melted iron -- all of which formed in temperatures higher than 2200 degrees Celsius.

"The critical materials are extremely rare under normal temperatures, but are commonly found during impact events," Kennett said. According to the study, the meltglass was formed "from the nearly instantaneous melting and vaporization of regional biomass, soils and floodplain deposits, followed by instantaneous cooling." Additionally, because the materials found are consistent with those found in the YDB layers at the other sites across the world, it's likely that they resulted from a fragmented comet, as opposed to impacts caused by individual comets or asteroids.

"A single major asteroid impact would not have caused such widely scattered materials like those discovered at Abu Hureyra," Kennett said. "The largest cometary debris clusters are proposed to be capable of causing thousands of airbursts within a span of minutes across one entire hemisphere of Earth. The YDB hypothesis proposed this mechanism to account for the widely dispersed coeval materials across more than 14,000 kilometers of the Northern and Southern Hemispheres. Our Abu Hureyra discoveries strongly support a major impact event from such a fragmented comet."

7. Sticky tape: A key ingredient for mapping artifact origins

Summary:

Researchers have demonstrated that combining a highly sensitive sulfur analysis technique with simple sulfur-free tape is an effective and harmless way to test extremely small samples of vermilion from artifacts that are thousands of years old. The study used this technique to confirm that trade likely existed between Japan's northern island of Hokkaido and the western part of Japan's mainland -- a distance of over 1000 miles -- more than 3000 years ago.

Researchers at the RIKEN Nishina Center for Accelerator-Based Science in Japan have demonstrated that combining a highly sensitive sulfur analysis technique with simple sulfur-free tape is an effective and harmless way to test

extremely small samples of vermilion from artifacts that are thousands of years old. Published in the *Journal of Archaeological Science: Reports*, the study used this technique to confirm that trade likely existed between Japan's northern island of Hokkaido and the western part of Japan's mainland -- a distance of over 1000 miles -- more than 3000 years ago.

Vermilion, sometimes called cinnabar, is a bright red mineral that was used in paintings, figurines, statues, ceramics, and ritual ceremonies dating back almost 9000 years across Europe, Asia, and the Americas. The chemical name for vermilion is mercuric sulfide, and small variations in sulfur can distinguish one batch of vermilion from another. Within every vermilion sample, some of the sulfur atoms are standard, while some are isotopes with two extra neutrons. Because the ratio of these atoms does not change over time, it can be used as a fingerprint to identify where the sample came from.

Recently, Kazuya Takahashi and his colleagues in the Astro-Glaciology Research Group developed a highly sensitive method for analyzing sulfur isotope ratios that only requires 1 microgram of vermilion -- one millionth of a gram -- which is about 500 times smaller than what other methods need. This is important because the smaller the sample, the less damage to the artifacts being tested.

After developing this new technique, Takahashi realized that they needed a way to collect the tiny samples, keeping in mind that the samples need to be burned up to produce sulfur oxide gas during the analysis. The easiest way was to use a tiny 3 mm × 3 mm square of adhesive tape to pick up the vermilion from an artifact. Then, the vermillion and tape could be places into the apparatus and tested. However, most tape contains sulfur, and given the minuscule size of the sample, even the tiniest amount would throw off the results. After trying several different commercial tapes, he got lucky. "By chance, I met an old friend who works in a company that sells different kinds of tape. She knew of one tape that could be sulfur free, which was a great suggestion for me!"

The team tested this polyester adhesive tape as well as two other tapes from local stores. They found that the store-bought tapes contained about 0.5% sulfur, while the special tape did not contain any sulfur. Now they were ready to test the system on real artifacts.

An area in western Japan called Izumo contains an archaeological site with artifacts from a settlement about 3500 years ago. People have speculated that the

people of that era traded extensively within Japan. With cooperation from the local government in Izumo, the researchers collected vermilion samples from artifacts excavated from the site and used their highly sensitive analysis technique to determine their sulfur isotope ratios. Then, they compared the sample ratios to the ratios found at eight cinnabar ore mines across Japan. They found that most of the artifacts contained vermilion that was likely mined in the Northern island of Hokkaido, more than 1000 miles away, rather than in closer mines located in western Japan.

Archaeologists often wish to analyze the origins of pigments on wall paintings or pottery, but in many cases, the artifacts are too important to damage even a small amount for sample collection. "Our method might open the doors for new research into ancient trade routes and the history of individual works of ancient art," notes Takahashi.

The precision of the system can still be improved. "Analyzing sample origins using sulfur isotopic ratios is not sufficient at the present time," says Takahashi. "Using ratios from multiple elements can enable us to estimate the origins more precisely than conventional methods can." The team has already started analyzing lead (Pb) and sulfur isotopic ratios of pigment samples from ancient Roman wall paintings found in Spain.

As is often the case, the success of this project relied on technology that was actually created for a totally different purpose. "This is an intriguing application of our isotope analysis technique," notes Yuko Motizuki, director of the Astro-Glaciology Research Group. "But it was originally developed for taking measurements in Antarctic ice cores, which is the main focus of our laboratory.

"We hope archaeologists and research centers around the world can use Takahashi's technique to develop their own measurement systems and continue studying how ancient peoples interacted and traded across continents."

8. Bronze Age diet and farming strategy reconstructed using integrative isotope analysis

Summary:

Isotope analysis of two Bronze Age El Algar sites in present-day south-eastern Spain provides a integrated picture of diets and farming strategies, according to a new study.

The El Algar society thrived in complex hilltop settlements across the Iberian Peninsula from 2200-1550 cal BCE, and gravesites and settlement layouts provide strong evidence of a marked social hierarchy.

Knipper and colleagues conducted carbon and nitrogen isotope analysis at two different El Algar hilltop settlements: the large fortified urban site La Bastida (in present-day Totana, Murcia), and the smaller settlement Gatas (Turre, Almería). Their sample included remains of 75 human individuals from across social strata, 28 bones from domestic animals and wild deer, charred barley (75 grains total), and charred wheat (29 grains) from the middle and late phases of El Algar civilization across the two sites.

The sampled human individuals showed no significant difference between isotope values for males and for females, suggesting that diets may have been similar between genders. However, "elite" individuals at La Bastida showed higher levels of both carbon and nitrogen. This might have implied that the people of La Bastida consumed higher levels of animal-based food, but the authors suggest that the isotope value differences between La Bastida and Gatas could in fact have resulted from similar dietary compositions. Nitrogen values are similar at both sites for barley, but higher for the domestic animals at La Bastida, meaning that diets with similar relative contributions of barley and meat/dairy products would have led to higher nitrogen values in the humans at La Bastida compared to Gatas.

The researchers found a strong reliance on cereal farming, supplemented by livestock, in the El Algar economy. The range and values of carbon in the barley and wheat sample reflect what was likely a dry, unirrigated landscape, though nitrogen levels in the cereal crops suggest the El Algar people applied animal manure to their fields. Cereals and their by-products appear to have contributed substantially to the forage of domesticated sheep/goats, cattle and pigs.

Though the sample used in this study is relatively small, and there are limitations to what can be sampled with this type of isotope analysis, this study shows the importance of considering the complete trophic chain in order to adequately interpret isotope data from human remains -- and also demonstrates the sophistication of El Algar farming techniques.

Knipper adds: "It is essential to not only investigate human remains, but also comparative samples of different former food stuffs as well as to interpret the data in the light of the archaeological and social historical context."

9. Surprising research: Prehistoric hyenas and humans share migration patterns

Summary:

New research into the evolutionary history and prehistoric migrations of hyenas reveals surprising similarities between hyenas and prehistoric humans. The results also indicate that humans had a detrimental effect on hyena populations about 100,000 years ago.

Prehistoric humans left Africa for the first time about 2 million years ago. The research community has been aware of this for some time. Now, novel research reveals that hyenas apparently did the same thing.

'Our new study shows that prehistoric humans and hyenas left Africa at approximately the same time. And like humans, spotted hyenas have had extensive and complex migration between continents. We can observe repeated gene flow events between Africa and Eurasia', says Michael Westbury, corresponding author and postdoc at GLOBE Institute at the University of Copenhagen.

The researchers collaborated with researchers at the University of Potsdam and sequenced complete genomes from both modern spotted hyenas in Africa and subfossils of the extinct cave hyena from Europe and Asia.

Separate lineages

The two kinds of hyena -- spotted and cave -- were previously believed to form a closely related evolutionary lineage. DNA analyses published 15 years ago showed that the two types of hyena were genetically intermingled. Today, however, thanks to technological advances, the researchers have been able to obtain a lot more genetic data and show that this genetic intermingling is limited. The new study thus reveals an ancient separation.

'The results nicely illustrate the power of palaeogenome analyses. The relationship of spotted and cave hyenas could not be resolved using morphological or short mitochondrial DNA sequence data and was actually discussed quite controversially for decades', says Michael Hofreiter Professor at the University of Potsdam.

While prehistoric hyenas show some similarities with humans in their trans-continental migration patterns, the researchers also found signs that modern humans of the species *Homo sapiens* had a detrimental impact on hyenas.

'Historical population sizes of spotted hyenas seem to correlate negatively with that of humans after about 100,000 years ago, echoing similar results we found for herbivores', says Rasmus Heller, Assistant Professor at the Department of Biology at the University of Copenhagen.

In addition, he explains that humans are believed to have played a role in the extinction of cave hyenas around the end of the last ice age.

That means that coexistence between humans and hyenas -- like that between humans and other large mammals -- may have changed from being relatively benign to detrimental as humans became more advanced.

The researchers argue that their study reveals new aspects of when and how animals moved across continents in prehistory.

"Our results conforms with the hypothesis that animal migration may have occurred in pulses during which several species migrated more or less at the same time, possibly as a response to climate change. More comparative work is needed to confirm this hypothesis," says postdoc Michael Westbury, postdoc at GLOBE Institute.

10. Early evolution of the brain's cortex revealed in new study

Summary:

Research on the lamprey brain has enabled scientists to push the birth of the cortex back in time by some 300 million years to over 500 million years ago, providing new insights into brain evolution.

A new study on the lamprey brain has enabled researchers at Karolinska Institutet in Sweden to push the birth of the cortex back in time by some 300 million years to over 500 million years ago, providing new insights into brain evolution. The study is published in the scientific journal *Nature Ecology & Evolution*.

The human brain is one of the most complex structures that evolution has created. It has long been believed that most of the forebrain evolution took place largely in mammals and that the brains of simpler, pre-mammalian animal groups such as fish and amphibians lack a functional cortex. The cortex, which is the outer layer of the brain, controls the more complex cerebral functions like vision and movement and higher skills such as language, memory and emotion.

"We've spent a long time studying brain evolution using the lamprey, which is one of the oldest groups of extant vertebrates," says Sten Grillner, last author of

the study and professor of neurophysiology at the Department of Neuroscience, Karolinska Institutet. "Here we've made detailed studies of the lamprey brain, combining neurophysiological analyses with histochemical techniques."

In the study, the researchers show that even the lamprey, which existed hundreds of millions of years before mammals, possesses a detailed blueprint for the development of the cortex, the basal ganglia and the dopamine system -- all the vital ingredients of integrative cerebral function.

The researchers also found that the lamprey's cortex has a visual area on which different parts of its visual field are represented. Sensory and motor areas have also been discovered.

"This shows that the birth of the cortex has to be pushed back about 300 million years," says Professor Grillner. "This, in turn, means that the basic plan of the human brain was defined already over 500 million years ago, that's to say before the lamprey branched off from the evolutionary line that led to mammals and humans."

The study shows that all the main components of the human brain are also to be found in the lamprey brain, albeit with much fewer nerve cells in each part.

"That vital parts of the lamprey brain are conserved and organised in the same way as in the human brain was unexpected," he continues. "These findings are crucial to our understanding of how the brain evolved and how it has been designed through evolution."

The study was financed with grants from the Swedish Research Council, the EU's Seventh Framework Programme for Research and Technological Development, the Parkinson Foundation and Karolinska Institute

11. Scientists have discovered the origins of the building blocks of life

Summary:

Researchers have discovered the origins of the protein structures responsible for metabolism: simple molecules that powered early life on Earth and serve as chemical signals that NASA could use to search for life on other planets. Their study predicts what the earliest proteins looked like 3.5 billion to 2.5 billion years ago.

Rutgers researchers have discovered the origins of the protein structures responsible for metabolism: simple molecules that powered early life on Earth and serve as chemical signals that NASA could use to search for life on other planets

Their study, which predicts what the earliest proteins looked like 3.5 billion to 2.5 billion years ago, is published in the journal *Proceedings of the National Academy of Sciences*.

The scientists retraced, like a many thousand piece puzzle, the evolution of enzymes (proteins) from the present to the deep past. The solution to the puzzle required two missing pieces, and life on Earth could not exist without them. By constructing a network connected by their roles in metabolism, this team discovered the missing pieces.

"We know very little about how life started on our planet. This work allowed us to glimpse deep in time and propose the earliest metabolic proteins," said co-author Vikas Nanda, a professor of Biochemistry and Molecular Biology at Rutgers Robert Wood Johnson Medical School and a resident faculty member at the Center for Advanced Biotechnology and Medicine. "Our predictions will be tested in the laboratory to better understand the origins of life on Earth and to inform how life may originate elsewhere. We are building models of proteins in the lab and testing whether they can trigger reactions critical for early metabolism."

A Rutgers-led team of scientists called ENIGMA (Evolution of Nanomachines in Geospheres and Microbial Ancestors) is conducting the research with a NASA grant and via membership in the NASA Astrobiology Program. The ENIGMA project seeks to reveal the role of the simplest proteins that catalyzed the earliest stages of life.

"We think life was built from very small building blocks and emerged like a Lego set to make cells and more complex organisms like us," said senior author Paul G. Falkowski, ENIGMA principal investigator and a distinguished professor at Rutgers University-New Brunswick who leads the Environmental Biophysics and Molecular Ecology Laboratory. "We think we have found the building blocks of life -- the Lego set that led, ultimately, to the evolution of cells, animals and plants."

The Rutgers team focused on two protein "folds" that are likely the first structures in early metabolism. They are a ferredoxin fold that binds iron-sulfur compounds, and a "Rossmann" fold, which binds nucleotides (the building blocks of DNA and RNA). These are two pieces of the puzzle that must fit in the evolution of life.

Proteins are chains of amino acids and a chain's 3D path in space is called a fold. Ferredoxins are metals found in modern proteins and shuttle electrons around cells to promote metabolism. Electrons flow through solids, liquids and gases and power living systems, and the same electrical force must be present in any other planetary system with a chance to support life.

There is evidence the two folds may have shared a common ancestor and, if true, the ancestor may have been the first metabolic enzyme of life.

The lead author is Hagai Raanan, a former post-doctoral associate in the Environmental Biophysics and Molecular Ecology Laboratory. Rutgers co-authors include Saroj Poudel, a post-doctoral associate, and Douglas H. Pike, a doctoral student in the ENIGMA project.

12. One of Darwin's evolution theories finally proved

Summary:

Scientists have proved one of Charles Darwin's theories of evolution for the first time -- nearly 140 years after his death. Researchers discovered mammal subspecies play a more important role in evolution than previously thought. Her research could now be used to predict which species conservationists should focus on protecting.

Scientists have proved one of Charles Darwin's theories of evolution for the first time -- nearly 140 years after his death.

Laura van Holstein, a PhD student in Biological Anthropology at St John's College, University of Cambridge, and lead author of the research published today (March 18) in *Proceedings of the Royal Society*, discovered mammal subspecies play a more important role in evolution than previously thought.

Her research could now be used to predict which species conservationists should focus on protecting to stop them becoming endangered or extinct.

A species is a group of animals that can interbreed freely amongst themselves. Some species contain subspecies -- populations within a species that differ from each other by having different physical traits and their own breeding ranges. Northern giraffes have three subspecies that usually live in different locations to each other and red foxes have the most subspecies -- 45 known varieties -- spread all over the world. Humans have no subspecies.

van Holstein said: "We are standing on the shoulders of giants. In Chapter 3 of On the Origin of Species Darwin said animal lineages with more species should also contain more 'varieties'. Subspecies is the modern definition. My research investigating the relationship between species and the variety of subspecies proves that sub-species play a critical role in long-term evolutionary dynamics and in future evolution of species. And they always have, which is what Darwin suspected when he was defining what a species actually was."

The anthropologist confirmed Darwin's hypothesis by looking at data gathered by naturalists over hundreds of years ¬- long before Darwin famously visited the Galapagos Islands on-board HMS Beagle. On the Origin of Species by Means of Natural Selection, was first published in 1859 after Darwin returned home from a five-year voyage of discovery. In the seminal book, Darwin argued that organisms gradually evolved through a process called 'natural selection' -- often known as survival of the fittest. His pioneering work was considered highly controversial because it contradicted the Bible's account of creation.

van Holstein's research also proved that evolution happens differently in land mammals (terrestrial) and sea mammals and bats (non-terrestrial)¬ because of differences in their habitats and differences in their ability to roam freely.

van Holstein said: "We found the evolutionary relationship between mammalian species and subspecies differs depending on their habitat. Subspecies form, diversify and increase in number in a different way in non-terrestrial and terrestrial habitats, and this in turn affects how subspecies may eventually become species. For example, if a natural barrier like a mountain range gets in the way, it can separate animal groups and send them off on their own evolutionary journeys. Flying and marine mammals -- such as bats and dolphins -- have fewer physical barriers in their environment."

The research explored whether subspecies could be considered an early stage of speciation -- the formation of a new species. van Holstein said: "The answer was yes. But evolution isn't determined by the same factors in all groups and for the

first time we know why because we've looked at the strength of the relationship between species richness and subspecies richness."

The research acts as another scientific warning that the human impact on the habitat of animals will not only affect them now, but will affect their evolution in the future. This information could be used by conservationists to help them determine where to focus their efforts.

van Holstein explained: "Evolutionary models could now use these findings to anticipate how human activity like logging and deforestation will affect evolution in the future by disrupting the habitat of species. The impact on animals will vary depending on how their ability to roam, or range, is affected. Animal subspecies tend to be ignored, but they play a pivotal role in longer term future evolution dynamics."

van Holstein is now going to look at how her findings can be used to predict the rate of speciation from endangered species and non-endangered species.

Notes to editors: What Darwin said on page 55 in 'On the Origin of Species': "From looking at species as only strongly-marked and well-defined varieties, I was led to anticipate that the species of the larger genera in each country would oftener present varieties, than the species of the smaller genera; for wherever many closely related species (i.e species of the same genus) have been formed, many varieties or incipient species ought, as a general role, to be now forming. Where many large trees grow, we expect to find saplings."

Datasets: Most of the data is from Wilson and Reeder's Mammal Species Of The World, a global collated database of mammalian taxonomy. The database contains hundreds of years' worth of work by taxonomists from all over the world. The current way of "doing" taxonomy goes all the way back to botanist Carl Linnaeus (1735), so the accumulation of knowledge is the combined work of all taxonomists since then.

13. 'Wonder chicken' fossil from the age of dinosaurs reveals origin of modern birds

Summary:

The oldest fossil of a modern bird yet found, dating from the age of dinosaurs, has been identified by an international team of palaeontologists.

The oldest fossil of a modern bird yet found, dating from the age of dinosaurs, has been identified by an international team of palaeontologists.

The spectacular fossil, affectionately nicknamed the 'Wonderchicken', includes a nearly complete skull, hidden inside nondescript pieces of rock, and dates from less than one million years before the asteroid impact which eliminated all large dinosaurs.

Writing in the journal *Nature*, the team, led by the University of Cambridge, believe the new fossil helps clarify why birds survived the mass extinction event at the end of the Cretaceous period, while the giant dinosaurs did not.

Detailed analysis of the skull shows that it combines many features common to modern chicken- and duck-like birds, suggesting that the 'Wonderchicken' is close to the last common ancestor of modern chickens and ducks. The fossil was found in a limestone quarry near the Belgian-Dutch border, making it the first modern bird from the age of dinosaurs found in the northern hemisphere.

The fossil doesn't look like much on first glance, with only a few small leg bone fragments poking out from a piece of rock the size of a deck of cards. Even those small bones attracted the researchers' interest, since bird fossils from this point in Earth's history are so rare.

Using high-resolution X-ray CT scans, the researchers peered through the rock to see what was lying beneath the surface. What they saw, just one millimetre beneath the rock, was the find of a lifetime: a nearly complete 66.7-million-year-old bird skull.

"The moment I first saw what was beneath the rock was the most exciting moment of my scientific career," said Dr Daniel Field from Cambridge's Department of Earth Sciences, who led the research. "This is one of the best-preserved fossil bird skulls of any age, from anywhere in the world. We almost had to pinch ourselves when we saw it, knowing that it was from such an important time in Earth's history.

"The ability to CT scan fossils, like we can at the Cambridge Biotomography Centre, has completely transformed how we study palaeontology in the 21st century."

"Finding the skull blew my mind," said co-author Juan Benito, also from Cambridge, who was CT scanning the fossils with Field when the skull was discovered. "Without these cutting-edge scans, we never would have known that we were holding the oldest modern bird skull in the world."

The skull, despite its age, is clearly recognisable as a modern bird. It combines many features common to the group that includes living chickens and ducks -- a group called Galloanserae. Field describes the skull as a kind of 'mash-up' of a chicken and a duck.

"The origins of living bird diversity are shrouded in mystery -- other than knowing that modern birds arose at some point towards the end of the age of dinosaurs, we have very little fossil evidence of them until after the asteroid hit," said co-author Albert Chen, a PhD student based at Cambridge. "This fossil provides our earliest direct glimpse of what modern birds were like during the initial stages of their evolutionary history."

While the fossil is colloquially known as the Wonderchicken, the researchers have given it the slightly more elegant name of Asteriornis, in reference to Asteria, the Greek Titan goddess of falling stars.

"We thought it was an appropriate name for a creature that lived just before the end-Cretaceous asteroid impact," said co-author Dr Daniel Ksepka from the Bruce Museum in Greenwich, Connecticut. "In Greek mythology, Asteria transforms herself into a quail, and we believe Asteriornis was close to the common ancestor that today includes quails, as well as chickens and ducks."

The fact that Asteriornis was found in Europe is another thing which makes it so extraordinary. "The late Cretaceous fossil record of birds from Europe is extremely sparse," said co-author Dr John Jagt from the Natuurhistorische Museum Maastricht in the Netherlands. "The discovery of Asteriornis provides some of the first evidence that Europe was a key area in the early evolutionary history of modern birds."

"This fossil tells us that early on, at least some modern birds were fairly small-bodied, ground-dwelling birds that lived near the seashore," said Field. "Asteriornis now gives us a search image for future fossil discoveries -- hopefully it ushers in a new era of fossil finds that help clarify how, when and where modern birds first evolved."

The announcement of the Wonderchicken find coincides with a new exhibit at Cambridge's Sedgwick Museum of Earth Sciences, where visitors can learn more about Asteriornis and see the fossil up close. "Dawn of the Wonderchicken" runs from 19 March to 15 June. Admission is free.

Dr Daniel Field is funded by a UKRI Future Leaders Fellowship. He is a University Lecturer in the Department of Earth Sciences at the University of Cambridge, and a Fellow of Christ's College Cambridge.

14. Bone analyses tell about kitchen utensils in the Middle Ages

Summary:

Who in the Middle Ages cooked their dinner in copper pots? And where did they do it? Such information can be revealed by chemical analyses of human bones.

Clay pots? Wooden spoons? Copper pots? Silver forks? What materials has man used for making kitchen utensils throughout history? A new study now sheds light on the use of kitchen utensils made of copper.

At first thought, you would not expect hundreds of years old bones from a medieval cemetery to be able to tell you very much -- let alone anything about what kinds of kitchen utensils were used to prepare food.

But when you put such a bone in the hands of Professor Kaare Lund Rasmussen, University of Southern Denmark, the bone begins to talk about the past.

A warehouse full of bones

"For the first time, we have succeeded in tracing the use of copper cookware in bones. Not in isolated cases, but in many bones over many years, and thus we can identify trends in historical use of copper in the household," he explains.

The research team has analyzed bones from 553 skeletons that are between 1200 and 200 years old. They all come from nine, now abandoned cemeteries in Jutland, Denmark and Northern Germany. The skeletons are today kept at Schloss Gottorf in Schleswig, Germany and at the University of Southern Denmark.

Some of the bones examined are from Danish cities such as Ribe and Haderslev, while others are from small rural communities, such as Tirup and Nybøl.

Your body needs copper

The element copper can be traced in bones if ingested. Copper is needed for the body to function; it is, among other things, involved in a number of metabolic processes, such as the function of the immune system -- so without copper, the individual would not be able to live.

The need for copper is usually met through the food we eat and most of us probably never think about this.

It is different with the high concentrations of copper now revealed to have been ingested by our predecessors in the Viking Age and the Medieval Times. Much of this copper must have come from the kitchen utensils with which the daily meals were prepared, the researchers believe.

How did the copper get into the body?

One possibility is that the copper pots were scraped by metal knives, releasing copper particles, and that these particles were ingested with the food.

Or maybe copper was dissolved and mixed with food, if the pot was used for storing or cooking acidic foods.

"The bones show us that people consumed tiny portions of copper every day throughout their lives. We can also see that entire cities have been doing this for hundreds of years. In Ribe, the inhabitants did this for 1000 years," says Kaare Lund Rasmussen.

Who ate the copper?

Apparently, the copper intake was at no time so great that it became toxic. But the researchers can't say for sure.

However, they can with certainty say that some people never ingested copper enough for it to be traceable in the bones. Instead, they ate food prepared in pots made of other materials.

These people lived in the countryside. The bones reveal that inhabitants in the small villages of Tirup and Nybøl did not prepare their food in copper pots.

Rely less on written sources

But how do these findings go with historical accounts and pictures of copper cookware used in in country kitchens?

"A copper pot in a country kitchen may have been so unusual that the owner would tell everybody about it and maybe even write it down. However, such an account should not lead to the conclusion that copper cookware was commonly used in the countryside. Our analyses show the opposite," says Kaare Lund Rasmussen.

Contrary, the use of copper pots was evident in the towns of Ribe, Horsens, Haderslev and Schleswig.

1000 years of constant copper ingestion

"The cities were dynamic communities and homes of rich people who could acquire copper items. Wealthy people probably also lived in the countryside, but they did not spend their money on copperware," concludes Kaare Lund Rasmussen.

208 of the skeletons originate from a cemetery in Ribe, covering a period of 1000 years from AD 800 to AD 1800, spanning from the Viking Age over the Middle Ages to recent times.

"These skeletons show us there was a continuous exposure of copper throughout the period. Thus, for 1000 years, the inhabitants consumed copper via their daily diet."

Mercury in Tycho Brahe's beard

Professor Kaare Lund Rasmussen has performed several chemical analyses of historical and archaeological artifacts.

Among other things, he has analyzed a hair from the Danish Renaissance astronomer Tycho Brahe's beard and found that the he did not die from mercury poisoning, as hard-nosed rumors would otherwise know.

In turn, Tycho Brahe was exposed to large amounts of gold until two months before his death -- perhaps as a result of his alchemist life, perhaps because he ate and drank from gold-plated service.

15. Global human genomes reveal rich genetic diversity shaped by complex evolutionary history

Study will help identify the susceptibility of different populations to disease

Summary:

A new study has provided the most comprehensive analysis of human genetic diversity to date, after the sequencing of 929 human genomes. The study uncovers a large amount of previously undescribed genetic variation and provides new insights into our evolutionary past, highlighting the complexity of the process through which our ancestors diversified, migrated and mixed throughout the world.

A new study has provided the most comprehensive analysis of human genetic diversity to date, after the sequencing of 929 human genomes by scientists at the Wellcome Sanger Institute, the University of Cambridge and their collaborators. The study uncovers a large amount of previously undescribed genetic variation and provides new insights into our evolutionary past, highlighting the complexity of the process through which our ancestors diversified, migrated and mixed throughout the world.

The resource, published in *Science* (20 March), is the most detailed representation of the genetic diversity of worldwide populations to date. It is freely available to all researchers to study human genetic diversity, including studies of genetic susceptibility to disease in different parts of the world.

The consensus view of human history tells us that the ancestors of present-day humans diverged from the ancestors of extinct Neanderthal and Denisovan groups around 500,000-700,000 years ago, before the emergence of 'modern' humans in Africa in the last few hundred thousand years.

Around 50,000-70,000 years ago, some humans expanded out of Africa and soon after mixed with archaic Eurasian groups. After that, populations grew rapidly,

with extensive migration and mixture as many groups transitioned from hunter-gatherers to food producers over the last 10,000 years.

This study is the first to apply the latest high-quality sequencing technology to such a large and diverse set of humans, covering 929 genomes from 54 geographically, linguistically and culturally diverse populations from across the globe. The sequencing and analysis of these genomes, which are part of the Human Genome Diversity Project (HGDP)-CEPH panel, now provides unprecedented detail of our genetic history.

The team found millions of previously unknown DNA variations that are exclusive to one continental or major geographical region. Though most of these were rare, they included common variations in certain African and Oceanian populations that had not been identified by previous studies.

Variations such as these may influence the susceptibility of different populations to disease. However, medical genetics studies have so far predominantly been conducted in populations of European ancestry, meaning that any medical implications that these variants might have are not known. Identifying these novel variants represents a first step towards fully expanding the study of genomics to underrepresented populations.

However, no single DNA variation was found to be present in 100 per cent of genomes from any major geographical region while being absent from all other regions. This finding underlines that the majority of common genetic variation is found across the globe.

Dr Anders Bergström, of the Francis Crick Institute and an alumnus of the Wellcome Sanger Institute, said: "The detail provided by this study allows us to look deeper into human history, particularly inside Africa where less is currently known about the timescale of human evolution. We find that the ancestors of present-day populations diversified through a gradual and complex process mostly during the last 250,000 years, with large amounts of gene flow between these early lineages. But we also see evidence that small parts of human ancestries trace back to groups that diversified much earlier than this."

Hélène Blanché, Head of the Biological Resource Centre at the Centre d'Etude du Polymorphisme Humain (CEPH) in Paris, France, said: "The Human Genome Diversity Project resource has facilitated many new discoveries about human history in the past two decades. It is exciting to see that with the latest genomic

sequencing technology, these genomes will continue to help us understand our species and how we have evolved."

The study also provides evidence that the Neanderthal ancestry of modern humans can be explained by just one major 'mixing event', most likely involving several Neanderthal individuals coming into contact with modern humans shortly after the latter had expanded out of Africa. In contrast, several different sets of DNA segments inherited from Denisovans were identified in people from Oceania and East Asia, suggesting at least two distinct mixing events.

The discovery of small amounts of Neanderthal DNA in west African people, most likely reflecting later genetic backflow into Africa from Eurasia, further highlights how human genetic history is characterised by multiple layers of complexity. Until recently, it was thought that only people outside sub-Saharan Africa had Neanderthal DNA.

Dr Chris Tyler-Smith, recently retired from the Wellcome Sanger Institute, said: "Though this resource is just the beginning of many avenues of research, already we can glimpse several tantalising insights into human history. It will be particularly important for better understanding human evolution in Africa, as well as facilitating medical research for the full diversity of human ancestries."

16. Ancestor of all animals identified in Australian fossils

A worm like creature that lived more than 555 million years ago is the earliest bilaterian

Summary:

Geologists have discovered the first ancestor on the family tree that contains most animals today, including humans. The wormlike creature, Ikaria wariootia, is the earliest bilaterian, or organism with a front and back, two symmetrical sides, and openings at either end connected by a gut. It was found in Ediacaran Period deposits in Australia and was 2-7 millimeters long, with the largest the size of a grain of rice.

A team led by UC Riverside geologists has discovered the first ancestor on the family tree that contains most familiar animals today, including humans.

The tiny, wormlike creature, named *Ikaria wariootia*, is the earliest bilaterian, or organism with a front and back, two symmetrical sides, and openings at either

end connected by a gut. The paper is published today in *Proceedings of the National Academy of Sciences*.

The earliest multicellular organisms, such as sponges and algal mats, had variable shapes. Collectively known as the Ediacaran Biota, this group contains the oldest fossils of complex, multicellular organisms. However, most of these are not directly related to animals around today, including lily pad-shaped creatures known as *Dickinsonia* that lack basic features of most animals, such as a mouth or gut.

The development of bilateral symmetry was a critical step in the evolution of animal life, giving organisms the ability to move purposefully and a common, yet successful way to organize their bodies. A multitude of animals, from worms to insects to dinosaurs to humans, are organized around this same basic bilaterian body plan.

Evolutionary biologists studying the genetics of modern animals predicted the oldest ancestor of all bilaterians would have been simple and small, with rudimentary sensory organs. Preserving and identifying the fossilized remains of such an animal was thought to be difficult, if not impossible.

For 15 years, scientists agreed that fossilized burrows found in 555 million-year-old Ediacaran Period deposits in Nilpena, South Australia, were made by bilaterians. But there was no sign of the creature that made the burrows, leaving scientists with nothing but speculation.

Scott Evans, a recent doctoral graduate from UC Riverside; and Mary Droser, a professor of geology, noticed miniscule, oval impressions near some of these burrows. With funding from a NASA exobiology grant, they used a three-dimensional laser scanner that revealed the regular, consistent shape of a cylindrical body with a distinct head and tail and faintly grooved musculature. The animal ranged between 2-7 millimeters long and about 1-2.5 millimeters wide, with the largest the size and shape of a grain of rice -- just the right size to have made the burrows.

"We thought these animals should have existed during this interval, but always understood they would be difficult to recognize," Evans said. "Once we had the 3D scans, we knew that we had made an important discovery."

The researchers, who include Ian Hughes of UC San Diego and James Gehling of the South Australia Museum, describe *Ikaria wariootia*, named to acknowledge the

original custodians of the land. The genus name comes from Ikara, which means "meeting place" in the Adnyamathanha language. It's the Adnyamathanha name for a grouping of mountains known in English as Wilpena Pound. The species name comes from Warioota Creek, which runs from the Flinders Ranges to Nilpena Station.

"Burrows of *Ikaria* occur lower than anything else. It's the oldest fossil we get with this type of complexity," Droser said. "*Dickinsonia* and other big things were probably evolutionary dead ends. We knew that we also had lots of little things and thought these might have been the early bilaterians that we were looking for."

In spite of its relatively simple shape, *Ikaria* was complex compared to other fossils from this period. It burrowed in thin layers of well-oxygenated sand on the ocean floor in search of organic matter, indicating rudimentary sensory abilities. The depth and curvature of *Ikaria* represent clearly distinct front and rear ends, supporting the directed movement found in the burrows.

The burrows also preserve crosswise, "V"-shaped ridges, suggesting *Ikaria* moved by contracting muscles across its body like a worm, known as peristaltic locomotion. Evidence of sediment displacement in the burrows and signs the organism fed on buried organic matter reveal *Ikaria* probably had a mouth, anus, and gut.

"This is what evolutionary biologists predicted," Droser said. "It's really exciting that what we have found lines up so neatly with their prediction."

17. Neanderthals ate mussels, fish, and seals too

Summary:

Over 80,000 years ago, Neanderthals fed themselves on mussels, fish and other marine life. The first evidence has been found by an international team in the cave of Figueira Brava in Portugal. The excavated layers date from 86,000 to 106,000 years ago, the period when Neanderthals settled in Europe. Sourcing food from the sea at that time had only been attributed to anatomically modern humans in Africa.

Over 80,000 years ago, Neanderthals were already feeding themselves regularly on mussels, fish and other marine life. The first robust evidence of this has been found by an international research team with the participation of the University

of Göttingen during an excavation in the cave of Figueira Brava in Portugal. Dr Dirk Hoffmann at the Göttingen Isotope Geology Department dated flowstone layers -- calcite deposits that form like stalagmites from dripping water -- using the uranium-thorium method, and was thus able to determine the age of the excavation layers to between 86,000 and 106,000 years. This means that the layers date from the period in which the Neanderthals settled in Europe. The use of the sea as a source of food at that time has so far only been attributed to anatomically modern humans (*Homo sapiens*) in Africa. The results of the study were published in the journal *Science*.

The cave of Figueira Brava is located 30 kilometres south of Lisbon on the slopes of the Serra da Arrábida. Today it is located directly on the waterfront, but at that time it was up to two kilometres from the coast. The research team, coordinated by the first author of the study, Professor João Zilhão from the University of Barcelona, found that the Neanderthals living there were able to routinely harvest mussels and fish, and to hunt seals. Their diet included mussels, crustaceans and fish as well as waterfowl and marine mammals such as dolphins and seals. Food from the sea is rich in omega-3 fatty acids and other fatty acids that promote the development of brain tissue.

Until now, it has always been suspected that this consumption increased the cognitive abilities of the human populations in Africa. "Among other influences, this could explain the early appearance of a culture of modern people that used symbolic artefacts, such as body painting with ochre, the use of ornaments or the decoration of containers made of ostrich eggs with geometric motifs," explains Hoffmann. "Such behaviour reflects human's capacity for abstract thought and communication through symbols, which also contributed to the emergence of more organised and complex societies of modern humans."

The recent results of the excavation of Figueira Brava now confirm that if the habitual consumption of marine life played an important role in the development of cognitive abilities, this is as true for Neanderthals as it is for anatomically modern humans. Hoffmann and his co-authors previously found that Neanderthals made cave paintings in three caves on the Iberian Peninsula more than 65,000 years ago and that perforated and painted shells must also be attributed to the Neanderthals.

18. Regular climbing behavior in a human ancestor

Summary:

A new study has found evidence that human ancestors as recent as two million years ago may have regularly climbed trees.

A new study led by the University of Kent has found evidence that human ancestors as recent as two million years ago may have regularly climbed trees.

Walking on two legs has long been a defining feature to differentiate modern humans, as well as extinct species on our lineage (aka hominins), from our closest living ape relatives: chimpanzees, gorillas and orangutans. This new research, based on analysis of fossil leg bones, provides evidence that a hominin species (believed to be either Paranthropus robustus or early Homo) regularly adopted highly flexed hip joints; a posture that in other non-human apes is associated with climbing trees.

These findings came from analysing and comparing the internal bone structures of two fossil leg bones from South Africa, discovered over 60 years ago and believed to have lived between 1 and 3 million years ago. For both fossils, the external shape of the bones were very similar showing a more human-like than ape-like hip joint, suggesting they were both walking on two legs. The researchers examined the internal bone structure because it remodels during life based on how individuals use their limbs. Unexpectedly, when the team analysed the inside of the spherical head of the femur, it showed that they were loading their hip joints in different ways.

The research project was led by Dr Leoni Georgiou, Dr Matthew Skinner and Professor Tracy Kivell at the University of Kent's School of Anthropology and Conservation, and included a large international team of biomechanical engineers and palaeontologists. These results demonstrate that novel information about human evolution can be hidden within fossil bones that can alter our understanding of when, where and how we became the humans we are today.

Dr Georgiou said: 'It is very exciting to be able to reconstruct the actual behaviour of these individuals who lived millions of years ago and every time we CT scan a new fossil it is a chance to learn something new about our evolutionary history.'

Dr Skinner said: 'It has been challenging to resolve debates regarding the degree to which climbing remained an important behaviour in our past. Evidence has

been sparse, controversial and not widely accepted, and as we have shown in this study the external shape of bones can be misleading. Further analysis of the internal structure of other bones of the skeleton may reveal exciting findings about the evolution of other key human behaviours such as stone tool making and tool use. Our research team is now expanding our work to look at hands, feet, knees, shoulders and the spine.'

19. Mesoamerican copper smelting technology aided colonial weaponry

Spanish conquerors depended on indigenous expertise to keep up their munitions supplies, archaeologists have found

Summary:

spanish conquerors depended on indigenous expertise to keep up their munitions supplies, archaeologists have foundWhen Spanish invaders arrived in the Americas, they were generally able to subjugate the local peoples thanks, in part, to their superior weaponry and technology. But archeological evidence indicates that, in at least one crucial respect, the Spaniards were quite dependent on an older indigenous technology in parts of Mesoamerica (today's Mexico, Guatemala, Belize, and Honduras).

The invaders needed copper for their artillery, as well as for coins, kettles, and pans, but they lacked the knowledge and skills to produce the metal. Even Spain at that time had not produced the metal domestically for centuries, relying on imports from central Europe. In Mesoamerica they had to depend on local smelters, furnace builders, and miners to produce the essential material. Those skilled workers, in turn, were able to bargain for exemption from the taxes levied on the other indigenous people.

This dependence continued for at least a century, and perhaps as long as two centuries or more, according to new findings published in the journal *Latin American Antiquity*, in a paper by Dorothy Hosler, professor of archeology and ancient technology at MIT, and Johan Garcia Zaidua, a researcher at the University of Porto, in Portugal.

The research, at the site of El Manchón, in Mexico, made use of information gleaned from more than four centuries worth of archeological features and

artifacts excavated by Hosler and her crew over multiple years of fieldwork, as well as from lab work and historical archives in Portugal, Spain, and Mexico analyzed by Garcia.

El Manchón, a large and remote settlement, initially displayed no evidence of Spanish presence. The site consisted of three steep sectors, two of which displayed long house foundations, some with interior rooms and religious sanctuaries, patios, and a configuration that was conceptually Mesoamerican but unrelated to any known ethnic groups such as the Aztec. In between the two was an area that contained mounds of slag (the nonmetallic material that separates out during smelting from the pure metal, which floats to the surface).

The Spanish invaders urgently needed enormous quantities of copper and tin to make the bronze for their cannons and other armaments, Hosler says, and this is documented in the historical and archival records. But "they didn't know how to smelt," she says, whereas archaeological data suggest the indigenous people had already been smelting copper at this settlement for several hundred years, mostly to make ritual or ceremonial materials such as bells and amulets. These artisans were highly skilled, and in Guerrero and elsewhere had been producing complex alloys including copper-silver, copper-arsenic, and copper-tin for hundreds of years, working on a small scale using blowpipes and crucibles to smelt the copper and other ores.

But the Spanish desperately required large quantities of copper and tin, and in consultation with indigenous smelters introduced some European technology into the process. Hosler and her colleagues excavated an enigmatic feature that consisted of two parallel courses of stones leading toward a large cake of slag in the smelting area. They identified this as the remains of a thus-far-undocumented hybrid type of closed furnace design, powered by a modified hand-held European bellows. A small regional museum in highland Guerrero illustrates just such a hybrid furnace design, including the modified European-introduced bellows system, capable of producing large volumes of copper. But no actual remains of such furnaces had previously been found.

The period when this site was occupied spanned from about 1240 to 1680, Hosler says, and may have extended to both earlier and later times.

The Guerrero site, which Hosler excavated over four field seasons before work had to be suspended because of local drug cartel activity, contains large heaps of copper slag, built up over centuries of intensive use. But it took a combination of

the physical evidence, analysis of the ore and slags, the archaeological feature in the the smelting area, the archival work, and reconstruction drawing to enable identification of the centuries of interdependence of the two populations in this remote outpost.

Earlier studies of the composition of the slag at the site, by Hosler and some of her students, revealed that it had formed at a temperature of 1150 degrees Celsius, which could not have been achieved with just the blowpipe system and would have required bellows. That helps to confirm the continued operation of the site long into the colonial period, Hosler says.

Years of work went into trying to find ways to date the different deposits of slag at the site. The team also tried archaeomagnetic data but found that the method was not effective for the materials in that particular region of Mexico. But the written historical record proved key to making sense of the wide range of dates, which reflected centuries of use of the site.

Documents sent back to Spain in the early colonial period described the availability of the locally produced copper, and the colonists' successful tests of using it to cast bronze artillery pieces. Documents also described the bargains made by the indigenous producers to gain economic privileges for their people, based on their specialized metallurgical knowledge.

"We know from documents that the Europeans figured out that the only way they could smelt copper was to collaborate with the indigenous people who were already doing it," Hosler says. "They had to cut deals with the indigenous smelters."

Hosler says that "what's so interesting to me is that we were able to use traditional archeological methods and data from materials analysis as well as ethnographic data" from the furnace in a museum in the area, "and historical and archival material from 16th century archives in Portugal, Spain, and Mexico, then to put all the data from these distinct disciplines together into an explanation that is absolutely solid."

The research received support from Charles Barber, CEO of Asarco; the Wenner-Gren Foundation; FAMSI; and MIT's Undergraduate Research Opportunities Program.

20. New Guinea's Neolithic period may have started without outside help

Artifacts counter the idea that cultural changes sparked by farming were imported from Asia

Signs of a cultural shift in toolmaking and lifestyles sparked by farming, previously found at ancient Asian and European sites, have surfaced for the first time on New Guinea.

Excavations at a highland site called Waim produced relics of a cultural transition to village life, which played out on the remote island north of Australia around 5,050 to 4,200 years ago. Archaeologist Ben Shaw of the University of New South Wales in Sydney and colleagues report the findings March 25 in *Science Advances*.

Agriculture on New Guinea originated in the island's highlands an estimated 8,000 to 4,000 years ago. But corresponding cultural changes, such as living in villages and making elaborate ritual and symbolic objects, have often been assumed to have emerged only when Lapita farmers from Southeast Asia reached New Guinea around 3,000 years ago (*SN: 9/2/15*). In Asia and Europe, those cultural changes mark the beginning of the Neolithic period. The new finds suggest that a Neolithic period also independently developed in New Guinea.

Key finds at Waim consist of a piece of a carved human or animal face that probably had symbolic meaning and two stone pestles bearing traces of yam, fruit and nut starches.

Other discoveries include a stone cutting or chopping tool, a pigment-stained stone with deep incisions that may have been used to apply coloring to plant fibers and an iron-rich rock fragment that was likely struck with other stones to create sparks for igniting fires.

Farming's rise on New Guinea apparently inspired long-distance, seagoing trade, the scientists say. Chemical analysis of an unearthed chunk of obsidian — displaying marks created when someone hammered off sharp flakes — indicates it was imported from an island located at least 800 kilometers away.

PAPER -2

1. Tribals to heighten protest over Ajodhya Hills hydel project

Tribals opposed to a proposed hydel power project in the remote Ajodhya Hills in West Bengal have threatened to heighten their protests. Villagers across two gram panchayat areas in the hills — Baghmundi and Ajodhya — said that even after securing a legal victory in the Calcutta High Court against the proposed 1,000 MW Turga Pumped Storage Project in July 2019, the State government had challenged the order before a Division Bench.

Sushil Murmu, a petitioner in the case and a resident of one of the villages that will be affected by the proposed power plant, said that lakhs of trees will be cut down because of the project, which will impact the lives of those depending on forest produce. "We do not want this project at any cost," Mr. Murmu, who was in Kolkata for a hearing of the matter, told *The Hindu*.

The case is being heard before the Division Bench of Justices Sanjib Banerjee and Kaushik Chandra.

Several irregularities

Justice Debangshu Basak, in the order of July 2019, had "quashed" the permissions granted by the State government for the implementation of the project by the gram sabha. The order has cited a number of irregularities in connection with the permission obtained by the State government for going ahead with the project.

Referring to the two resolutions filed by the gram sabha, on the basis of which the State government went ahead with the project, Justice Basak stated in his order that "none of them satisfies the tests laid down under the Act of 2006". The Act in the order refers to Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.

"One of the resolutions is unsigned by any villager. The other resolution shows an attendance and does not discuss the number of adults available in the village

for the Gram Sabha convened. Requisite notice for convening the Gram Sabha are absent on record," the order stated.

Forest Rights Act

According to the Forest Rights Act, 2006 if a forest land has to be acquired, then at least 50% of the affected population dependent on the land has to give consent in gram sabha, and a third of the villagers have to be women.

In the order, Justice Basak pointed put that in the absence of the "requisite materials being produced by the State despite opportunities given to the State to do so, the irresistible inference is that, appropriate procedure laid down under the Act of 2006 was not followed for the purpose of convening any meeting of any gram sabha of any village affected by the project".

Rajen Tudu, a tribal leader from Purulia district said that the people who will be affected by the project are speaking to tribals from other parts of the State, and whatever be the fate of the legal case, the villagers would oppose the project.

Nakul Baske, another villager, said that the hydel power project on the river Tunga will affect 17 *mouza*s (a revenue collection unit) and more than 60 villages in the region. Mr. Baske said that the villagers have formed the Ajodia Buru Banchao Andolan Sanhati Mancha to protest against the power plant.

Livelihoods lost

The villagers protesting against the project refer to the 900 MW Purulia Pumped Storage Project (PPSP) that came up at Ajodhya Hills in the Baghmundi block of Purulia district around a decade ago. The villagers allege that it lead to massive loss of vegetation and hundreds of tribals lost their livelihoods.

The proposed project is to be implemented by the West Bengal State Electricity Distribution Company Limited, which comes under the State government's Department of Power. Despite attempts to reach Power Minister Sovandeb Chattopadhyay, no response could be ascertained from his end on the subject.

"The situation in this case is not only unfortunate, because instead of following the law and engaging as well taking proper consent of the people, which is a must under the Forest Rights Act, the state is manufacturing evidence of consent," Santanu Chacraverti, an environmental activist concerned with the matter said.

2. Coronavirus outbreak: Andaman's indigenous tribes face extinction threat.

In the past week, the islands have seen an alarming rise in infections since reporting the first case on 26 March. Delhi's Nizamuddin area, fast emerging as a covid-19 hotspot, could have an unsuspecting victim in one of the world's most ancient tribes living in faraway Andaman and Nicobar Islands, with potentially devastating consequences.

The Andaman Islands, home to the Jarawa, Onge and Shompen indigenous people, whose low natural immunity makes them particularly vulnerable to diseases, have recorded several coronavirus cases directly linked to the religious congregation in South Delhi's Nizamuddin Markaz, organized by Tablighi Jamaat, an Islamic missionary movement.

Confirmed cases currently stand at 10 with more than 1,500 under home and special quarantine. Local authorities have found that several people who had attended the event in Delhi made their way back to the islands before the country was placed under lockdown on 25 March. Government officials, who did not wish to be named, said of the ten positive cases identified so far, seven had left Port Blair on 16 February to attend the Jamaat in Delhi. Subsequently, all of them tested positive on return, spreading the infection to three more persons who came in close contact with them. According to officials, so far samples of 40 suspected cases have been sent for testing and several localities, where the seven patients had visited on their arrival to Andamans, are under complete lockdown.

Experts said the current situation poses a grave risk to the tribes, especially the Jarawas who live in tribal reserves barely 100km from capital Port Blair, where most infections have been reported. While the local administration has assured that all possible safeguards will be taken and has imposed strict restrictions around the reserves, experts said that a past outbreak of measles epidemic among the Jarawa, thought to be spread by direct contact with outsiders, mainly non-tribal settlers, serves as a grim reminder. The Jarawas, numbering around 300 today, have survived the outbreak twice.
In the first, in 1999, 108 Jarawa were known to have been infected but there were no reports of fatalities. There was a second outbreak in 2006 but it is not clear how many contracted the disease. "The only way to contain a spread is to follow complete isolation of the tribes," said Madhumala Chattopadhyay, a noted anthropologist, well-known for making the first contact with

3. A Call to Nomadic Tribes: Do Not Cooperate With the NPR Process.

It is unreasonable to expect this historically marginalised and exploited community to produce documents and prove their citizenship.
In the eyes of the government of India, the questions posed by nomadic (NT) and denotified (DNT) tribes are of little importance. The issues of Marathas, Adivasis, Muslims are at least looked at, however superficially in the case of the latter two communities, because of their vote banks. Only our community, of nomadic migrant tribes with no place to call home, is still waiting like the chataka bird for even basic needs like education, health or social security, are right now far beyond the margins for the decision-makers.
A report by the government of India's National Commission of Denotified, Nomadic and Semi-Nomadic Tribes of India affirms this:

"Although, many of the denotified, nomadic and semi-nomadic tribes are spread among SC/ST/OBC, many are still not classified anywhere and have no access to socioeconomic benefits whether education, health, housing or otherwise."
While sympathy is available for us, there is a scarcity of those willing to actually stand with us. Our current condition of terrible vulnerability is a situation originally loaned to us by the British, and we may thank the Indian government for adding to the debt. In 1871, the nomadic tribes rebelled against the British, for which our voices were clamped down and displacement was forced upon us using pressure tactics. Mental and physical violence became a staple, and we were stamped as criminals. This proud community was rendered homeless, stateless, landless and powerless.

This historically, culturally, socially and economically exploited community, finally had the stigma of criminality wiped off by Dr B.R. Ambedkar in 1952, through legal provisions. These tribes gained true freedom later than the rest of India. However, those who were supposed to implement the law failed the NT/DNT communities miserably. In the almost-150 years since 1871, I cannot say there has been much change in the way we have been treated.
Gosavi, Vaidu, Ghisadi, Banjara are some communities under this NT/DNT category. They live on the side of roads, on footpaths or in *kachha*, half-built homes with their everyday, basic needs unfulfilled. I am discussing this situation because, when the government plans to conduct exercises like the National Register of Citizens or Citizenship Amendment Act, one has to assume that

detention camps will be the destination for nomadic communities. The community fights many battles every day, just to meet the most basic of needs. That we should be expected to prove our citizenship is a cruel joke.

Data collection for the National Population Register (NPR), which is a preliminary step for the NRC, shall start from April 1 (but could be delayed because of the lockdown imposed to contain the spread of the coronavirus). The government's workers will go from house to house, asking questions. They will ask us if we are citizens of our own country, and documents to prove that we are. The collected information shall be analysed and those found wanting or 'suspicious' shall be investigated. In this process, we will have to again produce documents to prove we are citizens of this country. Which documents will be accepted as proof of citizenship is not yet clear.

Those who will be unable to prove their citizenship will then have to ask for help from courts. Those who fail to prove their citizenship in courts shall then be sent to detention centres. This is a very brief but the basic picture of how the NRC process will unfold.
Here, I want to pose some fundamental questions to the Centre.

1. Nomadic tribes have been landless since 1871. So, how can we provide documentary proof of property rights?
2. The literacy levels of nomadic tribes are poor. Only 37% of NTs and DNTs in the Marathwada region of Maharashtra are literate. Even among those literate, it is the first generation which is completing primary education. So which documents are we expected to produce for our forefathers and mothers?
3. These communities, which are nomadic, find it hard to get even a simple domicile certificate made. According to a study conducted by the Housing and Land Rights Network (HLRN) in collaboration with the Gadia Lohar Sangharsh Samiti in Delhi, this community (to which I belong) cannot avail benefits of various government schemes, since almost 99% do not have caste certificates. To obtain Aadhaar and ration cards made, we are forced to pay thousands of rupees to agents. How are these communities expected to face the NRC exercise?
4. These tribes have been oppressed, exploited and ostracised for ages by the police, the government and the dominant feudal powers. How are we expected to confidently accept this law and face the consequent administrative processes?
5. Without political reservations, we have no political leaders who will strongly present our case. Political and intellectual revolution has still not taken place in these communities. It can, in fact, be said that social hierarchies have purposely

kept this revolution away from us. While social violence, atrocities and casteist mentalities constantly target us, there is no law that protects us.

We are not protected under the Prevention of Atrocities Act either. In short, in the emergency that will be created in the wake of the NPR, we shall be rendered outsiders.
6. We do not have a single place of residence. Where we live, 'villagers' still consider us 'outsiders'. What assurance do we have that the decision-makers in these villages will not use pressure mechanisms against us, will not cheat and exploit us to declare us as 'foreigners'?
7. A majority of nomadic and denotified tribes are engaged in daily labour. Many have been taken over by addiction. Youth are unemployed and have been waiting for generations to see their basic needs met.

In this pathetic situation, how does the government feel confident that the NT/DNT communities will manage to produce documents, give necessary correct information under the NPR?
In this scenario, what is the logic of imposing the CAA-NPR process on us? We are descendants of proud communities that rebelled against the British. We have given everything for this country. Forcing us to prove our citizenship is disrespectful of the fight for this country's independence.

In my opinion, the combination of CAA and NPR will harm our country in ways even worse than the partition of India. Because then, we at least had the freedom to choose where to live. With this law, even that choice will be taken away.
This is my call to all nomadic and denotified tribes: Whichever political party you support or whatever is your ideology, at least this time, think about our own community first. Hold close this statement, "I am first and last an Indian".

Do not give in to politics of hate, thinking that this law will harm people of a particular religion. The biased misconception that the law will keep out 'infiltrators' should also be done away with. The CAA is only the first step in the BJP's vote bank politics.
This law will infuse Manuwadi ideology into the Indian constitution, through the democratic process itself. The only solution is to not cooperate with the government's decision.

4.Whose land is it anyway: Of India's 703 ongoing conflicts, 25% are in tribal areas.

In India, on average, at least 10,600 people are impacted by each ongoing land conflict. The number crosses 21,300 in the land conflicts involving mining projects, reveals a recent study released last month.

The study revealed that investments worth about Rs 13.7 lakh crore were found embroiled in 335 of the 703 ongoing land conflicts, which is equivalent to about 7.2% of the revised estimate of India's gross domestic product for 2018–'19.
The study, titled *Locating the Breach* and released by the Land Conflict Watch, a New Delhi-based research group, reveals where and why land conflicts are occurring in the country. The report, based on three years of research, stresses on how land conflicts are affecting different sections of society and several segments of business and economy.
It highlighted that over 2.1 million hectares of land is locked in land conflicts that were categorised into six broad sectors – infrastructure, power, conservation and forestry, land use, mining, and industry. Of those, infrastructure-related conflicts are spread over the largest area, about 1.56 million hectares, which is almost equal to the area of Nagaland.

As per the study, infrastructural development and mining projects are responsible for about 50% of the total land conflicts, with 43% and 6% conflicts respectively. Conservation and forestry-related activities such as compensatory afforestation plantations and wildlife conservation schemes account for 15% of the conflicts.

The report stressed that an estimated 6.5 million people have been impacted by the 703 land conflicts analysed in the report. Of those, land conflicts caused by infrastructure projects affect more than three million people with each infrastructure project caught in a land conflict impacts the lives of 12,354 people, on average. Mining-related land conflicts have the second-biggest impact, affecting 852,488 citizens.

Of the total investments worth about Rs 13.7 trillion embroiled in the conflicts, infrastructure-related conflicts involve investments worth over Rs seven trillion, followed by power-and industry-related conflicts that at Rs 2.8 trillion and Rs 2.7 trillion, respectively.
Another interesting data highlighted in the study is that of the 703 cases, in 667 or 95% of the cases, the "state [government] comprised the second party in the

conflict." The report said that in these 667 cases, government agencies or public sector undertakings are interested parties either as project promoters or as mediators of the conflict as regulators.
"In 188 cases [27%], private companies or businesses are involved in the conflict. In 23 [3%] cases, the conflicts are between different communities," the report said.

The report identified 703 land conflicts across India. Credit: Land Conflict Watch
"India has an array of laws to recognise the traditional land rights of people and to facilitate equitable sharing of land resources. But a large number of land conflicts are still jeopardising human rights of people and huge investments," said Kumar Sambhav Shrivastava, co-founder of Land Conflict Watch and one of the co-authors of the study.

Conflict patterns.

The Land Conflict Watch report highlighted that the majority of land conflicts across the country involve common lands. "In most cases involving common lands, as opposed to private lands, citizens do not own private individual titles to these lands. The title, control, and ownership over these lands can be held collectively by communities, villages, municipal authorities, different levels of local elected bodies, and/or state governments.
While the government defines many types of common lands as "wastelands", most of these common lands are heavily used by citizens, particularly those from the marginal communities. Communities and citizens often have either state-recognised or traditional rights over these commons," said the report. As per the report, 36% of the conflicts were exclusively about common lands, 29% of land conflicts involved only private lands, and the remaining 32% involved both common and private lands.

The report also looked at the nature of land conflicts in tribal-dominated Fifth Schedule Areas, which have relatively higher levels of economic backwardness. The Indian Constitution provides special administrative dispensation for areas marked as Scheduled Areas and currently, according to the Government of India, these areas are in 100 districts across 10 states. These states are Andhra Pradesh, Jharkhand, Chhattisgarh, Himachal Pradesh, Madhya Pradesh, Gujarat, Maharashtra, Odisha, Rajasthan, and Telangana.
The report states that there are a total of 182 conflicts in Fifth Schedule districts, comprising 25% of the total conflicts. It also said that these districts had higher incidences of mining conflicts – 60% of all mining conflicts are situated here.

The report analysed conflicts that involved forest land and found 272 conflicts. According to the report, of the 272 eligible conflicts, 131 included the violation or non-implementation of the Forest Rights Act 2006 as a cause of conflict.
These comprised 48% of all conflicts, involving forests and 18.6% of all 703 documented conflict cases. A total of 12 lakh people have been impacted by conflicts involving the Act, on a total land area of 368,138 hectares.

States' failure

The report discussed that several state governments in India began creating land banks in the 1990s. It stressed that land banks create avenues for the immediate diversion of land to private investors, bypassing lengthy bureaucratic processes such as those under the land acquisition laws.

The report highlighted that "according to state government websites, up to 2.68 million [26.8 lakh] hectares of land – an area larger than the state of Meghalaya – has been set aside for land banks in eight states." These eight states are Andhra Pradesh, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Tamil Nadu, and Uttar Pradesh.
"Most Indian states either already have sizable land banks or are in the process of creating them. However, only the eight aforementioned states have provided details regarding them in the public domain as of September 2017," the report said.

The Land Conflict Watch report stated that the strategy to have land parcels free of encumbrances readily available for prospective projects may sound rational, but land banks also act as a bypass mechanism to deny the rights of communities.
It noted that there are cases where conflicts were caused by the creation of land banks. In those cases, the report said, that the land was initially allotted for industrial and infrastructure projects but when these projects were shelved due to local opposition, the state hoarded these lands for itself.

"[Land Conflict Watch's] data shows that these lands were predominantly common lands or forests to which communities had traditional rights. Instead of giving conflicted lands back to the people and to the communities who had opposed these projects, states have banked these lands, locking it away for potential future use. In most cases, the initial conflict was never resolved," said the report.

The report emphasised that this practice generates grave issues for communities that lose their livelihoods, connection, and physical possession over the lands.
"There is also the potential risk of future investments on banked lands facing conflicts similar to those that prevented the previously planned projects. In addition to the industry, the government has now started banking land even for the plantations under the compensatory afforestation scheme. In many cases, common lands over which communities had traditional rights have been set aside as part of land banks," said the report.
It explained that such lands are often targeted for creating land banks because citizens do not have clear titles over them and once the land is banked, it becomes even more difficult for communities to claim rights over it under laws such as the Forest Rights Act.
Shrivastava from Land Conflict Watch stressed that the data clearly shows that "progressive laws like the FRA [Forest Rights Act] and the LARR [Land Acquisition, Rehabilitation and Resettlement Act] are not being implemented in letter and spirit."
"This has clearly reflected in our data. Over two-third of the conflicts are related to the use of common lands. The government is failing to recognise the traditional rights of communities over such lands. Often there is also a false narrative propagated that the requirement of consent in the [Forest Rights Act] and the [Land Acquisition, Rehabilitation and Resettlement Act], delays the project. Our data analysis shows that it is not the requirement of the consent but the violation or sidelining the consent provisions that cause conflicts and locks up the project's investments," he said.

Dalits left behind

The report highlighted that the Dalits, members of the Scheduled Castes in the Indian Constitution, which form the largest landless social group in the country, are still not able to own land. According to the India Land and Livestock Holding Survey, almost 60% of Dalit households did not own any farmland in 2013 Further, land ownership is substantially lower in this group compared to Scheduled Tribes, Other Backward Classes, and General Category households.

It is a significant issue because landlessness among Dalits has deep roots as the ancient caste system practiced in India banned them from owning land, which forced them to do jobs determined by their caste and their status as "untouchables".
Since Independence, the authorities have tried to introduce land reforms but they have not able to deliver. The Land Conflict Watch report showed that Dalits

continue to be excluded from owning property, an issue that greatly contributes to inequality and land conflicts across India. It documented 31 ongoing conflicts involving at least 92,000 Dalits in 13 states.
"The conflicts cover a total area of 39,400 hectares – equivalent to the area of Chennai city. The states where these conflicts were reported, such as Punjab, Bihar, Gujarat, Maharashtra, and Kerala lie at dramatically varying ends of social and economic parameters but are united by their poor implementation of land reforms and a high incidence of landlessness among Dalits," said the report.

Vincent Manoharan, who is the chairperson of the National Federation of Dalit Land Rights Movements, said that the study is an eye-opener for the policymakers, legislators, bureaucrats, academics, researchers, campaigners and land right movement leaders to analyse and scrutinise the current development policy of India and land governance as a whole.
"This report warrants all actors to look at land with a different perception, as to how it affects people at large, whose life and livelihood is based on land. The land has been viewed as a commodity by the development sector, but that is the base for the dignity and identity of Dalits. India is still known as an agricultural country, but the agricultural sector and Dalits who put their sweat and labour are side-lined and ignored," said Manoharan.
He stressed that the National Federation of Dalit Land Rights Movements will use the study to mobilise Dalit peasants and agricultural labourers to intensify their struggles to check this ongoing trend, which is detrimental to the very life and livelihood of Dalits.

5. Coronavirus and the Neo-Tribes of an Increasingly Fractured India.

Housing colonies are turning away anyone they think is a coronavirus threat.
A residential building in a suburb of Mumbai, where a coronavirus patient died, found that other neighbouring buildings had 'blacklisted' it, ordering maids and service providers not to go anywhere near it.

A maid was quoted in the newspaper as saying that she would lose six other part time jobs if she entered the first building, where she worked only in one apartment.
Meanwhile, Air India, which as always rose to the occasion and fulfilled its public duty by bringing back Indians stuck abroad, issued a statement criticising 'vigilante' Residents' Welfare Associations in Mumbai and Delhi for ostracising their crew and even calling the police simply because the flight staff living in their colonies had gone abroad.

In Mumbai, a tenant who had come back from a foreign country was summarily ejected from his apartment by a landlord and in some parts of the country, those from the North East of India are being mocked with cries of 'coronavirus'.

Social prejudice and bigotry are an essential part of the Indian DNA. RWAs and cooperative societies – two complete misnomers – are the global champions of vigilantism, arrogating to themselves the power to decide the social life, food habits and even sexual orientation of their residents. They are the self-appointers upholders of morality and values, and are always on a sharp lookout for any transgression of the arbitrary rules they have set up.
Prejudice in India has largely been around caste, religion and community and in recent years, a new dimension, class, has been added. The gated community, with expensive flats in skyscrapers hermetically sealed off from the neighbourhood, is the epitome of class insulation, based on incomes and social standing. Builders proudly promote these enclaves as 'exclusive' and 'away from the chaos of the street'. A resident in one of these could go from the apartment to a the car parking in the basement, drive to the workplace, then the club, and return home without interacting with or noticing the rest of the city. For him, Work From Home is a bonus, not a punishment. This complete secession from the harsh realities of quotidian urban life is further enhanced by good connectivity and home delivery services.

But that cozy universe has now been severely dented. The above instances – by no means isolated – demonstrate that even class solidarity (and presumably of other kinds too) – can crumble in the face of a crisis. Forget empathy, even compassion evaporates when there is any perceived external threat. Just when there is need to offer support to a victim's family, or, as in the case of the Air India crew, acknowledge the heroic effort, their social peers reject them. We saw a bit of that during demonetisation, when everyone rushed to the bank to change notes and no quarter was given to even the old and the vulnerable–it was each to his own.
The coronavirus victim and his family and neighbours would more or less be of similar backgrounds as the residents of other buildings in the vicinity. They may have mixed socially in normal times and it is possible they helped each other on occasion. Mumbai is known for its large heart. During the 2005 flash floods in Mumbai, when the city was submerged in a sudden deluge and many were stuck far away from home for hours, there were countless instances of strangers offering assistance, including food and a place to sleep. That must surely be

happening even now, but we are also seeing examples of collective social ostracisation which is unprecedented.

It is fairly certain that many of these self-same residents of housing colonies and complexes were out in their balconies and compounds banging *thalis* and ringing temple bells on Sunday in response to Prime Minister Narendra Modi's call to show appreciation for the countless medical staff working tirelessly to fight the virus. But that was in the abstract, from a safe distance. It doesn't call for a personal touch.

We are seeing the emergence of a new form of tribal identity that transcends religion, caste, community and class. This kind of tribe is based on common, selfish interests. It bands together as a unit when it perceives a threat and reacts by shutting it out. It is also has a fluid structure, and should one of its own turn rogue in any way, or become a hazard, it won't hesitate in throwing them out. If a resident from one of those buildings that imposed a boycott were to get infected, there is a very good chance that their household too will face the same kind of banishment.
A notable feature of this grouping is that most of the members belong to a class that can be called privileged. Residents of cooperative societies in Mumbai or colonies in Delhi are more likely than not people with jobs or businesses. They would fit the general social profile of those who are educated, reasonably aware about the world around them and consume not just goods but also leisure. They are not poor by any definition.

The segment that the lockdown has hit the hardest are workers and daily-wage earners, who live on their daily earnings. Our policy makers and political leaders seem to have forgotten them – no one, barring some state governments, has so far talked about any measures to help them by giving them cash, food or any kind of economic security. The Centre is reportedly mulling over such proposals, but a decision is yet to be announced.

And ironically, they are the ones who have been the least affected by the virus itself. In Mumbai, a maid who was infected got it from her employer who had returned from the US. Local infections may yet rise, but it is not yet a full blown 'poor man's disease' – it is now directly affecting the middle and upper middle class. If it had been only among slum dwellers, say, it would have been easy to stay away from them, since no self-respecting middle-class person really enters a slum.

In that situation, the usual prejudiced stereotypes – 'you know how *these people* live' – would have been all over WhatsApp chats. Maids would have lost their jobs. Now, those very maids are desperately needed, and it's a dashed inconvenience that the driver cannot come whenever he is wanted. Though of course many housing complexes have simply banned the entry of domestic workers – who knows what other disease they have. But any domestic worker would now be in their rights to tell their employer, "I'm afraid of getting it from you."
The lockdown is in its early stages; there is no saying how long it will go on and how it will shape up. If the cases climb, the lockdown may become even harsher. The lives of every citizen,Neven those who are materially comfortable, will be affected in ways we cannot predict. Food and other supplies could run out. For those who have vulnerable people at home – the old, the sick – it could have devastating consequences.

At that time, will we see social cooperation or more social fractures? Will people step forward to help their neighbour or to shun him? Will humanity assert itself, as it must, in times of crisis? Or will more tribes form and fight each other, and then, in the face of repeated and growing threats, explode into fragments of hyper-individuality, where each one will be for themselves, the others be damned.

6.Practice disease distancing — how India can use corona crisis to kill its caste virus.

The coronavirus does not care whether one is a Dalit or Brahmin, Muslim or Christian. Modi govt and media must stop recommending 'social distancing' as a measure. when the world is under siege by the coronavirus' 'war against humanity' and the 'social distancing' is being projected as the only protective gear, India faces the danger of practising untouchability again with which it has suffered for millennia. The Narendra Modi government and the country's media must avoid recommending 'social distancing' as a measure and use only 'disease distancing'.
No patient of coronavirus is socially untouchable. S/he needs to be kept at a distance from others so that his/her mouth or nasal droplets do not reach a healthy person. And once that virus disappears from his/her body, s/he is more resilient than anyone who did not get infected by the virus. The idea must be to keep a distance from the Covid-19 disease, not humans. Even the World Health

Organization (WHO) now prefers to call it 'physical distancing' instead of 'social distancing'.

A casteist campaign:

But several brahminical and caste fundamentalist campaigns have used the 'social distancing' measure to defend caste discrimination, saying their castebased distancing is a cure for coronavirus that they had discovered thousands of years ago. Even in an otherwise rationalist and Dravidian state like Tamil Nadu, this mantra is being spread on social media. The same forces are also saying that meat (lamb, beef, chicken, fish and egg) eaters will get coronavirus but vegetarians won't. This dirty campaign saw the closure of all meat shops in Telangana. Then, chief minister K. Chandrashekar Rao, on the advice of doctors, made a strong plea to the people to eat more meat for protein because this will help them develop a better immune system, which is crucial in the fight against coronavirus. From the next morning, there were massive queues outside chicken and mutton shops. With one press conference, he dismantled the negative campaign and helped bring the price of the produce down. Even the poor in Telangana are eating chicken now.

What a virus can teach us

The coronavirus does not care whether one is a Dalit or Brahmin, Muslim or Christian, man or a woman. It does not care whether one is a meat eater or a vegetarian. It can affect anyone but its fatality rate is low. Those who cracked jokes about the food habits of Chinese must understand that China has defeated the disease to a large extent through science and medicine and with the help of highly alert doctors like Li Wenliang.

At a time when religious institutions all over the world have shut their doors and people who depend on religion have to turn to doctors and medicine and scientifically tested food that help build a healthy immune system, spreading brahminical myth and human untouchability in India will do more damage to the nation.

Bhim Rao Ambedkar, after his strenuous research, had told us that Buddhist beef-eating communities were later designated as 'untouchables'. But it was from these untouchable Dalits that many survived the 1897 bubonic plague in which one crore Indians died. The Bahujans, who were always the ones to carry dead bodies for burial or cremation because upper caste people wouldn't touch their

own family members out of fear of contracting the plague, had built a strong immunity by eating beef.

A recent national survey found that over 70 per cent of people who eat beef are from the Scheduled Castes (SCs) and Scheduled Tribes (STs), 21 per cent are from Other Backward Classes and only 7 per cent belong to upper castes.
Most Dalits during the bubonic plague survived only on the strength of their immunity as there was no hospital support in the villages. Their experience is still valid to fight coronavirus. The bubonic plague of 1897 was much more dangerous than the Covid-19 pandemic, but it has acquired a global presence within a short span time, threatening the world economy. We should kill this virus as soon as possible for human good.

One hopes that in a post-coronavirus India, all food restrictions and ostracisation of communities would end because this pandemic is teaching us new nationalist lessons — protect and save Indians with good food, whichever food they eat, and with improved medical and health care. In fact, the post-pandemic India should be a nation of shared food, medicine and housing resources by men and women of all castes, communities, religions, putting the history of human untouchability and casteism behind us. We should move towards developing a more scientific temper while practising human equality.

It is now proved that a virus is more dangerous than nuclear war. While fighting the virus, we should show more social solidarity and empathy for oppressed castes and groups. Disease distancing is a short-time measure. But if we push into every person's psyche that social distancing should be as systemically practised as caste-driven human untouchability, then India will never be able to develop and successfully fight future virus wars. In this situation where we are struggling to fight climate change, we do not know what kind of viruses will attack us in the future. Religious dogmas do not save us in such scenarios, but science will definitely come to our rescue every time.

But this is another malaise that the Indian society is currently fighting, even during an ongoing pandemic. Instances of doctors and nurses being evicted by their landowners from rented properties show a new level of selfishness. They ignore that it's these doctors and nurses who will save them if they contract Covid-19 or any other disease. Human untouchability and extreme selfishness without any sense of collective social responsibility will only make India more vulnerable to death and destruction.

The coronavirus crisis, which has shaken the entire world and is destroying even developed economies, must make India's radical and fundamentalist forces think that their country and the world will be a different place once the pandemic has been overcome. Human relationships will have to be completely repositioned with reduced selfishness, warmongering and ultra-nationalist behaviours of Right-wing ideologues. Only re-induced tolerance of plural food cultures, secular practices and complete absence of human untouchability will have to become the new normal. Every life is equal and every human being is a gift of god. Let us all learn this from the new world that is emerging out of this war against a virus.

7. With the Covid-19 pandemic, people from the Northeast are facing a rise in racial attacks across the country.

At a time when the world is battling a global health crisis, and state leaders are talking about forming a united front to fight the Covid-19 pandemic, things in India have taken an unpleasant turn. With US President Donald Trump repeatedly referring to the corona virus as a 'Chinese virus' (the racist hashtag continues to trend on Twitter) fuelling conspiracies that this was a biological weapon unleashed by China, in India this appears to have become an excuse to attack people from the Northeast. Today anyone with Tibeto-Burman facial features is being heckled, abused and called, "Corona" or "virus", and the use of these racial slurs is spreading almost as fast as the infection. Last Sunday, a 25-year-old woman from Manipur was spat paan on when she stepped out to buy groceries with her friend in the Delhi University area. The man, who was riding a scooter, called her "Corona".

In Pune, a young woman, also from Manipur, was teased by men at a mall, who told her "Coronavirus aa gaya!" On March 23, a young woman, who was facing racial abuse and harassment on Twitter, filed an FIR with Delhi Police for being called "Chinki" and told to wash her hands in a sexually graphic illustration. Last month, students living in Punjab's Chunni Kalan village took to Facebook to protest against the racism in a video captioned, "Stop calling us corona, ch***i, Chinese ... North East students of Punjab. #Govt_Of_India #say #No #to #Racism #Students #Northeast #India."

India's Northeast region is home to several tribes, including the Nagas, Mizos, Garos, Tripuris, Bodos, Kukis and Meiteis, who are largely of Tibeto-Burman descent. Only the Khasis and Jaintias are of Austro-Asiatic lineage. Over the last two decades, several metros have seen a proliferation of students from this area, either pursuing professional courses (because of a paucity of reputed educational

institutions in the region) or looking for employment. In Delhi alone, there are some seven lakh people from the Northeast currently working in malls, restaurants, spas and beauty parlours, among others. There are also a large number employed in government posts, and though they're not the ones that face the brunt of the attacks, they're usually looked at askance when they step out of their homes and offices. The hostility is an everyday reality.

One incident that stands out is of Nido Tania, a 20-year-old student from Arunachal Pradesh, who was lynched in New Delhi's Lajpat Nagar in 2014, because he protested against people who were taunting him for his hair colour and hairstyle. This incident led to public outrage, after which the Bezbaruah Committee was formed to look into discrimination against people who don't have the typical Aryan or Dravidian 'Indian' look, but possess facial features similar to those of South East Asians.

Indeed, the Northeast has always been called the 'gateway to South East Asia'. The seven states share only a four per cent border with rest of India and are only connected by the 27 km landmass at Siliguri. If that region were to be cut off, the Northeast would be severed from 'mainland' India. There's no denying that the Northeast was a late entrant into the Indian mainstream — a term the people there detest because they have always felt a part of the mainstream. Most of the seven states signed the Instrument of Accession to the Indian Union only in 1948, when Sardar Vallabhai Patel visited the area and coerced many of the tribal chieftains to accede to India. But groups like the Nagas are still unresolved about their 'Indian'
identity, having picked up arms time and again against the Indian states since the 1950s. They are also currently in talks with the government about their special status. In fact, the region has had a troubled past with insurgent movements — in Mizoram in the late '70s and early '80s, followed by Assam, Manipur, Tripura and Meghalaya. Today, many of these movements are on the wane and the insurgent leaders are either in peace talks with the government or on in cessation of operations mode. But often, the disenchantment persists.

The racial profiling Northeasterners are facing in the wake of Covid-19 is heart-rending. Many living in the metros are starving or worried sick about not being able to pay rent since their employment — mainly in the informal sector — has been hit by the lockdown. To make things worse, they are being socially ostracised and shunned.

On a social media group called the 'Northeast Solidarity Group', young people living in
Bangalore, Mumbai and Delhi, are reporting how poorly they are being treated and forced to go back home. Take for instance, Prerna Pradhan from Sikkim, who is working in a private company in Bangalore, where her sisters are also studying. "We are stuck inside our homes because if we step out, people here abuse us. They think we are Chinese. Will our government help us? Many don't even dare step out of their homes for groceries. Others have been asked to evict their apartments by March 31 and not return," she writes. From being abused and spat on, to being evicted from their hostels and rented rooms and trolled online, Covid-19 has shown the apathy and cruelty towards people from the Northeast.

The sad truth is that the Northeastern states, between them, have no potential for job creation. The IIT in Guwahati and IIM in Shillong have failed to become major educational hubs because it's difficult for people from the Northeast to compete with the rest of India. There are not enough medical and engineering colleges so students are forced to leave their hometown to look for lucrative options elsewhere. Someone has rightly said that fear is intensely narcissistic. It drives out all thoughts of others. The fearful person does not see particular individuals, just hateful hues that arouse disgust and anger.

This hatred could manifest itself in reverse racism in the Northeast, where the 'mainland Indian' is seen as an 'outsider' by many tribal societies, and is given a particular label to distinguish him/her from the indigenous tribal. In the past, there have been instances of clashes between these so-called outsiders and locals. Meghalaya has a history of ethnic clashes where Bengali speaking people were targeted and many had to leave their hearths and homes in 1979. This cycle was repeated in 1982, '87 and '92. The state slowly returned to normal but the underlying tension is palpable even today. A similar anti-Bengali drive also rocked Assam in the 1980s. Many of those who had to leave Meghalaya under duress carry a deep hurt, which surfaces in their writings and on social media every now and again. This vicious cycle needs to be broken. Now more than ever, when there is the larger fear of Covid-19 looming over all of us — without exception.

Here are five key recommendations made by the Bezbaruah Committee on tackling
discrimination against the community:

New law against discrimination: Either a new law should be promulgated as directed by the High Court of Delhi or the Indian Penal Code should be amended. The offence should be cognizable and non-bailable. The investigation of the FIR should be completed in 60 days by a special squad and investigated by a police officer not below the rank of deputy SP or ACP. A special prosecutor should be appointed to handle all such cases of atrocities. And the trial should be completed in 90 days.

Fast-track courts and special police squads: The Committee strongly suggests the creation of fast-track courts for handling the cases relating to the North East people, particularly those which are racially motivated and involving heinous crimes against the North East women and children. Specially designated public prosecutors should be appointed for cases involving people from the North East. They should also be properly trained and sensitised. The committee feels that the creation of a special squad supervised by the North East Special Police Unit would go a long way in ensuring speedy justice in criminal cases. The squad could be manned by people specially selected for such purposes and they could be specially trained and sensitised about the problems of people from the North East.

Interventions in Education: Suitable innovative ways should be devised to integrate each and every aspect of the North East into the consciousness of people outside. The Committee recommends that when the next the NCERT takes place, one, all teacher training institutes be advised to make their syllabus in a way that can sensitise their trainees on the North East and, two, universities and schools outside the North East make projects on North East a mandatory part of the course curricula.

Social media outreach and legal awareness campaigns: The committee recommends legal awareness campaigns in neighbourhoods that have a significant presence of members from the North East community and on introducing lectures on legal rights for university students. It underlines the role of social media in improving connectivity and communication with the community. A dedicated Facebook page should be created and nodal police officers should be in constant touch with members of the community on WhatsApp.

Bonding power of sports: The committee recommends that the Ministry should take steps to hold regular national and international events in the North East as such events will create greater harmony and better understanding. The ministry should, therefore, review the status of present facilities and make an assessment if they are suitable for such events. If not, such facilities should be created in every state of the North East. Indigenous games of the North East should be promoted the Sentinelese, a remote tribe that still remains hostile to outsiders. Chattopadhyay, now a joint director in the ministry of social justice and empowerment, was part of the government response team to reach the Jarawas soon after the first measles outbreak in 1999. "A covid-19 outbreak would bring the entire race to the brink of extinction and there are no two ways about it," she warned.

Experts said one of the key reasons for the rising contact with the Jarawa is the construction of the Andaman Trunk Road, a two-lane highway that connects parts of middle and south Andaman and passes through the heart of Jarawa territory. And though the government has banned any outside contact, critics argue the road has led to free mixing with the tribe, often with disastrous consequences.

This is not the first time the tribes have faced a threat of this magnitude. The islands are home to five different indigenous groups. The Great Andamanese were once the most numerous of the five, with an estimated population of 6,000, but only around 50 survive today, most succumbing to diseases brought in by colonial settlers British rule. "Diseases, mainly syphilis, claimed many lives of the Great Andamanese, driving them to near extinction,'' said Chattopadhyay

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