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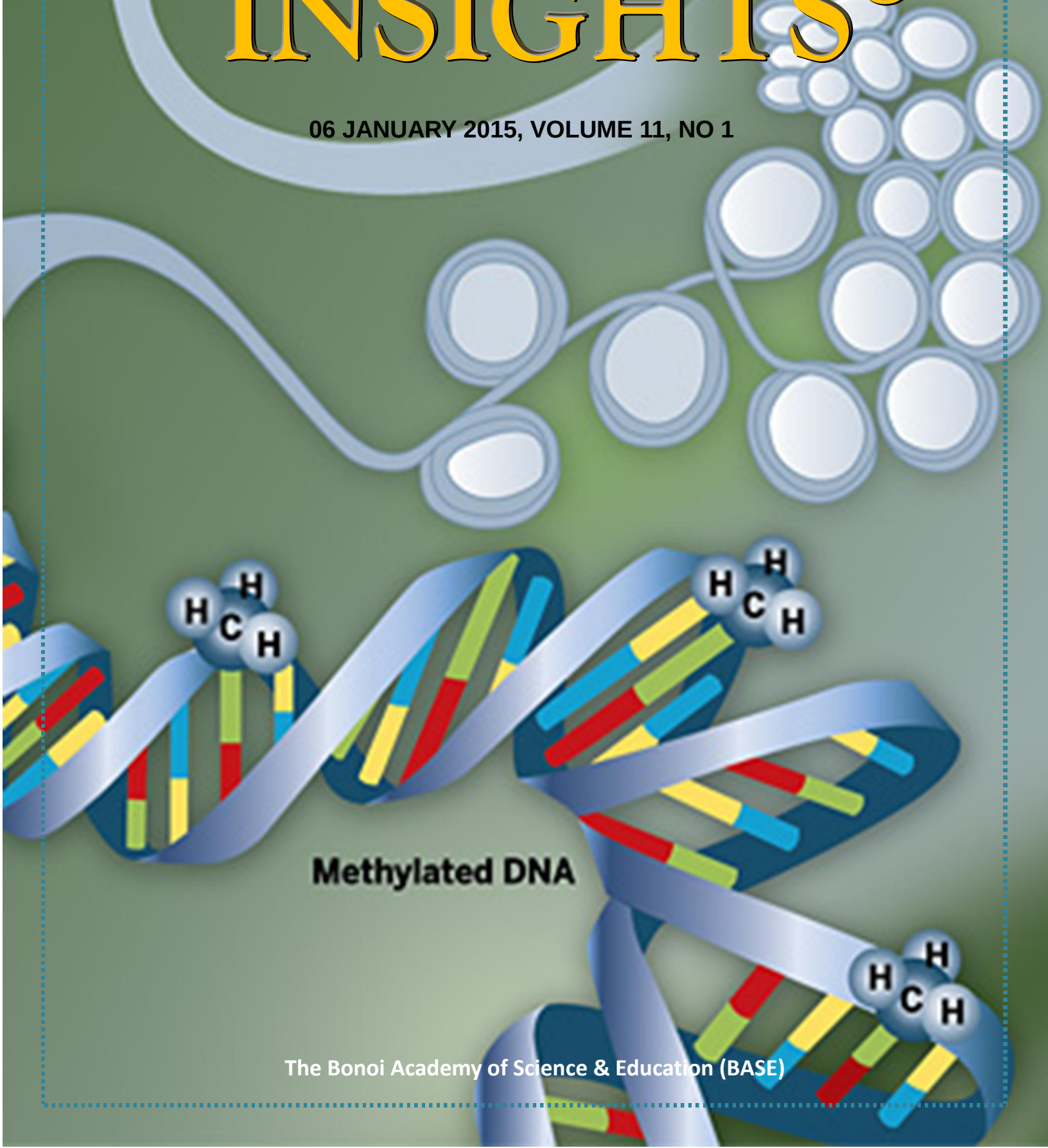

Methylated DNA

The Bonoi Academy of Science & Education (BASE)

BASE

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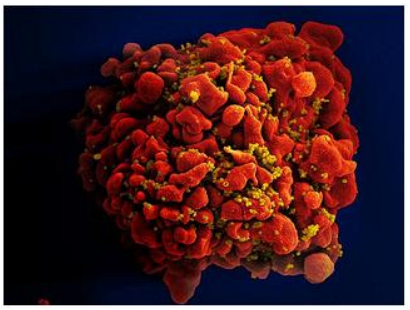

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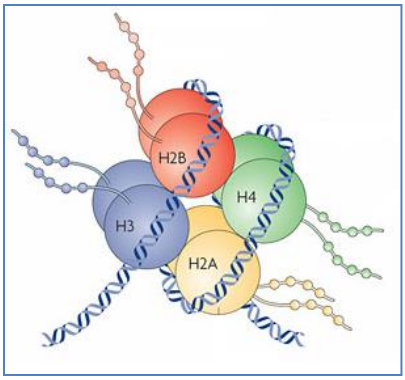
EDITOR'S CHOICE

PICTURE STATION

HYPOTHESIS



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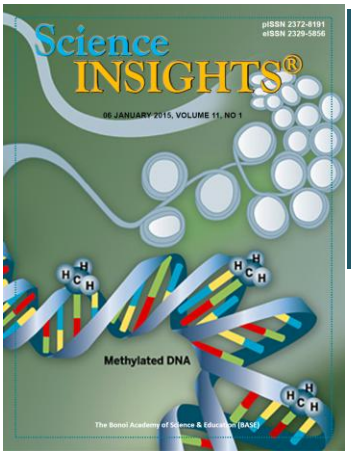
COMMON SCIENCE



COVER
Histone variant exchange, in which canonical histones are replaced with their variant counterparts, is an entire branch of epigenetics that has received limited attention in the brain and has never, to our knowledge, been studied in relation to pain-related social defect. See page 303.
Image: BASE illustrating group

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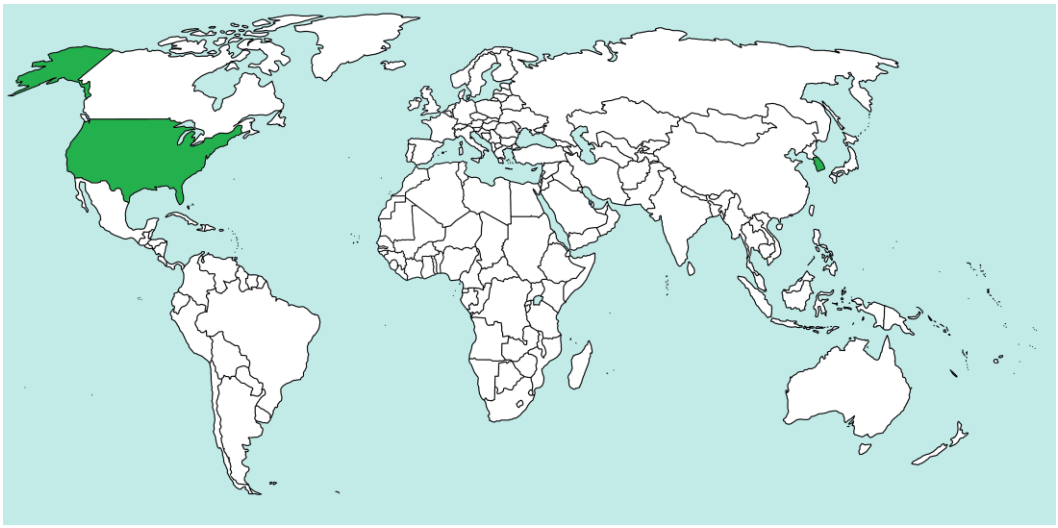
Seoul, SOUTH KOREA

Tiny Dinosaur Skeleton in South Korea



The dinosaur's fossilized remains span about 11 inches, but scientists told Korea JoongAng Daily that it was likely about 20 inches long when it was alive. “Based on the findings so far, we assume that the dinosaur is something close to a microraptor or others in the raptor genera,” Lim Jong-deock, chief curator of the National Research Institute of Cultural Heritage, told the news agency. “However, it’s uncertain at this stage exactly which type of dinosaur it was, and there is a chance that it is a new type that hasn’t been reported to academia as of yet.” The tiny dino is a theropod, a family of carnivorous dinosaurs that includes Tyrannosaurus rex. That means it had sharp teeth and claws--only a whole lot smaller. And if it is indeed a microraptor, it would also have had four wings. The dinosaur lived during the Cretaceous period, which ended some 66 million years ago with the Cretaceous-Tertiary mass extinction event. “The way this dinosaur has been fossilized is unique in that it was discovered with its vertebrae connected to its ribs,” the institute told the Korea Times. The institute also said there may be another fossilized dinosaur in the rock next to this one. Whatever the dinosaur turns out to be, it's the first complete dinosaur skeleton found in South Korea, and among the smallest dinosaur fossils ever found in the country. "It is difficult for a small dinosaur to become fossilized and such fossils are very rare across the world," an unnamed researcher from the National Research Institute of Cultural Heritage told Korea.net. "We need to conduct further research into whether the fossil is related to the Minisauripus, whose footprints were discovered in the southern areas of Gyeongsangnam-do."■

Tacoma, USA

New Clues about Ancient “Computer”

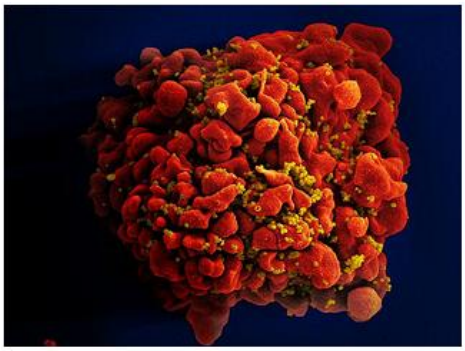
Researchers have unearthed new clues to an ancient Greek astronomical puzzle that has fascinated archaeologists for over a century. The Antikythera Mechanism, an ancient machine dubbed “the world’s first computer,” was recovered from a treasure-laden shipwreck off the coast of Greece in 1901. However, the latest research by James Evans, professor of physics at the University of Puget Sound, and Christián Carman, history of science professor at the University of Quilmes, Argentina, sheds new light on the clocklike astronomical

mechanism. The study, published in the Archive for History of Exact Science, pinpoints the date when the mechanism was timed to begin as 205 B.C., making it 50 to 100 years older than previously thought. According a statement released by the University of Puget Sound, the research “fills a gap in ancient scientific history by indicating that the Greeks were able to predict eclipses and engineer a highly complex machine” much earlier than was previously thought. Evans and Carman’s work also supports the idea that the eclipse prediction scheme was not based on Greek trigonometry (which was nonexistent in 205 B.C.) but on Babylonian arithmetical methods, the University said. The researchers arrived at the 205 B.C. date via a method of elimination they devised. Evans and Carman examined the hundreds of ways that the device’s eclipse patterns could match Babylonian records reconstructed by John Steele, professor of Egyptology and Assyriology at Brown University. “The calculations take into account lunar and solar anomalies (which result in faster or slower velocity), missing solar eclipses, lunar and solar eclipse’s cycles, and other astronomical phenomena,” explained the University of Puget Sound, in its statement. “The work was particularly difficult because only about a third of the Antikythera’s eclipse predictor is preserved.” The latest research may also place the Antikythera Mechanism close to the lifetime of Archimedes, who died in 212 B.C., although experts have questionedpossible links to the celebrated mathematician. The Mechanism’s heavily encrusted fragments are kept in the National Archaeological Museum of Athens.■

Minneapolis, USA

Why Some People Immune to HIV-1?

Doctors have long been mystified as to why HIV-1 rapidly sickens some individuals, while in others the virus has difficulties gaining a foothold. Now, a study of genetic variation in HIV-1 and in the cells it infects reported by University of Minnesota researchers in this week's issue of PLOS Genetics has uncovered a chink in HIV-1's armor that may, at least in part, explain the puzzling difference—and potentially open the door to new treatments. HIV-1 harms people by invading immune system cells known as T lymphocytes, hijacking their molecular machinery to make more of themselves, then destroying the host cells—leaving the infected person more susceptible to other deadly diseases. T lymphocytes are not complete sitting ducks, however. Among their anti-virus defense mechanisms is a class of proteins known as APOBEC3s that have the ability to block the HIV-1's ability to replicate. Not surprisingly, however, HIV-1 has a counter-defense mechanism—a protein called Vif that cons the T lymphocytes into destroying their own APOBEC3. Suspecting differential susceptibility to HIV-1 might be related to genetic variations in this system, a research team led by doctoral student Eric Refsland and Reuben Harris of the University's College of Biological Sciences and Medical School took a closer look. First, the researchers found that HIV-1 infection boosts the production of one kind of APOBEC3, APOBEC3H—suggesting it's a key player in fighting back. Then, using an experimental technique known as separation of function mutagenesis, they discovered that different people have different strengths/potencies of APOBEC3H, with some proteins expressed stably and others inherently unstable. The stable variations, the researchers found, were able to successfully limit HIV-1's ability to replicate if the infecting virus had a weak version of Vif—but not for HIV-1 viruses that had strong Vif. "This work shows that the competition

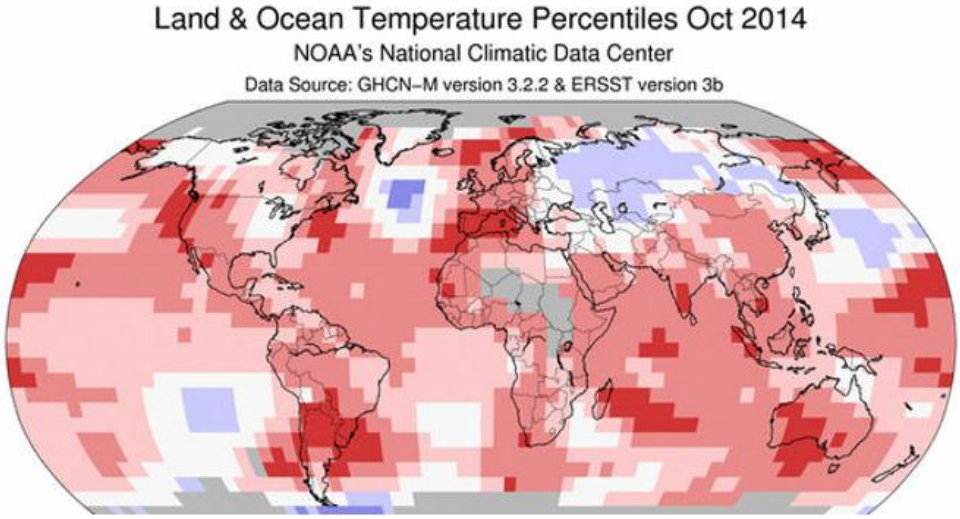


between the virus and the host is still ongoing," Refsland says. "The virus hasn't completely perfected its ability to replicate in humans." Armed with this clearer picture of the multifaceted interactions between Vif and APOBEC3, Harris says, the next step is to figure out how to stop Vif from disabling the APOBEC3 enzymes. "One could imagine drugs that stop Vif from binding with APOBEC," he said. "This is a bonafide HIV killing pathway, and we just have to devise clever ways to activate it in infected persons. Such an approach could indefinitely suppress virus replication, and even result in curing it."■

Buffalo, USA

2014 is Earth's Hottest Year on Record, Despite US Cold

"It's becoming pretty clear that 2014 will end up the warmest year on record," said Deke Arndt, chief of the climate monitoring branch at the National Climate Data Center. "The remaining question is, by how much." The eastern United States was one of Earth's cold zones this year, with temperatures running 2.7 degrees Fahrenheit (1.5 degrees Celsius) below average, scientists from the National Oceanic and Atmospheric Administration (NOAA) said today during the agency's monthly climate briefing. But the bitter cold couldn't offset record-breaking heat waves in California, Europe and Australia this year, nor the incredible warmth in the world's oceans. "Notably, every major ocean basin and every continent all had some pieces — and some had significant pieces of their area — that were the warmest on record [during 2014]," Arndt said. "It's virtually certain that California will have its warmest year on record, even if California has record cold in December." October was the sixth straight month of chart-busting heat in the oceans, according to NOAA. Last month was also the hottest October on record for land temperatures. Combining land and sea temperatures, the average worldwide temperature of 58.43 F (14.74 C) for October 2014 topped the previous high set in October 2003 by 0.02 F (0.01 C). November 2013 through November 2014 is now the warmest 12-month stretch on record for any 12-month period recorded since 1880, NOAA said. With less than two months left in 2014, the planet is on track to beat the warmest years in the historical record. So far this year, worldwide temperatures are averaging 58.62 F (14.78 C). The entire planet would have to go through a cold snap for 2014 to miss finishing in the top 10. (And it may feel that way for people in eastern North America and eastern Russia, where heavy snows arrived early this year.) Two giant pools of warmer-than-average water in the Pacific Ocean helped boost global temperatures in 2014, NOAA scientists said. One pool is sloshing around the eastern Pacific along the equator, and is related to the El Niño climate pattern that is struggling to develop. The other pool is a large mass of warm water stretching from Alaska to California. These warm, West Coast waters suggest that a decades-long natural climate pattern called the Pacific Decadal Oscillation (PDC) has flipped into its positive phase, said NOAA forecaster David Unger. The PDO influences weather in North America by shifting the jet stream and changing where rain and snow fall, similar to El Niño's worldwide effects. Sea surface temperatures in the northern Pacific Ocean haven't been

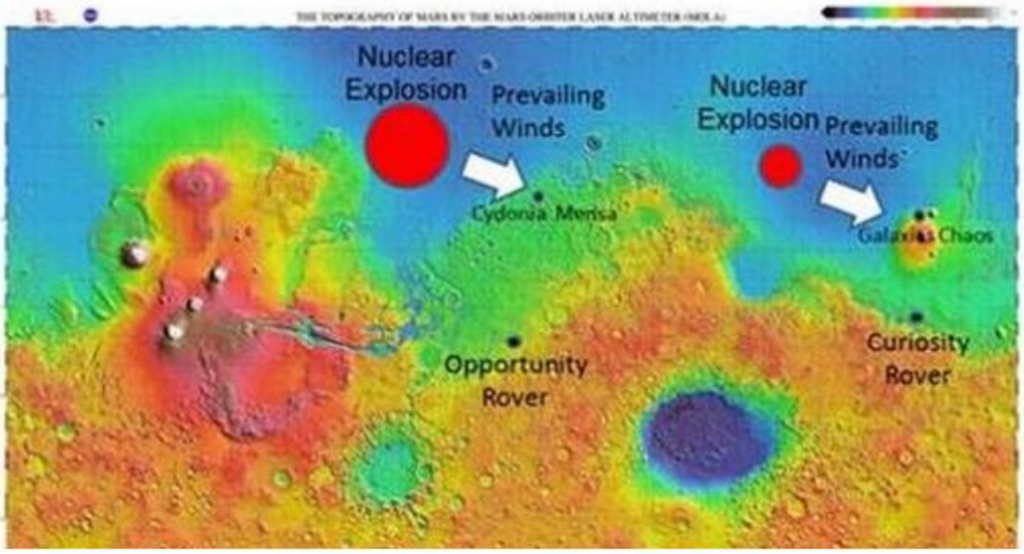


this warm in 10 years, Unger said. "Whether it will stay this way, only time will tell," he said. The PDO has generally been in a negative, or cold phase, since 1998, scientists think. By Becky Oskin. Originally published on *Live Science*.■

Chicago, USA

Physicist Claims Evidence Ancient Nuclear Explosions Ended Life on Mars

A plasma physicist is advancing a theory in which he claims to have evidence of two ancient nuclear explosions on Mars, events that he believes wiped out an ancient civilization on the red planet. According to the Daily Mail, Dr. John Brandenburg is set to present his theory at the 2014 Annual Fall Meeting of the American Physical Society in Illinois, which will be held this Saturday. His lecture, Evidence of Massive Thermonuclear Explosions in Mars Past, The Cydonian Hypothesis, and Fermi's Paradox, will examine the theory, which he also advances in a paper set to be published in the Journal of Cosmology and Astroparticle physics. "Given the large amount of nuclear isotopes in Mars atmosphere resembling those from hydrogen bomb tests on Earth, Mars may present an example of civilization wiped out by a nuclear attack from space," he wrote. Brandenburg's research centers around a high concentration of Xenon-129 in the atmosphere of Mars, as well as an abundance of Uranium and Thorium on the planet's surface, as Vice notes.



He claims that Mars was the site of several "massive radiological events," which were responsible for the current concentrations of radioactive elements. "This pattern of phenomenon can be explained as due to two large anomalous nuclear explosions on Mars in the past." Brandenburg, who holds a degree from UC Davis, has previously claimed that Mars was once home to two ancient civilizations, known as Cydonia and Utopia, which possessed a level of technology similar to that of the ancient Egyptians. "Analysis of new images from Odyssey, MRO and Mars Express orbiters now show strong evidence of eroded archeological objects at these sites," he wrote. "Taken together, the data requires that the hypothesis of Mars as the site of an ancient planetary nuclear massacre, must now be considered." Observers have long claimed to see evidence of ancient civilizations in photos sent back by rovers on the surface of Mars, as the Inquisitr has previously noted. Brandenburg asserts that the infamous "face on Mars," which was found in the Cydoina region, is an artifact from an ancient alien race.

Brandenburg also believes that his theory could explain the Fermi Paradox, which questions why humanity has yet to contact alien life, despite the mathematically high probability of its existence. Warning that mankind should be wary of such an attack on our own planet, he advocates a manned mission to Mars in order to study any remaining evidence.■ Read more at *http://www.inquisitr.com/1625693/physicist-claims-evidence-ancient-nuclear-explosions-ended-life-on-mars/#vgKoz0JauQ7f2ziA.99*

Pasadena, USA

Binary Earth-Size Planets Possible Around Distant Stars

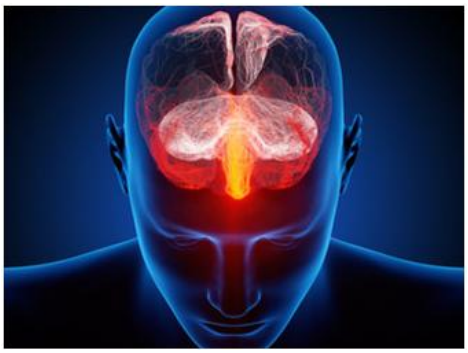
The solar system has many examples of moons orbiting planets; Jupiter and Saturn both possess more than 60 satellites. However, these moons are usually much smaller than their planets — Earth is nearly four times wider than its moon and more than 80 times its mass. Still, some moons are as large as planets. For instance, Ganymede, Jupiter's largest moon, is

larger than Mercury, and three-quarters the diameter of Mars. Also, moons at times are nearly as large as their worlds; Pluto's largest moon, Charon, is about half the diameter of the dwarf planet itself. This raises the intriguing possibility that planets of equal size could orbit each other. Binary stars, or two stars orbiting each other, are very common throughout the Milky Way galaxy. Some of these two-star systems are even known to host exoplanets — worlds with two suns, like Luke Skywalker's home planet of Tatooine in "Star Wars." Binary asteroids also exist in the solar system. However, binary or double planets involving Earth-size worlds are currently only science fiction. One possible way that binary planets might form is when two worlds orbiting a star get close enough to one another to interact gravitationally. To see if these systems are possible, researchers simulated two rocky Earth-sized planets veering toward each other. They modeled each world as made up of 10,000 particles and varied the speed of the planets and the angles of their approaches. The scientists managed to simplify their models so that each simulation took as little as a day to run instead of up to a week as they did at the beginning of their work. The scientists ran about two dozen simulations. However, these simulations often resulted in the planets colliding, typically merging or accreting together into a larger planet and sometimes leaving behind a disk of debris from which a moon could form. Also, in some simulations, the planets collided in a grazing manner at high speeds, resulting in "hit and run" interactions in which the worlds escaped from one another. Still, about one-third of the simulations resulted in binary planets forming. These involved relatively slow, grazing collisions. "Previously, the only expected outcomes of large-body impacts of this sort were escape or accretion — that is, either the two bodies do not stay together or they merge into one, occasionally with a disk of debris," study co-author Keegan Ryan, an undergraduate student at the California Institute of Technology in Pasadena, told Space.com. "Our findings suggest the possibility of another outcome — binary planets. The bodies stay mostly intact, but end in a bound orbit with one another." These binary planets would loom extraordinarily close to one another, separated by a distance of about half the diameter of each of the worlds. Over time, the rate at which both planets spin would fall into lockstep, with each world only turning one face toward its partner. Such binaries can persist for billions of years, researchers say, provided they form at least half an astronomical unit or more away from their parent stars — far enough away for the star's gravitational pull to not disrupt the binary planet system. (One astronomical unit, or AU, is the average distance between the sun and Earth, about 93 million miles, or 150 million kilometers.) The research team's goal from here "is to run more simulations, increase the parameters of the simulations, and work to get a better picture of the probability that a binary planet might form," Ryan said. Ryan and his colleagues Miki Nakajima and David Stevenson detailed their findings Nov. 11 at the American Astronomical Society's Division for Planetary Sciences meeting in Tucson, Arizona. By Charles Q. Choi. Originally published on *Space.com*.■


Who feeds us?

NEUROSCIENCE

"Trigger" for Stress Processes Discovered in the Brain



At the Center for Brain Research at the MedUni Vienna an important factor for stress has been identified in collaboration with the Karolinska Institutet in Stockholm (Sweden). This is the protein secretagogin that plays an important role in the release of the stress hormone CRH and which only then enables stress processes in the brain to be transmitted to the pituitary gland and then onwards to the organs. A current study on this molecular switch has now been published in the top-ranked *EMBO Journal*. "If, however, the presence of secretagogin, a calcium-binding protein, is suppressed, then CRH (= Corticotropin Releasing Hormone) might not be released in the hypothalamus of the brain thus preventing the triggering of hormonal responses to stress in the body," explains Tibor Harkany of the Department of Molecular Neurosciences at the MedUni Vienna. The hypothalamus requires the assistance of CRH to stimulate the production and release of the hormone ACTH from cells in the pituitary gland into the blood stream. Thus, ACTH reaches the adrenal cortex and once there stimulates the production and release of further hormones including, cortisol, a vital stress hormone. Upon stress, the hypothalamus responds by releasing CRH and thus produces the critical signal orchestrating also ACTH and cortisol secretion. However, if this cycle is interrupted, it is not possible for acute, and even chronic, stress to arise. Another interesting fact: secretagogin was discovered at the MedUni Vienna 15 years ago by Ludwig Wagner at the University Department of Internal Medicine III in connection with research on the pancreas. "Now we have a better understanding of how stress is generated," says Tomas Hökfelt of the Karolinska Institutet and guest professor at the Med Uni Vienna. This could result in a further development where secretagogin is deployed as a tool to treat stress, perhaps in people suffering from mental illness such as depression, burn out or posttraumatic stress disorder, but also in cases of chronic stress brought on by pain. If a rapid recovery phase follows a period of stress, body and mind are restored to "normal working", which is associated with a suppression of the release of circulating stress hormones. In contrast, the consequences of chronic stress are manifold and can, for example, lead to an increased tendency to suffer from infections but also to high blood pressure, diabetes and an increased risk of cardio-vascular disease right through to chronic headaches, tinnitus or osteoporosis. Illnesses resulting from stress steadily increase in frequency and place a burden on the health care system. The European Agency for Safety and Health at Work has therefore dedicated 2014 to the subject of stress. According to the Austrian employees' organisation, international studies show that in Europe over 50 percent of sick leave is attributable to a form of stress. In a recent analysis by the Austrian Economic Research Institute, IWS, a figure of seven billion Euros a year was placed on the economic damage due to mental illness in Austria.■

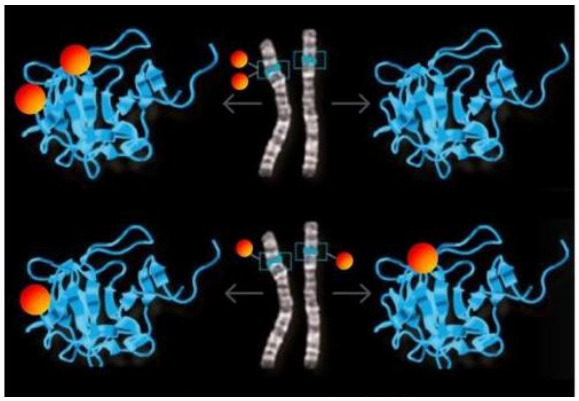
EMBO Journal, DOI: 10.15252/embj.201488977

BIOCHEMISTRY

Duality in the Human Genome

Humans don't like being alone, and their genes are no different. Together we are stronger, and the two versions of a gene – one from each parent – need each other. Scientists at the Max Planck Institute for Molecular Genetics in Berlin have analysed the genetic makeup of several hundred people and decoded the genetic information on the two sets of chromosomes separately. In this relatively small group alone they found millions of different gene forms. The results also show that genetic mutations do not occur randomly in the two parental chromosome sets and that they are distributed in the same ratio in everyone. In 2001 scientists announced the successful decoding of the first human genome. Since then, thousands more have been sequenced. The price of a genetic analysis will soon fall below the 1,000 dollar mark. Given this rapid pace of development, it's easy to forget that the technology used only reads a mixed product of genetic

information. The analytical methods commonly employed do not take into account the fact that every person has two sets of genetic material. "So they are ignoring an essential property of the human genome. However, it's important to know, for example, how mutations are distributed between the two chromosome sets," says Margret Hoehe from the Max Planck Institute for Molecular Genetics, who carried out the study. Hoehe and her team have developed molecular genetic and bioinformatic methods that make it possible to sequence the two sets of chromosomes in a human separately. The researchers decoded the maternal and paternal parts of the genome in 14 people and supplemented their analysis with the genetic material of 372 Europeans from the 1000 Genomes Project. "Fourteen people may not sound like a lot, but given the technical challenge, it is an unprecedented achievement," says Hoehe. The results show that most genes can occur in many different forms within a population: On average, about 250 different forms of each gene exist. The researchers found around four million different gene forms just in the 400 or so genomes they analysed. This figure is certain to increase as more human genomes are examined. More than 85 percent of all genes have no predominant form which occurs in more than half of all individuals. This enormous diversity means that over half of all genes in an individual, around 9,000 of 17,500, occur uniquely in that one person - and are therefore individual in the truest sense of the word. The gene, as we imagined it, exists only in exceptional cases. "We need to fundamentally rethink the view of genes that every schoolchild has learned since Gregor Mendel's time. Moreover, the conventional view of individual mutations is no longer adequate. Instead, we have to consider the two gene forms and their combination of variants," Hoehe explains. When analysing genomes, scientists should therefore examine each parental gene form separately, as well as the effects of both forms as a pair. According to the researchers, mutations of genes are not randomly distributed between



the parental chromosomes. They found that 60 percent of mutations affect the same chromosome set and 40 percent both sets. Scientists refer to these as cis and trans mutations, respectively. Evidently, an organism must have more cis mutations, where the second gene form remains intact. "It's amazing how precisely the 60:40 ratio is maintained. It occurs in the genome of every individual – almost like a magic formula," says Hoehe. The 60:40 distribution ratio appears to be essential for survival. "This formula may help us to understand how gene variability occurs and how it affects gene function." Some of the many variants that alter the genome also have an effect at the protein level. The researchers have now identified a set of 4,000 genes that are altered by mutations so that their proteins occur especially frequently in two different forms in humans. These genes mainly control signal transmission between cells, the immune system and gene activity. This dual gene and protein arrangement has the advantage that it allows the activity of genes to be more flexibly adjusted and altered. By using the more favourable variant, the body is better able to adapt to changes in its own processes and to environmental conditions. If the duality of genes goes awry and the wrong protein form is used, this can trigger pathogenic mechanisms. This is probably why those 4,000 genes include many disease genes. These findings will change the interpretation of genetic analyses and the prediction of diseases. Moreover, individualised medicine cannot ignore the "dual nature" of human genomes. "Our investigations at the protein level have shown that 96 percent of all genes have at least 5 to 20 different protein forms. This results in tremendous individual diversity in possible interactions between genes, and shows how daunting the challenge is to develop individually tailored therapies," says Hoehe. So far, researchers have estimated the risk of disease only by the presence or absence of mutations. However, there is evidence that in cancer, for example, the severity and course of the disease is determined by the wrong distribution of a mutation. The location of mutations therefore needs to be considered in the diagnosis, prediction and prevention of diseases in future.■

Nature Communications
doi:10.1038/ncomms6569


Love the Wave
Love the Earth


When life starts,
It is so fresh.
Who knows the future?
Sunny
Rainy
Droughty
Or
……

Sand on the Edge of Qinghai Lake in China

By CNSA (2014, China)

Back in April 2013, China launched its first satellite with high-resolution imaging capabilities up into space. That satellite made some news today when the country's space agency said that authorities had used its imagery to detect illegal border crossings and even to bust marijuana farmers. The satellite, Gaofen-1, is the first of several that China plans to put up into space. In fact, it just launched the Gaofen-2 last week. In particular, Gaofen-1 was sent up for the purpose of monitoring the land and helping in the event of a disaster. Below, you can see the 10 images that the China National Space Administration published earlier this month. They're in false color — so they simultaneously look both alien and incredible, but you can usually expect that vegetation will show up as red, water will show up as blue, and dirt will show up as shades of gray.■


Working like a worker bee?
Relax yourself.....

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The Bonoi Academy of Science & Education

H2A.Z in Neuron: Implications in Pain-Related Social Defect

Xian Wang

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H2A.Z in Neuron: Implications in Pain-Related Social Defect

Xian Wang*,Δ

SUMMARY Cumulating evidence indicated that chronic pain-associated cellular and molecular changes play an essential role in contributing to the development of social defect symptoms, and more recent findings implicated the critical role of epigenetic mechanisms in chronic pain-related sensitization. Histone variant exchange, in which canonical histones are replaced with their variant counterparts, is an entire branch of epigenetics that has received limited attention in the brain and has never, to our knowledge, been studied in relation to pain-related social defect. Here we hypothesize that H2A.Z, a variant of histone H2A, is actively involved in the regulation of chronic pain related social defect symptoms, probably through downstream effects on gene expression. We hope the histone variant H2A.Z regulation may contribute to the molecular basis of cognitive function and serve as a potential therapeutic target for associated social defect.■

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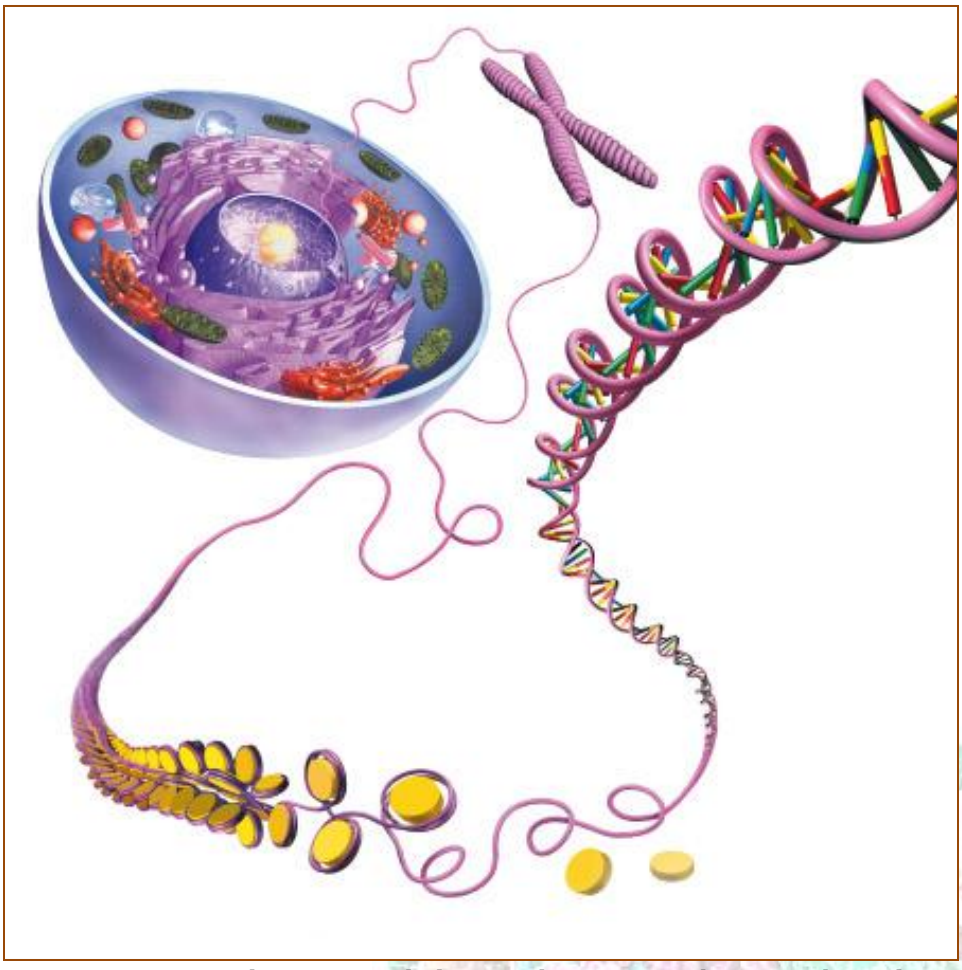
SOCIAL DEFECT underlies a combination of series of severe psychiatric conditions such as anxiety, depression, autism, schizophrenia, or suicidal tendency (1). At the same time, a considerable proportion of patients with chronic pain have been observed to have an increased risk of developing social defected symptoms (2). Considering the high comorbidity rate of chronic pain and social defect, it is important to explore the underlying etiological and pathophysiological mechanisms, and verifies the therapeutic efficacy of possible target interventions on the comorbidity as well.

Numerous studies have suggested the involvement of epigenetic mechanisms in the development of chronic pain and diverse neurological diseases underlying social defect symptoms. Tran and colleagues found that epigenetic programming in the amygdala, specifically histone modifications, is important in the maintenance of chronic anxiety and pain (3). Sampathkumar et al (4) outlined the importance of epigenetic modifications in neurodevelopmental disorders, especially autism spectrum disorders.



Epigenetic mechanisms include DNA methylation, histone modifications, nucleosome repositioning, higher order chromatin remodeling, noncoding RNAs, and RNA and DNA editing. Menke and colleagues suggested that current psychopharmacologic drugs including antidepressants, antipsychotics and mood stabilizers may exert some of their effects by inducing epigenetic changes (5). Epigenetic processing had been suggested as prospective molecular indicators of the biological consequences of stress and chronic pain (6).

Recently, H2A.Z, a universally conserved variant of histone H2A, an entire branch of epigenetics, has been demonstrated in the regulation of series of cognitive disorders. H2A.Z is found in nucleosomes within the promoters of most genes from yeast to plants to humans, and plays an essential role in transcriptional memory. Zovkic and coresearchers provided evidence that histone variant exchange was a novel mechanism contributing to the molecular basis of cognitive function and implicated H2A.Z as a potential therapeutic target for memory disorders (7). Besides, Maze et al (8) suggested histone regulation appears to have important roles in both the developing and adult CNS, and seems to be critical to many aspects of neural plasticity that directly influence the establish ment of complex behavioral phenotypes. Considering the role of histone variant H2A.Z in cognitive function, we hope it may serve as a potential therapeutic target for social defect symptoms.

Combining our previously established behavioral model of chronic pain-included social defect (9), in the future, we aimed to originally characterize the mechanisms underlying H2A.Z and social defect symptoms in patients with chronic pain and determine whether H2A.Z may serve as an effective therapeutic target for pain-related social defect symptoms.■

Conflict of Interests

None

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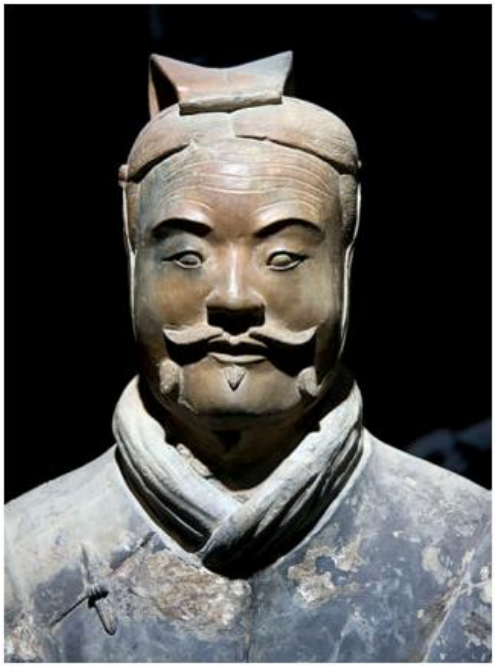
Help those in need…

Stop wasting foods

This 2000-Year-Old Pigment Can Eliminate the Third Dimension

HAN PURPLE is an ancient pigment that wasn't reconstructed by modern chemists until 1992. After the chemists got done with it, it was the physicists' turn. Han purple, they found, *eliminates an entire dimension*. It makes waves go two-dimensional. You'll see Han purple on the famous terracotta warriors surrounding the tomb of the first emperor of China, or on ancient pottery and other works of art. Where you won't see it is on anything made between 220 A.D. and 1992, because after the pigment disappeared it took 1700 years to re-discover it. Elisabeth FitzHugh, a conservator at the Smithsonian, pinned down the chemical composition of the pigment and announced it was a barium copper silicate.



Exactly how some inventor stumbled on a way to make the pigment is still a matter of debate. An early theory, not believed by many, is that the Chinese learned how to make purple pigment from the Egyptians. Egyptian purple pigment seems to be similar, but the chemical formulas don't add up — Egyptians used calcium instead of barium. It's also not an easy process to pass from one culture to another. To get the elements to melt together, they have to be heated to about 850-1000 °C. Most researchers think that because it contains both silicon and barium Han purple was a by-product of the glass-making process. Barium makes glass shinier and cloudy, which means this pigment could be the work of early alchemists trying to synthesize white jade. Barium copper-silicate doesn't just have archaeologists and chemists intrigued. At normal temperatures, it's an insulator and is nonmagnetic. Along with its many fine properties - prettiness, historical importance, a hint of aristocratic style — barium copper-silicat has many electrons, some of which spin up and some of which are spin down. Something unusual happens as the temperature drops and as a magnetic field is applied, although the temperature has to drop pretty far, going down to between one and three degrees Kelvin, and the magnetic field has to be about 800,000 times the strength of Earth's magnetic field. The results are worth it — the electrons seem to merge, taking on one spin, and acting as one electron. That sounds like an ordinary superconductor, you say. Then you're as foolish as a Phoenician in sub-par purple! Han purple still has a trick up its sleeve. Drop the temperature some more and something happens to the magnetic wave traveling through the substance. At higher temperatures, it propagates like a regular wave, traveling in three dimensions. Get under one degree Kelvin, and it no longer has a vertical component. It propagates in two dimensions only. Scientists think that this has something to do with the structure of barium copper silicate. It's components are arranged like layers of tiles, so they don't stack up neatly. Each layers' tiles are slightly out of sync with the layer below them. This may frustrate the wave and force it to go two dimensional. Anyone wonder if ancient physicists discovered this? And if the secret to making Han purple was lost because they waved themselves into two dimensions? By Esther Inglis-Arkell. *Terracotta Army Images: David Castor.*■


When you face the eruption
Do you feel the ending of the world?

Do the Endangered Animals Exist?

MOST PEOPLE would say they care about endangered animal species and yet, our ecosystems are currently experiencing mass extinctions! How could this be?! Are we doing all that we can to protect our friends at risk – like the Bornean and Sumatran orangutans, the Sumatran tiger, the Black rhinoceros, the Mountain gorilla, the California Condor, sea turtles, the Emperor penguin, the Giant panda, and other commonly recognized endangered animals? Besides the philosophy of all living beings having intrinsic value, the roles of many species are crucial to their ecosystems and even to human survival! If we Green Monsters want to see our endangered friends continue to exist, we need to be doing all that we can for their protection. For example, we could be using products that help animals and their environments, changing consumption habits, volunteering with or raising donations for organizations working to benefit endangered animals, and continuing to discover new ways you can help animals and ecosystems. While we may be focused on helping animals that are known to be in need of aid, what about the endangered species you've never even heard of? Recently, exotic species like the pangolin have started to become more publicly exposed. But just as new species can be discovered each day, more species are becoming extinct each day … many without even being noticed by people. While the daily lives of humans might not *seem* to be affected by loss of species biodiversity, ecosystems and many other animals are affected. And somewhere down the line, when other species are affected, so too will be humans. So let's check out some fascinating creatures that may be in critical danger. They need our help today!

RED BEARDED VULTURE

Vultures tend to have a bad reputation, but we Green Monsters love nature's clean-up crews! The red bearded vulture is the largest of birds in the Alps. Native to over 23 Eurasian countries, these beautiful birds were once known as "bone eaters" because they are the only animals whose diet consists primarily of bone! The bearded vulture has been historically feared due to the bird's immense size and it was believed the vultures were responsible for attacking lambs and small children (no longer believed to be true). These birds were hunted and poisoned to be eradicated from the Alps. It is estimated that there are between 2,000 and 10,000 individuals left in the world today. Current threats include collisions with power lines, human disturbance, habitat degradation, accidental poisoning, and illegal hunting.

BLOBFISH

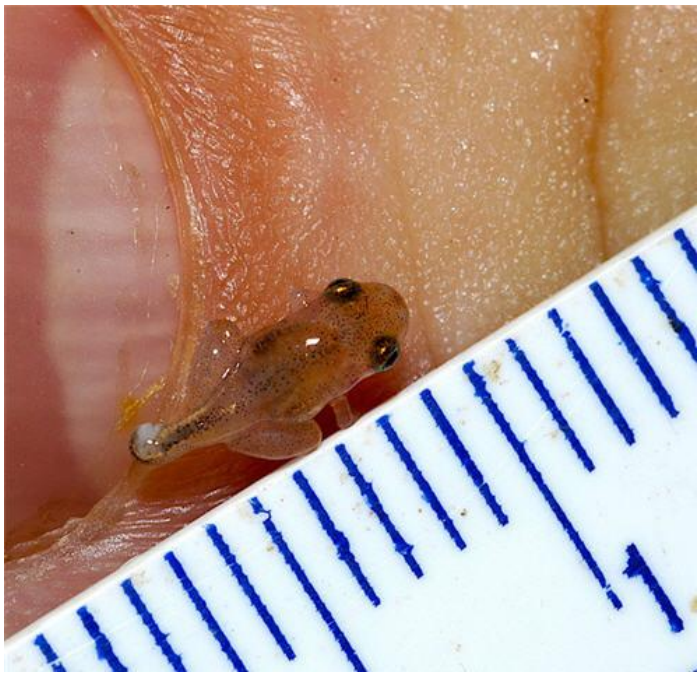
Aww! Look how sad this poor fish is … perhaps because her/his species is on the endangered list. Or … because this fish was actually trawled from a depth of over 300 meters and then brought to the surface, causing the fish to become a gooey pink gelatin-like … blob (Wouldn't that make you sad?). Located on the coasts of Australia and Tasmania, the blobfish (known more properly and respectfully as Psychrolutes

marcidus) can actually exist at depths as deep as 600 to 1,200 meters, where the environment's pressure is dozens of times greater than sea level. How is a deep-sea fish endangered? They are so far out of reach from most humans! Like our unfortunate friend in the photo, blobfish are often accidentally (they are inedible) captured by deep-sea trawlers. They are not adapted to swim quickly away from predators, so they are very vulnerable. Whether you think this fish is ugly or not, let's not judge one for appearances and help out this amazing species!

DHOLE

Are you a dog lover? Ever seen canines like these? If you're lucky, you might spot a dhole in Eastern or Central Asia. Like other dogs, dholes are playful, social omnivorous beings who live in packs with about five to twelve members. Unlike other dogs, dholes will allow the younglings of their pack to eat first after a kill. These dogs are the only member of the genus Cuon still in existence. Let's not see them go extinct! Dholes are considered endangered by the IUCN and the species continues to be threatened by habitat loss, transfer of disease from domestic and stray dogs, and lack of food resources. The dhole's primary sources of prey are ungulates (pigs, horses, etc) and since many species of ungulates have become extinct or rare to find in Asia, obviously this is a problem for dholes.

MATANG NARROW-MOUTHED FROG



Why is there a picture of a penny? Look closer – there's a frog on it! Commonly known as the "pea-sized frog", the species was first described in Borneo in 2010. Although adult males are between 10 and 12 millimeters in length, believe it or not, this is not the smallest frog in the world. Paedophryne amauensis stole the record for world's smallest vertebrate in 2012 at 7.7 mm long! Although it is difficult to determine the population status of these little beings (since they're so hard to find), one-third of amphibians are in danger of extinction and are considered to be the most threatened group of animals. Threats include deforestation, pollution, ecosystem disturbance, climate change, and disease.■

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FREEDOM


RIOT
TODAY'S WORLD
who should pay for this…

AUTHOR GUIDE

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Low income: $1,025 or less; (1st-type countries)
Lower-middle income: $1,026 - $4,035; (2nd-type countries)
Upper-middle income: $4,036 - $12,475; (3rd-type countries)
High income: $12,476 or more. (4th-type countries)
http://www.bonoi.org/node/75

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