http://bit.ly/2j7Fuq9

Alzheimer's drug, could revolutionize dental treatments

A new method of stimulating the renewal of living stem cells in tooth pulp using an Alzheimer's drug has been discovered by a team of researchers at King's College London.

Following trauma or an infection, the inner, soft pulp of a tooth can become exposed and infected. In order to protect the tooth from infection, a thin band of dentine is naturally produced and this seals the tooth pulp, but it is insufficient to effectively repair large cavities.

Currently dentists use man-made cements or fillings, such as calcium and silicon-based products, to treat these larger cavities and fill holes in teeth. This cement remains in the tooth and fails to disintegrate, meaning that the normal mineral level of the tooth is never completely restored.

However, in a paper published today in Scientific Reports, scientists from the Dental Institute at King's College London have proven a way to stimulate the stem cells contained in the pulp of the tooth and generate new dentine - the mineralised material that protects the tooth - in large cavities, potentially reducing the need for fillings or cements.

The novel, biological approach could see teeth use their natural ability to repair large cavities rather than using cements or fillings, which are prone to infections and often need replacing a number of times. Indeed when fillings fail or infection occurs, dentists have to remove and fill an area that is larger than what is affected, and after multiple treatments the tooth may eventually need to be extracted.

As this new method encourages natural tooth repair, it could eliminate all of these issues, providing a more natural solution for patients.

Significantly, one of the small molecules used by the team to stimulate the renewal of the stem cells included Tideglusib, which has previously been used in clinical trials to treat neurological disorders including Alzheimer's disease. This presents a real opportunity to fast-track the treatment into practice.

Using biodegradable collagen sponges to deliver the treatment, the team applied low doses of small molecule glycogen synthase kinase (GSK-3) to the tooth. They found that the sponge degraded over time and that new dentine replaced it, leading to complete, natural repair. Collagen sponges are commercially-available and clinically-approved, again adding to the potential of the treatment's swift pick-up and use in dental clinics.

Lead author of the study, Professor Paul Sharpe from King's College London said: "The simplicity of our approach makes it ideal as a clinical dental product for the natural treatment of large cavities, by providing both pulp protection and restoring dentine.

"In addition, using a drug that has already been tested in clinical trials for Alzheimer's disease provides a real opportunity to get this dental treatment quickly into clinics."

http://bit.ly/2ik2bAG

Why high-dose vitamin C kills cancer cells

Low levels of catalase enzyme make cancer cells vulnerable to high-dose vitamin C

Vitamin C has a patchy history as a cancer therapy, but researchers at the University of Iowa believe that is because it has often been used in a way that guarantees failure.

Most vitamin C therapies involve taking the substance orally. However, the UI scientists have shown that giving vitamin C intravenously--and bypassing normal gut metabolism and excretion pathways--creates blood levels that are 100 - 500 times higher than levels seen with oral ingestion. It is this super-high concentration in the blood that is crucial to vitamin C's ability to attack cancer cells.

Earlier work by UI redox biology expert Garry Buettner found that at these extremely high levels (in the millimolar range), vitamin C selectively kills cancer cells but not normal cells in the test tube and in mice. Physicians at UI Hospitals and Clinics are now testing the approach in clinical trials for pancreatic cancer and lung cancer that combine high-dose, intravenous vitamin C with standard

chemotherapy or radiation. Earlier phase 1 trials indicated this treatment is safe and well-tolerated and hinted that the therapy improves patient outcomes. The current, larger trials aim to determine if the treatment improves survival.

In a new study, published recently in the December issue of the journal Redox Biology, Buettner and his colleagues have homed in on the biological details of how high-dose vitamin C (also known as ascorbate) kills cancer cells.

The study shows that vitamin C breaks down easily, generating hydrogen peroxide, a so-called reactive oxygen species that can damage tissue and DNA. The study also shows that tumor cells are much less capable of removing the damaging hydrogen peroxide than normal cells.

"In this paper we demonstrate that cancer cells are much less efficient in removing hydrogen peroxide than normal cells. Thus, cancer cells are much more prone to damage and death from a high amount of hydrogen peroxide," says Buettner, a professor of radiation oncology and a member of Holden Comprehensive Cancer Center at the University of Iowa. "This explains how the very, very high levels of vitamin C used in our clinical trials do not affect normal tissue, but can be damaging to tumor tissue."

Normal cells have several ways to remove hydrogen peroxide, keeping it at very low levels so it does not cause damage. The new study shows that an enzyme called catalase is the central route for removing hydrogen peroxide generated by decomposing vitamin C. The researchers discovered that cells with lower amounts of catalase activity were more susceptible to damage and death when they were exposed to high amounts of vitamin C.

Buettner says this fundamental information might help determine which cancers and which therapies could be improved by inclusion of high-dose ascorbate in the treatment.

"Our results suggest that cancers with low levels of catalase are likely to be the most responsive to high-dose vitamin C therapy, whereas cancers with relatively high levels of catalase may be the least responsive," he explains.

A future goal of the research is to develop methods to measure catalase levels in tumors.

In addition to Buettner, the UI research team included Claire Doskey, Visarut Buranasudja, Brett Wagner, Justin Wilkes, Juan Du, and Joseph Cullen. The study was funded in part by grants from the National Institutes of Health (NIH), (CA169046, GM073929, CA148062, ES013661, ES005605, CA184051) and The Gateway for Cancer Research.

http://bit.ly/2jqZb1Z

Fear of diagnostic low-dose radiation exposure is overstated, experts assert

Long-held belief that even low doses of radiation increase cancer risk is based on an inaccurate, 70-year-old hypothesis

Reston, Va. -- In an article published in the January 2017 issue of "The Journal of Nuclear Medicine," researchers assert that exposure to medical radiation does not increase a person's risk of getting cancer. The long-held belief that even low doses of radiation, such as those received in diagnostic imaging, increase cancer risk is based on an inaccurate, 70-year-old hypothesis, according to the authors.

"We have shown that the claim made by Hermann Muller during his 1946 Nobel Lecture that all radiation is harmful, regardless of how low the dose and dose rate--known as the linear no-threshold hypothesis (LNTH)--was a non sequitur unrecognized by the radiation science community," states Jeffry A. Siegel, PhD, president and CEO of Nuclear Physics Enterprises, Marlton, New Jersey. "Since then, it has repeatedly been shown that the dose-response relationship may reasonably be considered to be linear but only down to a threshold, below which there is no demonstrable harm and even often benefit. Yet, the LNTH still rules radiation regulatory policy."

Siegel says that policies based on the presumption of harm at every dose level and proposing using lower and lower dosing for CT, x-ray, and nuclear medicine imaging studies--known as the ALARA (as low as reasonably achievable) doctrine--help reinforce existing widespread fear of radiation (radiophobia) in both physicians and patients, due to

decades of misinformation. He emphasizes, "This fear is unjustified by any scientific findings and is discredited by most experimental and epidemiological studies, which show that low-dose radiation, instead, stimulates protective responses provided by eons of evolution, resulting in beneficial effects."

Citing numerous studies, the authors assert that the LNTH and ALARA are fatally flawed, as they focus only on molecular damage while ignoring protective, biological responses. Low doses of radiation stimulate protective responses and provide enhanced protections against additional damage over time, including damage from subsequent, higher radiation exposures.

Evidence presented demonstrates a reduced, not increased, cancer risk at radiological imaging doses. The Life Span Study (LSS) atomic-bomb survivor data show the LNTH-predicted, low-dose carcinogenicity is invalid below approximately 200 mGy. The effective dose of a typical computed tomography (CT) scan is about 10 mSv; a PET/CT brain scan, 5-7 mSv; and a routine whole-body F-18 FDG PET/CT scan, 12-15 mSv. Thus, medical imaging's much lower doses for children or adults should not be feared or avoided for radiophobic reasons. The authors reason that the actual risk of misdiagnoses from inadequate dose, or from phobia-driven avoidance of needed imaging studies, should be the main concern.

Siegel advocates for the safety and life-saving benefits of medical imaging, saying, "The task before us is to undo the public's groundless fears of low-dose radiation exposure. The medical profession must be properly re-educated, beginning with diagnostic radiologists and nuclear medicine physicians, and only then can the public be given valid information that they can trust. Furthermore, defeating the LNTH and its offspring ALARA may lead to new ways of diagnosing and treating illness, and, even more importantly, preventing it."

Authors of the article "Subjecting Radiological Imaging to the Linear No-Threshold Hypothesis: A Non Sequitur of Non-Trivial Proportion" include Jeffry A. Siegel, PhD, president and CEO, Nuclear Physics Enterprises, Marlton, New Jersey; Charles W. Pennington, MS, MBA, NAC International (retired), Norcross, Georgia; and Bill Sacks, PhD, MD, U.S. FDA officer and clinical radiologist (retired), Green Valley, Arizona.

http://bit.ly/2inqbxP

New Midwestern University research suggests appendix may have important function

May serve as a reservoir for beneficial gut bacteria

The human appendix, a narrow pouch that projects off the cecum in the digestive system, has a notorious reputation for its tendency to become inflamed (appendicitis), often resulting in surgical removal. Although it is widely viewed as a vestigial organ with little known function, recent research suggests that the appendix may serve an important purpose. In particular, it may serve as a reservoir for beneficial gut bacteria. Several other mammal species also have an appendix, and studying how it evolved and functions in these species may shed light on this mysterious organ in humans.

Heather F. Smith, Ph.D., Associate Professor, Midwestern University Arizona College of Osteopathic Medicine, is currently studying the evolution of the appendix across mammals. Dr. Smith's international research team gathered data on the presence or absence of the appendix and other gastrointestinal and environmental traits for 533 mammal species. They mapped the data onto a phylogeny (genetic tree) to track how the appendix has evolved through mammalian evolution, and to try to determine why some species have an appendix while others don't.

They discovered that the appendix has evolved independently in several mammal lineages, over 30 separate times, and almost never disappears from a lineage once it has appeared. This suggests that the appendix likely serves an adaptive purpose. Looking at ecological factors, such as diet, climate, how social a species is, and where it lives, they were able to reject several previously proposed hypotheses that have attempted to link the appendix to dietary or environmental factors. Instead, they found that species with an appendix have higher average concentrations of lymphoid (immune) tissue in the cecum.

This finding suggests that the appendix may play an important role as a secondary immune organ. Lymphatic tissue can also stimulate growth of some types of beneficial gut bacteria, providing further evidence that the appendix may serve as a "safe house" for helpful gut bacteria.

They also found that animals with certain shaped ceca (tapering or spiral-shaped) were more likely to have an appendix than animals with a round or cylindrical cecum. Therefore, they concluded that the appendix isn't evolving independently, but as part of a larger "cecoappendicular complex" including both the appendix and cecum.

Researchers collaborating with Dr. Smith on this study are William Parker, Ph.D., Department of Surgery, Duke Medical Center, Durham, North Carolina; Sanet H. Kotzé, Ph.D., Department of Biomedical Sciences, Faculty of Medicine and Health Sciences, University of Stellenbosch, Tygerberg, South Africa; and Michel Laurin, Ph.D., from the Muséum National d'Histoire Naturelle in France. Midwestern University Senior Research Associate Brent Adrian also contributed illustrations for the study.

Citation: Smith HF, Parker W, Kotzé S, Laurin M. 2017. Morphological evolution of the mammalian cecum and cecal appendix. Comptes Rendus Palevol 16:39-57.

http://bit.ly/2ikeSv2

Do weekend warriors reap any health benefits?

But can people get a health benefit by working up a sweat only on the weekends?

WASHINGTON, DC - The U.S. Department of Health and Human Services recommends getting at least 150 minutes of moderate-intensity exercise spread out during the week. This could be accomplished by walking 30 minutes five days a week, but for many people even that modest amount of time just isn't there during the work week. But can people get a health benefit by working up a sweat only on the weekends?

Yes, says a study that will appear in the January 9 issue of the Journal of the American Medical Association Internal Medicine (JAMA IM). The study suggests that so-called "weekend warriors" have significantly lower all-cause mortality compared with inactive people. For people constrained by a busy weekday schedule, this study provides support for compressing their workout into a day or two, says a commentary that accompanies the study in the same issue. At the same time, there are still many questions remaining about the optimal dose of physical activity in terms of total time, frequency, and intensity, say the authors of the invited commentary Hannah Arem and Loretta DiPietro both from Milken Institute School of Public Health (Milken Institute SPH) at the George Washington University.

Arem and DiPietro go on to say that people who exercise throughout the week or on a daily basis may be getting additional health benefits, such as countering the negative effects of an otherwise inactive lifestyle. For busy people, they recommend building short stints of physical activity into a daily routine by taking the stairs instead of the elevator or taking short, frequent walks.

http://bit.ly/2jLVJCM

Earth's Moon Formed in 'Moonlet' Mash-Up After Many Earth Impacts

Earth's moon may be the product of many small moonlets that merged after multiple objects as big as Mars collided with Earth, leaving disks of planetary debris orbiting the planet, a new study suggests.

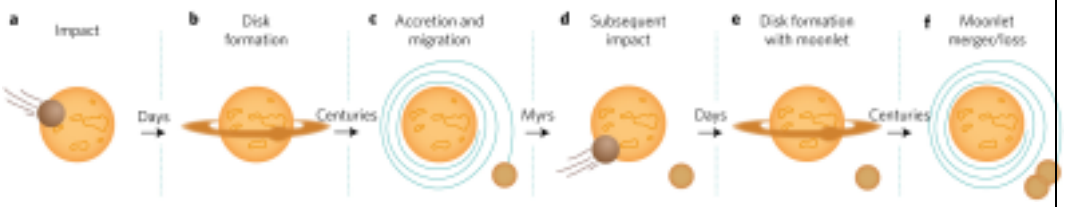
By Hanneke Weitering, Space.com Staff Writer-Producer

This idea that multiple impacts led to the moon's birth challenges the most prevalent theory of lunar formation, which suggests that one giant impact led to the formation of the moon.

The new, multiple-impact hypothesis suggests that about 20 moon- to Mars-size objects struck the Earth, flinging debris from the planet into orbit. There, the debris formed disks around the Earth that looked somewhat like Saturn's rings. Over centuries, debris in several disks accreted to form moonlets that migrated farther and farther from the

Earth due to tidal interactions. Eventually, the moonlets settled at a distance known as the Hill radius, coalescing to form one big moon.

This process isn't too far off from the "Giant Impact Hypothesis," which states that a planet-size rock named Theia struck the Earth, leaving behind a jet of debris that went on to form the moon. But there's one problem with this theory: it doesn't provide a good explanation for the strong similarity between the composition of the moon and the Earth.



This graphic illustrates how the moon may have formed after multiple collisions on Earth. Moon- to Mars-sized impactors strike the Earth and leave a disk of debris orbiting the planet. The debris forms "moonlets" and migrate farther away from the Earth due to a tidal interaction, but eventually settle at a distance known as the Hill radius. Here, the moonlets merge to eventually form the moon. **Raluca Rufu, et al. / Nature Geoscience**

"The multiple-impact scenario is a more natural way of explaining the formation of the moon," Raluca Rufu, a researcher at the Weizmann Institute of Science in Israel and lead author of the study, told Space.com. "In the early stages of the solar system, impacts were very abundant; therefore, it is more natural that several common impactors formed the moon, rather than one special one.

In a giant impact scenario, the object that struck the Earth would have needed an Earth-like composition to create a moon that is made of the same materials as Earth. If the impactor were composed of different stuff than Earth, the moon would not be so Earth-like in composition.

Authors of the new study, which was published today (Jan. 9) in the journal Nature Geoscience, performed several numerical simulations of moon-forming processes and determined that a multiple-impact scenario better explains the moon's Earthly composition.

"Moreover, the composition similarity between the Earth and the moon in the giant impact cannot be explained without using a special Earth-like impactor," Rufu added. "However, if multiple of bodies contribute to the final moon, their chemical signatures can even out, therefore the traces of the various impacts will be masked."

Rufu also said that no existing evidence points more strongly to a single-impact hypothesis, though some studies have found that it is possible to reproduce the moon's composition with a single impact if it strikes with enough angular momentum. Such an impact "will excavate more Earth material; hence the final moon composition is similar to Earth," she said. "After the impact, the Earth-moon system has to lose the excess angular momentum."

"To match both compositional and angular momentum constraints, the single giant-impact hypothesis requires such a specific type of collision that the moon's formation becomes an uncomfortably improbable coincidence," Gareth Collins, a planetary scientist at Imperial College London who studies impacts throughout the solar system, wrote in an accompanying Nature News & Views article. Collins wrote that the study revives "the hitherto largely discarded scenario that a series of smaller and more common impacts, rather than a single giant punch, formed the moon."

Rufu and her colleagues are not the first to propose a multiple-impact scenario. Another paper published in 1989 raised that possibility, but "no further work was done on the subject," Rufu said. "This paper is first to provide extensive calculations that we hope will stimulate others to reexamine the issue."

Further research into the multiple-impact hypothesis is already underway. One of Rufu's collaborators, physicist Hagai Perets of the Technion — Israel Institute of Technology, is already working to find out the efficiency of moonlet mergers. Rufu and her adviser also plan to study the moonlet-merging process "to understand the mixing of the moonlets inside the final moon."

http://bit.ly/2jeCW22

Astronomers predict explosion that will change the night sky in 2022

Astronomy prof, student predict explosion that will change the night sky

January 9, 2017 by Matt Kucinski, Lynn Rosendale

Calvin College professor Larry Molnar and his students along with colleagues from Apache Point Observatory (Karen Kinemuchi) and the University of Wyoming (Henry Kobulnicky) are predicting a change to the night sky that will be visible to the naked eye.

"It's a one-in-a-million chance that you can predict an explosion," Molnar said of his bold prognostication. "It's never been done before."

Molnar's prediction is that a binary star (two stars orbiting each other) he is monitoring will merge and explode in 2022, give or take a year; at which time the star will increase its brightness ten thousand fold, becoming one of the brighter stars in the heavens for a time. The star will be visible as part of the constellation Cygnus, and will add a star to the recognizable Northern Cross star pattern.

A question leads to exploration

Molnar's exploration into the star known as KIC 9832227 began back in 2013. He was attending an astronomy conference when fellow astronomer Karen Kinemuchi presented her study of the brightness changes of the star, which concluded with a question: Is it pulsing or is it a binary?

Also present at the conference was then Calvin College student Daniel Van Noord '14, Molnar's research assistant. He took the question as a personal challenge and made some observations of the star with the Calvin observatory.

"He looked at how the color of the star correlated with brightness and determined it was definitely a binary," said Molnar. "In fact, he discovered it was actually a contact binary, in which the two stars share a common atmosphere, like two peanuts sharing a single shell.

"From there Dan determined a precise orbital period from Kinemuchi's Kepler satellite data (just under 11 hours) and was surprised to discover that the period was slightly less than that shown by earlier data" Molnar continued.

This result brought to mind work published by astronomer Romuald Tylenda, who had studied the observational archives to see how another star (V1309 Scorpii) had behaved before it exploded unexpectedly in 2008 and produced a red nova (a type of stellar explosion only recently recognized as distinct from other types). The pre-explosion record showed a contact binary with an orbital period decreasing at an accelerating rate. For Molnar, this pattern of orbital change was a "Rosetta stone" for interpreting the new data.

Making a bold prediction

Upon observing the period change to continue through 2013 and 2014, Molnar presented orbital timing spanning 15 years at the January 2015 meeting of the American Astronomical Society, making the prediction that KIC 9832227 may be following in the footsteps of V1309 Scorpii. Before taking the hypothesis too seriously, though, one needed to rule out other, more mundane, interpretations of the period change.

In the two years since that meeting, Molnar and his team have performed two strong observational tests of the alternative interpretations. First, spectroscopic observations ruled out the presence of a companion star with an orbital period greater than 15 years. Second, the rate of orbital period decrease of the past two years followed the prediction made in 2015 and now exceeds that shown by other contact binaries.

Moving from theory to reality

"Bottom line is we really think our merging star hypothesis should be taken seriously right now and we should be using the next few years to study this intensely so that if it does blow up we will know what led to that explosion," said Molnar.

To that end, Molnar and colleagues will be observing KIC 9832227 in the next year over the full range of wavelengths: using the Very Large

Array, the Infrared Telescope Facility, and the XMM-Newton spacecraft to study the star's radio, infrared and X-ray emission, respectively.

"If Larry's prediction is correct, his project will demonstrate for the first time that astronomers can catch certain binary stars in the act of dying, and that they can track the last few years of a stellar death spiral up to the point of final, dramatic explosion," said Matt Walhout, dean for research and scholarship at Calvin College.

Watching in wonder

"The project is significant not only because of the scientific results, but also because it is likely to capture the imagination of people on the street," said Walhout. "If the prediction is correct, then for the first time in history, parents will be able to point to a dark spot in the sky and say, 'Watch, kids, there's a star hiding in there, but soon it's going to light up.'"

Molnar says that this is the beginning of a story that will unfold over the next several years, and people of all levels can participate.

"The orbital timing can be checked by amateur astronomers," said Molnar. "It's amazing the equipment amateur astronomers have these days. They can measure the brightness variations with time of this 12th magnitude star as it eclipses and see for themselves if it is continuing on the schedule we are predicting or not."

http://bit.ly/2ikmfmv

Zapping the brain really does seem to improve depression

Now we know – zapping the brain with electricity really does seem to improve some medical conditions, meaning it may be a useful tool for treating depression.

By Sally Adee

Transcranial direct current stimulation (tDCS) involves using electrodes to send a weak current across the brain. Stimulating brain tissue like this has been linked to effects ranging from accelerated learning to improving the symptoms of depression and faster recovery from strokes.

Thousands of studies have suggested the technique may be useful for everything from schizophrenia and Parkinson's to tinnitus and autism.

However, replicating such studies has generally been difficult, and two recent analyses found no evidence that tDCS is effective, leading some to say that the technique is largely a sham.

"There are too many folks out there right now who are using electrical brain stimulation in a cavalier way," says Michael Weisend, a tDCS researcher at Rio Grande Neuroscience in Santa Fe, New Mexico. "At best it has an effect that's poorly understood, at worst it could be dangerous."

Now a review has weighed up the best available evidence. It has found that depression, addiction and fibromyalgia are most likely to respond to tDCS treatment.

Reliably better

Jean-Pascal Lefaucheur, a neurophysiologist at Henri Mondor Hospital in Paris, France, and his team concluded this by sifting through all tDCS studies so far. Unlike the two previous analyses, this one didn't lump together studies of variable sizes and designs. Instead, the team chose only studies that were placebo-controlled, used tDCS as a daily medical treatment, and involved at least 10 participants.

Analysing these high-standard studies revealed that tDCS seems to reliably improve the symptoms of depression, addiction and craving, and fibromyalgia. It also uncovered that the technique does not work for tinnitus, and that the evidence for using tDCS for stroke rehabilitation was not as strong as many had thought.

This underscores the most significant finding of the analysis, says team member Walter Paulus at Göttingen University in Germany: tDCS seems to have the most effect when restructuring of the brain isn't required. Simply exciting some neurons in people with tinnitus is unlikely to do much to alleviate it, he says.

As for using electric current for rehabilitation after a stroke, the team uncovered one study in which brain function deteriorated after the administration of tDCS.

Personalised treatment

“This is an important paper,” says Marom Bikson, a biomedical engineer at City University of New York.

“It is really the type of work that could push the field further,” says Roi Cohen Kadosh at the University of Oxford.

But the study is unlikely to be enough to push tDCS closer to use in mainstream clinics. Most of the good studies had fewer than 25 participants. In contrast, a single trial of a new antipsychotic drug, for example, may involve as many as 18,000 volunteers. For now, “possible or probably effective” is the best label tDCS can hope for, says Weisend. “The community needs to push for bigger trials.”

However, the team’s findings do shed some light on what tDCS treatment may look like in the future. The analysis identified important factors, such as the exact position of the electrodes used, a person’s physiology and their particular brain chemistry. If adopted, there won’t be a one-size-fits-all tDCS treatment. Instead, tDCS will be tailored to individuals based on the drugs they are already taking – for example, antidepressants that boost serotonin in the brain – the thickness of their skull and other factors.

Journal reference: Clinical Neurophysiology, DOI: 10.1016/j.clinph.2016.10.087

http://bbc.in/2irY83r

New candidate for 'missing element' in Earth's core

Japanese scientists believe they have established the identity of a "missing element" within the Earth's core.

By Rebecca Morelle Science Correspondent, BBC News

They have been searching for the element for decades, believing it makes up a significant proportion of our planet's centre, after iron and nickel. Now by recreating the high temperatures and pressures found in the deep interior, experiments suggest the most likely candidate is silicon. The discovery could help us to better understand how our world formed.

Lead researcher Eiji Ohtani from Tohoku University told BBC News: "We believe that silicon is a major element - about 5% [of the Earth's inner core] by weight could be silicon dissolved into the iron-nickel alloys."

Hard to reach

The innermost part of Earth is thought to be a solid ball with a radius of about 1,200km (745 miles). It is far too deep to investigate directly, so instead scientists study how seismic waves pass through this region to tell them something of its make-up.

It is mainly composed of iron, which makes up an estimated 85% of its weight, and nickel, which accounts for about 10% of the core.

To investigate the unaccounted for 5% of the core, Eiji Ohtani and his team created alloys of iron and nickel and mixed them with silicon.

They then subjected them to the immense pressures and temperatures that exist in the inner core. They discovered that this mixture matched what was seen in the Earth's interior with seismic data.

Prof Ohtani said more work was needed to confirm the presence of silicon and that it did not rule out the presence of other elements.

Core formation

Commenting on the research, Prof Simon Redfern from the University of Cambridge, UK, said: "These difficult experiments are really exciting because they can provide a window into what Earth's interior was like soon after it first formed, 4.5 billion years ago, when the core first started to separate from the rocky parts of Earth. "But other workers have recently suggested that oxygen might also be important in the core."

He said that knowing what is there could help scientists to better understand the conditions that prevailed during the formation of the Earth. In particular whether the early interior was one where oxygen was greatly limited - known as reducing conditions. Or whether oxygen was in abundance, which is described as oxidising.

If a larger amount of silicon had been incorporated in Earth's core more than four billion years ago, as suggested by Prof Ohtani's results, that would have left the rest of the planet relatively oxygen rich.

But if, instead, oxygen was sucked into the core that would leave the rocky mantle surrounding the core depleted of the element.

Prof Redfern said: "In a way, these two options are real alternatives that depend a lot on the conditions prevailing when Earth's core first began to form. "The most recent results add to our understanding, but I suspect that they are by no means the last word on the story."

Prof Ohtani presented his research to the recent Fall Meeting of the American Geophysical Union in San Francisco.

http://bit.ly/2jfklCQ

Oldest Evidence of Silk Found in 8,500-Year-Old Tombs

Silk proteins were found in tombs at Jiahu in the Henan Province in central China.

By Charles Q. Choi, Live Science Contributor | January 10, 2017

The oldest evidence of silk made by silkworms has been found buried in 8,500-year-old tombs in China, revealing that people may have used the luxurious material thousands of years earlier than previously thought, a new study finds.

Silk was a rare luxury good in the ancient world. Its fame helped give a name to the Silk Road, the legendary network of trade routes that once connected the East and West from China to Rome.

The secret of how to make silk was first discovered in China. According to Chinese legend, after a silkworm cocoon dropped into the teacup of the wife of the Yellow Emperor, she found that the cocoon could unravel to yield about 3,300 feet (1 kilometer) of thread.

To learn more about the origins of silk, scientists investigated ruins dating back 9,000 years at Jiahu in the middle of Henan Province in central China. Previously at this site, scientists had unearthed bone flutes that are the earliest known playable musical instruments on Earth, as well as what may be the earliest Chinese writing.

Old tales suggested that silkworm breeding and silk weaving began around this area, said study co-author Decai Gong, an archaeologist at the University of Science and Technology of China at Hefei. In addition, prior work at Jiahu revealed that the area's warm and humid climate favored the growth of mulberry trees, whose leaves are the sole food of silkworms.

The scientists collected soil samples from three tombs at Jiahu. Chemical analyses revealed evidence of silk proteins in two of the three tombs, one of which dated back 8,500 years. This is "the earliest evidence of silk in ancient China," Gong told Live Science. Previously, the oldest evidence of silk dated back 5,000 years from China, the researchers said.

Although it's difficult to figure out exactly how silk was used at this site, the researchers suggested that these people were perhaps buried in silk garments. Evidence supporting that idea came from bone needles and weaving tools found at the site, which suggested that "Jiahu's residents possessed basic weaving and sewing skills," Gong said. "There is a possibility that the silk was made into fabric."

In their future research, the scientists will hunt for other signs of silk at this and other sites, Gong said. He and his colleagues detailed their findings online Dec. 12 in the journal PLOS ONE.

http://bit.ly/2inCY3q

Two years and multiple doctors often needed to diagnose polycystic ovary syndrome

Largest study of PCOS reveals 'major gaps' in early diagnosis, education and support

PHILADELPHIA - Polycystic ovary syndrome (PCOS) is the most common endocrine disorder -- and most common cause of infertility - affecting 9 to 18 percent of women around the world. Despite the prevalence of the complex and chronic condition, one-third of women diagnosed with PCOS saw at least three health professionals over the course of two years before receiving a diagnosis, according to a study from the Perelman School of Medicine at the University of Pennsylvania. The study, published in the Journal of Clinical Endocrinology & Metabolism, is the largest to date examining time to diagnosis, and reveals what the authors say are "major gaps" in education and support for women with the condition.

"Women with PCOS have an increased risk of type 2 diabetes, metabolic syndrome and anxiety and depression, and studies have shown that the longer it takes for the condition to be diagnosed, the greater the patient dissatisfaction," said senior author Anuja Dokras, MD, PhD, a professor of Obstetrics and Gynecology and director of the Penn Polycystic Ovary Syndrome Program. "These new results are concerning for both women who are, or may be, affected by PCOS, and health care providers. Not only do women often wait several months or even years before care providers are able to diagnose the condition, but even after diagnosis, patients are often unsatisfied with the information and support they receive."

PCOS primarily affects women of reproductive age -- most often between the ages of 18 to 35. Inconsistent menstrual periods, excess hair growth, acne, and obesity are the most common symptoms, but the authors caution against placing too much emphasis on only one of these symptoms.

In the study, researchers surveyed 1,385 women from 48 different countries who had been diagnosed with PCOS to learn more about their diagnosis experience and the information they were provided about PCOS. More than one-third (33.6 percent) of women surveyed reported that it took more than two years before receiving a diagnosis, and nearly half (47.1 percent) saw three or more health professionals before receiving a diagnosis. Additional results showed that only 15.6 percent of women said they were satisfied with the information they received.

When asked "how can we best support women with PCOS?" more than 90 percent of participants said providing broadly available educational materials would be helpful, while 70 percent expressed an interest in support and presentations at patient workshops. The authors suggest that greater community and clinician awareness about the full range of PCOS features is needed internationally to enable early diagnosis.

"Women with PCOS who responded to the survey were most concerned about trouble losing weight, irregular menstrual cycles, and infertility. Health care providers have an obligation to provide these patients with better support and information at the time of diagnosis to help them understand and manage their condition," Dokras said, noting that the absence of a targeted diagnostic test likely contributes to delays in diagnosis. "The delays in diagnosis reported in the new study suggest a significant missed opportunity to improve treatment and quality of life for these patients. Diagnosing women with PCOS earlier will allow providers to intervene in a more proactive manner, treating symptoms of the condition -- such as obesity, acne, excess body hair, anxiety, and depression - more effectively."

Based on the study findings, the authors are calling for the development of international evidence-based guidelines, co-designed consumer and health professional resources and international dissemination to improve diagnosis experience, education, management and health outcomes.

http://bit.ly/2iPpqau

'Dementia gene' may guard against decline associated with parasitic disease

New research in The FASEB Journal suggests that a gene associated with high risk for Alzheimer's disease and cardiovascular disease may actually have conferred an evolutionary advantage for humans at high risk for parasitic infections

New research published online in The FASEB Journal, suggests that carriers of the Apolipoprotein E4 allele, which is the single strongest genetic predictor of Alzheimer's disease and is associated with cognitive decline and cardiovascular disease, may have a reduced risk of cognitive decline associated with parasitic diseases. This protective effect may help explain why this "disease" gene has persisted over the millennia, as well as offering insights into preventing and treating the cognitive problems caused by human parasites.

"While being an E4 carrier is the strongest risk factor to date of Alzheimer's dementia and cognitive decline in industrial populations, it is associated with greater cognitive performance in individuals facing a high parasite and pathogen load, suggesting advantages to the E4 allele under certain environmental conditions," said Benjamin C. Trumble, Ph.D., a researcher involved in the work at the School of Human Evolution and Social Change and the Center for Evolution and Medicine at Arizona State University in Tempe, Arizona. "The current mismatch between sedentary postindustrial lifestyles and active parasite-rich lifeways experienced throughout most of human history may be critical for understanding genetic risk for cognitive aging."

Trumble and colleagues examined cognitive performance and parasite exposure data from a remote population of forager-horticulturalists in the Bolivian Amazon, called the Tsimane. The Tsimane experience high parasite loads, making them a suitable population for study for the role of the E4 allele in this circumstance. The researchers undertook a genetic analysis, measured immune markers of parasitic infection, and conducted cognitive tests on 372 Tsimane men and women aged 6 to 88 years. They found that for the Tsimane who did not carry the E4 allele, a larger parasite burden resulted in poorer cognitive performance. Those who carried the E4 allele, however, maintained cognitive performance even with very high parasite burdens.

"This is a wonderful, unanticipated case of a balanced polymorphism affecting a trait, dementia, with predictably major selection consequences" said Thoru Pederson, Ph.D., Editor-in-Chief of The FASEB Journal. "Evolution may not work in quite so mysterious ways as delightfully entertaining ways."

Details: Benjamin C. Trumble, Jonathan Stieglitz, Aaron D. Blackwell, Hooman Allayee, Bret Beheim, Caleb E. Finch, Michael Gurven, and Hillard Kaplan. Apolipoprotein E4 is associated with improved cognitive function in Amazonian forager-horticulturalists with a high parasite burden. FASEB J. doi:10.1096/fj.201601084R ; http://www.fasebj.org/content/early/2017/01/03/fj.201601084R.abstract

http://bit.ly/2jEeWCq

Play an instrument? You probably react faster, too

Could learning to play a musical instrument help the elderly react faster and stay alert?

Quite likely, according to a new study by Université de Montréal's School of Speech Language Pathology and Audiology, part of UdeM's medical faculty. Published in the U.S. journal Brain and Cognition, the study shows that musicians have faster reaction times to sensory stimuli than non-musicians have.

And that has implications for preventing some effects of aging, said lead researcher Simon Landry, whose study is part of his doctoral thesis in biomedical science.

"The more we know about the impact of music on really basic sensory processes, the more we can apply musical training to individuals who might have slower reaction times," Landry said."As people get older, for example, we know their reaction times get slower. So if we know that playing a musical instrument increases reaction times, then maybe playing an instrument will be helpful for them."

In his study, co-authored with his thesis advisor, audiology associate professor François Champoux, Landry compared the reaction times of 16 musicians and 19 non-musicians. They were sat in a quiet, well-lit room with one hand on a computer mouse and the index finger of the other on a vibro-tactile device, a small box that vibrated intermittently. They were told to click on the mouse when they heard a sound (a burst of white noise) from the speakers in front of them, or when the box vibrated, or when both happened.

Each of the three stimulations - audio, tactile and audio-tactile - was done 180 times. The subjects wore earplugs to mask any buzzing "audio clue" when the box vibrated. "We found significantly faster reaction times with musicians for auditory, tactile and audio-tactile stimulations," Landry writes in his study. "These results suggest for the first time that long-term musical training reduces simple non-musical auditory, tactile and multisensory reaction times."

The musicians were recruited from UdeM's music faculty, started playing between ages 3 and 10, and had at least seven years of training. There were eight pianists, 3 violinists, two percussionists, one double bassist, one harpist and one viola player. All but one (a violinist) also mastered a second instrument, or more. The non-musicians were students at the School of Speech Language Pathology. As with the musicians, roughly half were undergraduates and half graduates.

Landry, whose research interest is in how sound and touch interact, said his study adds to previous ones that looked at how musicians' brains process sensory illusions. "The idea is to better understand how playing a musical instrument affects the senses in a way that is not related to music," he said of his study.

Funding came from Canadian Institutes of Health Research, Fonds de recherche Québec - Santé, and Natural Sciences and Engineering Research Council of Canada.

http://bit.ly/2ir9zVP

Updated classification system captures many more people at risk for heart attack

New heart disease 'staging' system focuses on those previously considered at low risk

Experts at Johns Hopkins and New York's Mount Sinai Health System have published a suggested new plan for a five-stage system of classifying the risk of heart attack in those with heart disease, one they say puts much-needed and long-absent focus on the risks faced by millions of Americans who pass so-called stress tests or have less obvious or earlier-stage danger signs.

In a report in the Dec. 6 issue of the *Journal of the American College of Cardiology*, the authors estimate there are several million adults with concerning symptoms of heart disease who currently are clinically excluded as being at serious risk of heart attack because the current classification systems doctors use are heavily focused on so-called obstructive coronary heart disease criteria.

The article is accompanied by an audio commentary by author Valentin Fuster, M.D., Ph.D., of Mount Sinai.

Current classifications issued by American and European cardiology societies look mostly for evidence that fatty plaques have narrowed blood vessels that nourish the heart by 50 percent or even 70 percent or more, which may restrict blood flow to the heart muscle during exertion. Only when that benchmark 50 percent is reached are cardiologists and other physicians likely to formally diagnose patients with obstructive heart disease and deem them at high-enough risk for a heart attack to warrant preventive interventions with statins or other drugs. Women are twice as likely to have nonobstructive heart disease compared to men, and make up much of the undertreated population.

But based on data from a 2012 study by researchers in Denmark that looked at survival rates in 4,711 women and 6,512 men after analyzing the severity of blocked arteries through coronary angiography, the Johns Hopkins and Mount Sinai specialists say there is evidence that people with less than 50 percent blockage of their heart's arteries, with so-called nonobstructive heart disease, are at just about the same risk of death due to heart attack, stroke or heart failure (congestive heart disease) -- about 14 percent over five years for men and 8 percent for women -- as people with an artery with a 50 percent or greater blockage. Based on a 2013 review from the United Kingdom looking at angiography data among 41,960 patients evaluated for suspected heart disease from the U.S. and other countries, they say, individuals with nonobstructive heart disease account for an estimated third of people who visit their physician complaining of chest pain in the U.S. each year, or about 5 million to 7 million people.

"What we and others can conclude from such evidence is that far less severe blockages can cause trouble because the sticky plaques can lead to the clumping of blood cells in coronary arteries, producing small clots that may cause chest pain and ultimately may lead to a heart attack," says Armin Zadeh, M.D., Ph.D., M.P.H., associate professor of medicine and member of the Heart and Vascular Institute at the Johns Hopkins University School of Medicine. "But because our

current diagnostic criteria don't point to an immediate problem, we aren't always treating people who may have the same risk for heart attack as those with greater blockages."

That gap in diagnosis and preventive therapy, Zadeh says, led them to undertake development of an updated classification system better able to capture those with nonobstructive heart disease.

At the heart of the new system are "earlier" stages, dubbed stage 1 and stage 2, that encompass the previously underrecognized and untreated population, and including patients with several moderate blockages in the high-risk category. In practice, the researchers say, that population is composed of people complaining about chest pain or unexplained shortness of breath during mild exertion. To diagnose heart disease with mild or moderate blockages -- stages 1, 2 or even 3 -- such individuals could undergo a cardiac CT or MRI scan.

Current and widely used guidelines call for anyone with chest pain to undergo a cardiac exercise or chemical stress test. Those who "fail" the test then generally undergo coronary angiography by cardiac catheterization, a form of invasive imaging with a dye injected into a catheter threaded into the heart's blood vessel system, which visualizes blockages.

"The problem with this approach is that stress tests accurately detect only heart disease that is very advanced," says Zadeh. "And cardiac catheterization, which can give an accurate reading about the percentage of blockage, is invasive, so we don't want to be routinely doing that for people who do all right on a stress test or for those with borderline results." The suggested new system has five stages, which, Zadeh acknowledges, depend far more heavily on cardiac CT or MRI rather than stress testing.

Traditional treadmill stress tests, which use an EKG to measure the electric activity of the heart, run under $200 but go up to $500 if done with ultrasound imaging. Nuclear stress tests that use radioactive dyes to image the heart can cost around $950. Cardiac CT scans run between $400 and $600, and cardiac MRI scans cost a little over $800.

Stage 0 is defined as no visible heart disease based on a heart scan, meaning no visible plaque buildup in the heart's arteries. Stage 1 would be considered mild heart disease, in which one to two blood vessels may be blocked less than 30 percent. ***Stage 2*** is defined as moderate heart disease, with blockage between 30 and 49 percent in one to two vessels, or mild blockage in three blood vessels. At ***stage 3***, a person would be considered to have severe heart disease, meaning one to two coronary arteries show more than 50 percent narrowing of the vessels diameter, or three blood vessels are moderately blocked in the 30 to 49 percent range. Very severe heart disease, or ***stage 4***, has three or more vessels with over 50 percent blockage.

Based on data from the U.K. review and many others, Zadeh says, at each increasing stage, the risk of heart attack or death per year goes up, starting from a less than 0.1 percent risk a year among those at stage 0, 0.1 to 0.9 percent risk within a year at stage 1, 1 to 1.9 percent risk at stage 2, 2 to 3.9 percent risk at stage 3, and 4 percent or greater risk of heart attack or death for those at stage 4. The risks in these stages were established by coronary angiography from both cardiac catheterization and noninvasive CT scanning data.

"Heart disease deaths have dropped substantially thanks to better diagnosis and treatment, but particularly due to improved preventive measures, including treating risk factors such as high blood pressure and cholesterol," says Zadeh. "However, heart disease will remain a leading cause of death until we achieve better population health and identify earlier the millions of people whose risks of heart attack are being missed, underdiagnosed and untreated. Expanding our diagnostic criteria for heart disease is a good first step, and we think there's enough evidence to do so."

In the U.S., according to government statistics, heart disease remains the leading cause of all adult deaths, killing more than 600,000 people each year, although the cancer death rate is rapidly closing the gap.

Click to view and download a video that accompanies this release.

http://bit.ly/2inwNBa

Contrary to decades of hype, curcumin alone is unlikely to boost health

New review of the scientific literature on curcumin has found it's probably not all it's ground up to be

Curcumin, a compound in turmeric, continues to be hailed as a natural treatment for a wide range of health conditions, including cancer and Alzheimer's disease. But a new review of the scientific literature on curcumin has found it's probably not all it's ground up to be. The report in ACS' Journal of Medicinal Chemistry instead cites evidence that, contrary to numerous reports, the compound has limited -- if any -- therapeutic benefit.

Turmeric, a spice often added to curries and mustards because of its distinct flavor and color, has been used for centuries in traditional medicine. Since the early 1990's, scientists have zeroed in on curcumin, which makes up about 3 to 5 percent of turmeric, as the potential constituent that might give turmeric its health-boosting properties. More than 120 clinical trials to test these claims have been or are in the process of being run by clinical investigators. To get to the root of curcumin's essential medicinal chemistry, the research groups of Michael A. Walters and Guido F. Pauli teamed up to extract key findings from thousands of scientific articles on the topic.

The researchers' review of the vast curcumin literature provides evidence that curcumin is unstable under physiological conditions and not readily absorbed by the body, properties that make it a poor therapeutic candidate. Additionally, they could find no evidence of a double-blind, placebo-controlled clinical trial on curcumin to support its status as a potential cure-all. But, the authors say, this doesn't necessarily mean research on turmeric should halt. Turmeric extracts and preparations could have health benefits, although probably not for the number of conditions currently touted. The researchers suggest that future studies should take a more holistic approach to account for the spice's chemically diverse constituents that may synergistically contribute to its potential benefits.

The authors acknowledge funding from the National Center for Complementary and Integrative Health and the Office of Dietary Supplements at the National Institutes of Health.

The abstract that accompanies this study is available here.

http://bit.ly/2jPu8kb

Baboon vocalizations contain five vowel-like sounds comparable to those of human speech

Acoustic and anatomic analyses suggest speech-like sounds in a closely related nonhuman primate

An acoustical analysis of the grunts, barks, wahoos, copulation calls, and yaks from baboons shows that, like people who use several vowels during speech, these nonhuman primates make five distinct vowel-like sounds, according to a study published January 11, 2017 in the open-access journal PLOS ONE by Louis-Jean Boë, Grenoble Alpes University, France, and colleagues.

A prevalent idea on the origin of speech is that the low human larynx is required to be able to produce sets of distinct vowels, and that the high larynx of nonhuman primates prevents them from producing the vowels found across human languages. Thus, scientists believe that language originated relatively recently, within the last 70,000 - 100,000 years, and little research on links between the vocalization of nonhuman primates and human speech has been undertaken. To investigate any such parallels, Boë and colleagues analyzed 1335 spontaneous vocalizations produced by 15 male and female Guinea baboons in different social contexts, and studied the anatomy of vocal tracts from two baboons that died of natural causes.

The researchers found that baboons produce five sounds that have important similarities with the vowels of human speech. People form each vowel sound with a precise control of tongue position in the vocal tract, and the anatomical analysis revealed that baboon tongues have the same muscles as human tongues. This suggests that these monkeys likewise use tongue movements to form each of the vowel-like sounds. Taken together, these findings suggest that spoken

language in people may have evolved from articulatory capacities that were already possessed by our last common ancestor with baboons, or about 25 million years ago.

"Similarities between humans and baboons suggest that the vowels of human speech probably evolved from ancient articulatory precursors that were passed on and refined all along the hominid line," says co-author Joel Fagot.

http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0169321

Citation: Boë L-J, Berthommier F, Legou T, Captier G, Kemp C, Sawallis TR, et al. (2017) Evidence of a Vocalic Proto-System in the Baboon (Papio papio) Suggests Pre-Hominin Speech Precursors. PLoS ONE 12(1): e0169321. doi:10.1371/journal.pone.0169321

*Funding: Research was supported by grants ANR-11-LABX-0036 (BLRI) and ANR-11-IDEX-0001-02 (A*MIDEX). CK was supported by a BLRI research post-doctoral grant.*

Competing Interests: The authors have declared that no competing interests exist.

http://bit.ly/2jjl0Tw

Ohio State joins national call for HPV vaccination as a means of preventing cancer

Consensus statement supports fewer doses in children under age 15, urges action to increase national vaccination rates

Columbus, OHIO - Recognizing a critical need to improve national vaccination rates for the human papillomavirus (HPV), The Ohio State University Comprehensive Cancer Center - Arthur G. James Cancer Hospital a Richard J. Solove Research Institute (OSUCCC - James) has again united with each of the 69 National Cancer Institute (NCI)-designated cancer centers in issuing a joint statement in support of recently revised recommendations from the Centers for Disease Control and Prevention (CDC).

According to the CDC, incidence rates of HPV-associated cancers have continued to rise, with approximately 39,000 new HPV-associated cancers now diagnosed each year in the United States. Although HPV vaccines can prevent the majority of cervical, anal, oropharyngeal (middle throat) and other genital cancers, vaccination rates remain low across the U.S., with just 41.9 percent of girls and 28.1 percent of boys completing the recommend vaccine series. In Ohio, those rates are even lower with 35 percent of girls and 23 percent of boys completing vaccination.

The new guidelines from the CDC recommend that children under age 15 should receive two doses of the 9-valent HPV vaccine at least six months apart. Adolescents and young adults older than 14 should continue to complete the three-dose series.

Research shows there are a number of barriers to overcome to improve vaccination rates, including a lack of strong recommendations from physicians and parents not understanding that this vaccine protects against several types of cancer.

"Parents rely heavily on the recommendations of their child's health care provider for appropriate vaccination, and the medical community simply isn't consistently recommending the HPV vaccine like they do other public health prevention vaccines. This represents the No. 1 barrier to HPV vaccination and must change to reduce the burden of HPV-associated cancers in our community," says Electra Paskett, PhD, associate director for population sciences at the OSUCCC - James.

In an effort to overcome these barriers, NCI-designated cancer centers have organized a continuing series of national summits to share new research, discuss best practices, and identify collective action toward improving vaccination rates.

The original joint statement, published in January 2016, was the major recommendation from a summit hosted at The University of Texas MD Anderson Cancer in November 2015, which brought together experts from the NCI, CDC, American Cancer Society and more than half of the NCI-designated cancer centers.

"We have been inspired by the White House Cancer Moonshot to work together in eliminating cancer," adds Paskett. "Improving HPV vaccination is an example of an evidence-based prevention strategy we can implement today to save thousands of lives in the future."

The updated statement is the result of discussions from the most recent summit, hosted this summer by the OSUCCC - James. Nearly 150 experts from across the country gathered in Columbus to present

research updates and plan future collaborative actions across NCI-designated cancer centers.

Paskett notes that, like all vaccines used in the United States, HPV vaccines have passed extensive safety testing before and after being approved by the U.S. Food and Drug Administration (FDA). The vaccine is given in childhood in order to given the child maximum protection against HPV infection before transmission contact occurs.

"As a global community, we need to unite around HPV vaccination as a true means of cancer prevention. I am a cancer control researcher but I'm also a parent of three boys. The HPV vaccine is cancer prevention and our best defense in stopping HPV infection in our youth and preventing HPV-associated cancers in our communities. Don't let your kids become our cancer patients."

http://bit.ly/2ir8Wvp

The moon is older than scientists thought, UCLA-led research team reports

Formation occurred 4.51 billion years ago, millions of years earlier than previously believed

A UCLA-led research team reports that the moon is at least 4.51 billion years old, or 40 million to 140 million years older than scientists previously thought. The findings - based on an analysis of minerals from the moon called zircons that were brought back to Earth by the Apollo 14 mission in 1971 - are published Jan. 11 in the journal Science Advances.

The moon's age has been a hotly debated topic, even though scientists have tried to settle the question over many years and using a wide range of scientific techniques. "We have finally pinned down a minimum age for the moon; it's time we knew its age and now we do," said Mélanie Barboni, the study's lead author and a research geochemist in UCLA's Department of Earth, Planetary and Space Sciences.

The moon was formed by a violent, head-on collision between the early Earth and a "planetary embryo" called Theia, a UCLA-led team of geochemists and colleagues reported in 2016. The newest research would mean that the moon formed "only" about 60 million years after the birth of the solar system -- an important point because it would provide critical information for astronomers and planetary scientists who seek to understand the early evolution of the Earth and our solar system.

That has been a difficult task, Barboni said, because "whatever was there before the giant impact has been erased." While scientists cannot know what occurred before the collision with Theia, these findings are important because they will help scientists continue to piece together major events that followed it.

It's usually difficult to determine the age of moon rocks because most of them contain a patchwork of fragments of multiple other rocks. But Barboni was able to analyze eight zircons in pristine condition. Specifically, she examined how the uranium they contained had decayed to lead (in a lab at Princeton University) and how the lutetium they contained had decayed to an element called hafnium (using a mass spectrometer at UCLA). The researchers analyzed those elements together to determine the moon's age.

"Zircons are nature's best clocks," said Kevin McKeegan, a UCLA professor of geochemistry and cosmochemistry, and a co-author of the study. "They are the best mineral in preserving geological history and revealing where they originated."

The Earth's collision with Theia created a liquefied moon, which then solidified. Scientists believe most of the moon's surface was covered with magma right after its formation. The uranium-lead measurements reveal when the zircons first appeared in the moon's initial magma ocean, which later cooled down and formed the moon's mantle and crust; the lutetium-hafnium measurements reveal when its magma formed, which happened earlier.

"Mélanie was very clever in figuring out the moon's real age dates back to its pre-history before it solidified, not to its solidification,"

said Edward Young, a UCLA professor of geochemistry and cosmochemistry and a co-author of the study.

Previous studies concluded the moon's age based on moon rocks that had been contaminated by multiple collisions. McKeegan said those rocks indicated the date of some other events, "but not the age of the moon."

The UCLA researchers are continuing to study zircons brought back by the Apollo astronauts to study the early history of the moon.

Co-authors of the Science Advances study are Patrick Boehnke, a former UCLA graduate student who is now a University of Chicago postdoctoral scholar; Christopher Keller, a UC Berkeley postdoctoral scholar; Issaku Kohl, a UCLA research geochemist; and Blair Schoene, associate professor of geosciences at Princeton University.

The research was funded by NASA, and Barboni received support from the Swiss National Science Foundation.

http://wb.md/2jlxREW

The First FDA-Approved Artificial Pancreas System

Approval by the USFDA of what many would call the first artificial pancreas system

Anne L. Peters, MD|January 11, 2017

Hi. Today I'm going to tell you about some of the most exciting news in the field of type 1 diabetes that we've had in a long time. This is the approval by the US Food and Drug Administration of what many would call the first artificial pancreas system.

I am saying "artificial pancreas" because that is the terminology that many people use when describing this, but what we are actually talking about is a hybrid closed-loop system. I am going to explain to you what this means, how it works, how it helps patients, and some of its limitations.

First of all, you have to understand the components of this system. Many of you are probably familiar with an insulin pump. I am going to hold these up so you can see them. This is an insulin pump. It is actually the newest model of an insulin pump that is going to be used in this system.

The pump is basically a box, and inside that box we have programmed basal rates and bolus doses. We basically give the pump numbers so that when a person puts in their blood sugar level and how many carbohydrates they are eating, the pump can calculate a dose. Insulin is inserted into the pump in a reservoir. This tubing connects to the infusion set that the patient has stuck under their skin, and then these two are connected.

Now there is a fine trickle of insulin that is going in from the pump. It is infusing insulin constantly, with doses being given before meals and when the blood sugar level is too high.

We have had these on the market for a long while and they are very useful in the treatment of diabetes, but they require the patient to input the blood sugar levels before each time they eat. This can either be directly sent in through the meter or manually put in.

More recently, we've developed a technology called continuous glucose sensing. This is another externally worn device with a sensor inserted under the skin and a transmitter attached to the sensor. Every 5 minutes, an interstitial glucose level is sent somewhere. In the case of this pump, it is sent to the pump. It can also be sent to your iPhone. It can be sent to any of the receivers that will receive the signal. The beauty of the continuous glucose monitor is that it can alert patients when their blood sugars are too high or too low so that the patient can do something to correct the situation.

Until now, the pump was just a receiver for glucose levels. There was a model of this pump that would suspend if the blood sugar levels got too low, but that was only the first step.

Now there is integration between the sensor data and the pump. The pump has a control algorithm. Inside the pump, it looks at the sensor blood sugars as they go up and down, and the pump can go up and down in terms of the insulin it is giving the patient.

Now the patient doesn't have to be thinking every moment about what their blood sugar level is. The pump is, in essence, thinking for the patient. It is very nice at keeping blood sugar levels steady, particular overnight or during periods when the patient is not eating. It takes some of the thought process away from the patient and automates it.

You might think that this would be a simple thing to do, but I can tell you that many very smart people have been working on this for years, and this is the first time it has actually come to market. This system will be available in the spring of 2017 for limited distribution, and then wider distribution in the months and years to come.

This is the first in class. There are going to be many other similar systems that come out.

One of the problems with this specific system is that it doesn't know when a person is going to eat. It doesn't intuit how much food the person will eat, so people are still going to have to enter how many carbohydrates they are going to eat so that the pump can give them an appropriate pre-meal dose. A person does have to interact with this system and is going to have to do some adjusting for meals.

It is still a leap forward in terms of the pump and sensor communicating so that the pump can maintain normal basal levels of glucose and help people avoid having frequent low blood sugar levels, as well as having frequent high blood sugar levels.

I am going to tell you some of the downsides of this as well. First of all, in the world of technology, it's the user that makes the most difference. I have patients with good control on insulin pumps and bad control on insulin pumps, and patients with good control on injections and patients with less good control on injections, because the person has to be willing to interact with the disease. Patients have to do the steps that are required.

The thing that has really revolutionized diabetes care for most of my patients is the continuous glucose sensor, because whether you are on injections or on a pump, having that additional continuous information about blood sugar levels really helps you make treatment decisions and helps you avoid having frequent low blood sugar reactions. Remember that, in people with type 1 diabetes, it is a hard balance between being too high and too low to keep themselves in a normal healthy range as they live their lives.

An external challenge about devices is that they are subject to all sorts of issues that devices can have. Patients can have infusion set issues, they can get an infection, they can get a clog, or they can get a kink. My patients who are on insulin pumps have to do a fair amount of troubleshooting. This is not the sort of thing you stick on and forget about. It's something that requires the patient to interact with it. It's important to be realistic here; this is not something that we are going to be able to put on every person and expect to have completely normal blood sugar control, but I consider it an incredible step forward for many of our patients with type 1 diabetes.

There are a couple of other caveats that I would like to address. First of all, I don't push any technology on any patient. I like to give my patients options. The newer basal insulins can give very steady overnight blood sugar levels for my adult patients with type 1 diabetes. For many of them, just having a sensor is adequate. They may not need or want to have a pump. If somebody has really good control without an insulin pump, that's fine, but I have many other patients who prefer using an insulin pump. They consider it more convenient. Those individuals should have access to this.

Unfortunately, Medicare and Medicaid do not pay for glucose sensors, which is going to be a big problem for our patients who need this system the most. For instance, our older patients who have more brittle blood sugar levels may really benefit from a system such as this, but so far, we are not able to get sensors covered for them.

I really urge you to advocate for getting sensors covered for our older patients and our poorer patients so that they, too, can have access to technology that can change their life, whether it is a sensor alone or a sensor combined with a pump.

This hybrid closed-loop system is the beginning of a wonderful series of advancements in our treatment of type 1 diabetes, and I am very excited to be able to share this with you. Thank you.

http://bbc.in/2jljqRd

Cancer spread cut by 75% in tests

The deadly spread of cancer around the body has been cut by three-quarters in animal experiments, say scientists.

By James Gallagher Health and science reporter, BBC News website

Tumours can "seed" themselves elsewhere in the body and this process is behind 90% of cancer deaths. The mouse study, published in Nature, showed altering the immune system slowed the spread of skin cancers to the lungs. Cancer Research UK said the early work gave new insight into how tumours spread and may lead to new treatments. The spread of cancer - known as metastasis - is a fight between a rapidly mutating cancer and the rest of the body.

The team at the Sanger Institute in Cambridge was trying to figure out what affected tumour spread in the body. Researchers created 810 sets of genetically modified lab mice to discover which sections of the DNA were involved in the body resisting a cancer's spread.

The animals were injected with melanomas (skin cancer) and the team counted the number of tumours that formed in the lung.

Their hunt led them to discover 23 sections of DNA, or genes, that made it either easier or harder for a cancer to spread.

Many of them were involved in controlling the immune system.

Targeting one gene - called Spns2 - led to a three-quarters reduction in tumours spreading to the lungs.

'Interesting biology'

"It regulated the balance of immune cells within the lung," Dr David Adams, one of the team, told the BBC News website. "It changes the balance of cells that play a role in killing tumour cells and those that switch off the immune system."

The field of immunotherapy - harnessing the power of the immune system to fight cancer - has delivered dramatic results for some patients. A rare few with a terminal diagnosis have seen all signs of cancer disappear from their body, although the drugs still fail to work in many patients.

Dr Adams said: "We've learnt some interesting new biology that we might be able to use - it's told us this gene is involved in tumour growth." Drugs that target Spns2 could produce the same cancer-slowing effect but that remains a distant prospect.

Dr Justine Alford, from Cancer Research UK, said: "This study in mice gives a new insight into the genes that play a role in cancer spreading and may highlight a potential way to treat cancer in the future. "Cancer that has spread is tough to treat, so research such as this is vital in the search for ways to tackle this process."

http://bit.ly/2jcGvmX

Scientists switch on predatory kill instinct in mice

Brain circuitry that coordinates predatory hunting isolated

Researchers at Yale University have isolated the brain circuitry that coordinates predatory hunting, according to a study in the January 12 issue of Cell.

One set of neurons in the amygdala, the brain's center of emotion and motivation, cues the animal to pursue prey. Another set signals the animal to use its jaw and neck muscles to bite and kill.

The researchers used optogenetics, a means of engineering specific neurons to fire upon light stimulation, to isolate and selectively activate each set of neurons.

When the laser is off, the animals behave normally. But turn the laser on, and the mice take on qualities of "walkers" from The Walking Dead, pursuing and biting almost anything in their path, including bottle caps and wood sticks.

"We'd turn the laser on and they'd jump on an object, hold it with their paws and intensively bite it as if they were trying to capture and kill it," says lead investigator Ivan de Araujo, Associate Professor of Psychiatry at the Yale University School of Medicine and an Associate Fellow at the John B. Pierce Laboratory.

The Walking Dead analogy is fair only to a certain extent, says de Araujo. In nature, predatory hunting takes the form of highly complex

behaviors that are common to most jawed vertebrates, including humans.

"It is a major evolutionarily player in shaping the brain," says de Araujo. "There must be some primordial subcortical pathway that connects sensory input to the movement of the jaw and the biting."

The animals did not, however, attack other mice in the cage. Hunger also affected predatory behavior. Hungry mice more aggressively pursued prey during light stimulation than mice that were not hungry. "The system is not just generalized aggression," says de Araujo. "It seems to be related to the animal's interest in obtaining food."

The study grew out of de Araujo's efforts to understand the neural mechanisms underlying feeding behaviors in animals. His lab had been looking at mice living and eating in cages. "They have nothing else to do other than eat the pellets we throw in the cage," he says. "I began to wonder how natural and relevant this behavior is."

De Araujo's interest in more natural behaviors pointed him to a study that had mapped brain areas associated with hunting and feeding. Many areas were listed, but one responded almost exclusively to hunting and not to eating. That region, the central nucleus of the amygdala, also had projections that were linked to areas that control hunting muscles, such as the jaw and neck.

"This area was perfectly compatible with an activation system that drives the motor behavior associated with hunting," he says.

By selectively manipulating the different types of neurons in this region, they found that one set of neurons controlled pursuit, and another controlled the kill. Experiments involved inanimate stand-ins for prey, such as sticks and bottle caps and animate bug-like toys, as well as live insects.

The researchers also specifically lesioned each type of neuron. They found that, if they lesioned the neurons associated with biting and killing, the animals would pursue the prey but could not kill. The biting force of the jaw was decreased by 50 percent. "They fail to deliver the killing bite," says de Araujo.

The team is now exploring the sensory input into the amygdala to determine what triggers predatory behaviors and investigating how the two modules--one controlling pursuit and the other controlling the kill--are coordinated. "We now have a grip on their anatomical identities, so we hope we can manipulate them even more precisely in the future," says de Araujo.

This work was supported by the National Institutes of Health, the National Natural Science Foundation of China, and the Brazilian government.

Cell, Han et al.: "Integrated Control of Predatory Hunting by the Central Nucleus of the Amygdala." http://www.cell.com/cell/fulltext/S0092-8674(16)31743-3

http://bit.ly/2ipBJFL

Viruses in the genome important for our brain

Retroviruses may have played a significant role in the development of the human brain

Over millions of years retroviruses have been incorporated into our human DNA, where they today make up almost 10 per cent of the total genome.

A research group at Lund University in Sweden has now discovered a mechanism through which these retroviruses may have an impact on gene expression. This means that they may have played a significant role in the development of the human brain as well as in various neurological diseases.

Retroviruses are a special group of viruses including some which are dangerous, such as HIV, while others are believed to be harmless. The viruses studied by Johan Jakobsson and his colleagues in Lund are called endogenous retroviruses (ERV) as they have existed in the human genome for millions of years. They can be found in a part of DNA that was previously considered unimportant, so called junk-DNA -- a notion that researchers have now started to reconsider.

"The genes that control the production of various proteins in the body represent a smaller proportion of our DNA than endogenous retroviruses. They account for approximately 2 per cent, while retroviruses account for 8-10 per cent of the total genome. If it turns

out that they are able to influence the production of proteins, this will provide us with a huge new source of information about the human brain", says Johan Jakobsson.

And this is precisely what the researchers discovered. They have determined that several thousands of the retroviruses that have established themselves in our genome may serve as "docking platforms" for a protein called TRIM28. This protein has the ability to "switch off" not only viruses but also the standard genes adjacent to them in the DNA helix, allowing the presence of ERV to affect gene expression.

This switching-off mechanism may behave differently in different people, since retroviruses are a type of genetic material that may end up in different places in the genome. This makes it a possible tool for evolution, and even a possible underlying cause of neurological diseases. In fact, there are studies that indicate a deviating regulation of ERV in several neurological diseases such as ALS, schizophrenia and bipolar disorder.

Two years ago, Johan Jakobsson's team showed that ERV had a regulatory role in neurons specifically. However, this study was conducted on mice, whereas the new study - published in the journal Cell Reports -- was made using human cells.

The differences between mice and humans are particularly important in this context.

Many of the retroviruses that have been built into the human DNA do not exist in species other than humans and our closest relatives -- gorillas and chimpanzees. They seem to have incorporated themselves into the genome some 35-45 million years ago, when the evolutionary lineage of primates was divided between the Old and New World.

"Much of what we know about the overall development of the brain comes from the fruit fly, zebrafish and mouse. However, if endogenous retroviruses affect brain function, and we have our own set of these ERV, the mechanisms they affect may have contributed to the development of the human brain", says Johan Jakobsson.

http://bit.ly/2iynnS0

Just How Safe Are Vaccines? Here Are the Numbers

Science on this issue is already clear; numerous studies show that vaccines are safe and effective, and that serious side effects are rare

By Rachael Rettner, Senior Writer | January 12, 2017 04:49pm ET

Anti-vaccine advocate Robert F. Kennedy Jr. said that President-elect Donald Trump asked him to lead a new government commission on vaccine safety. But science on this issue is already clear; numerous studies show that vaccines are safe and effective, and that serious side effects are rare.

On Tuesday (Jan. 10), Kennedy met with the president-elect at Trump Tower, and later told reporters about the new commission. However, the Trump administration did not confirm that such a commission was in the works. A spokesperson for Trump said only that the president-elect was "exploring the possibility of forming a committee on autism," according to The New York Times. This response may reference the proposed, but discredited link between the MMR vaccine and autism.

Members of the medical community quickly expressed strong concerns about the possibility of a government committee on vaccine safety, headed by an anti-vaccine advocate.

"Claims that vaccines are linked to autism or are unsafe when administered according to the recommended schedule have been disproven by a robust body of medical literature," Dr. Fernando Stein, president of the American Academy of Pediatrics (AAP), and Dr. Karen Remley, executive vice president of the AAP, said in a statement. "Vaccines are safe. Vaccines are effective. Vaccines save lives," the statement said.

But how do doctors know this?

First, the United States requires that all vaccines undergo extensive testing on safety and effectiveness before they can be brought to market, according to the Centers for Disease Control and Prevention (CDC). And once vaccines are on the market, there are several

systems in place to monitor the safety of the treatments within the general population.

These studies do show that, like all medicines, vaccines come with a small risk of side effects, but these side effects are rarely serious. What's more, the alternative of not vaccinating a child also comes with risks, because vaccines prevent diseases that can be dangerous and sometimes fatal, the CDC said. For each approved vaccine, researchers have determined that the benefits outweigh the risks.

Here's a look at some of the data behind vaccine safety and effectiveness:

- ***Over the past two decades, childhood vaccines have saved the lives of 732,000 U.S. children and prevented more than 300 million kids from getting sick, according to a 2014 study from the CDC.***
- ***Nearly 90 percent of vaccine side effects are not serious, according to the CDC.***
- ***More than 20 rigorous scientific studies have shown that there is no link between the MMR vaccine and autism, according to the CDC. The original study that claimed to find such a link has been discredited, and was retracted.***
- ***A 2011 report from the National Academy of Medicine reviewed more than 1,000 vaccine studies and concluded that serious reactions to vaccines are extremely rare.***
- ***The MMR vaccine can cause fevers, and some children who develop a fever can have a seizure; these are called fever-triggered seizures. However, studies show there is one case of fever-triggered seizure for every 3,000 to 4,000 children who receive this vaccine. And these seizures almost never cause harm over the long term, the 2011 review said.***
- ***About one in 10 children who is infected with measles develops an ear infection, and such infections can result in permanent hearing loss, according to the CDC.***
- ***For every 1,000 children who get measles, one or two will die from the disease, the CDC said.***
- ***Two doses of the measles vaccine are about 97 percent effective at preventing measles, the CDC said.***
- ***In rare cases, the rotavirus vaccine, called RotaTeq, is linked to the development of a serious intestinal disorder called intussusception. A 2014 study found that for every 65,000 children who received this vaccine, there was one case of intussusception.***
- ***A 2011 study found that the rotavirus vaccine had prevented 65,000 U.S. children from being hospitalized with rotavirus since 2006.***
- ***A 2012 study found that the human papillomavirus (HPV) vaccine is linked with an increased risk of fainting. The study, which included nearly 200,000 girls who received at least one dose of the Gardasil HPV vaccine, found that there were 24 cases of fainting per 1,000 people on the day of vaccination. For comparison, there were an average of four cases of fainting per 1,000 people when studied months after vaccination.***
- ***The HPV vaccine was introduced in 2006, and during the next four years, the rate of HPV infections among teen girls decreased by 56 percent, despite a relatively low vaccination rate in this age group, according to a 2013 study. (HPV infections in women increase the risk of cervical cancer.)***
- ***Studies on the safety of the chicken-pox vaccine found that about 3 percent of children had a mild, chicken-pox-like rash after the first dose of the vaccine, according to the CDC. On average, these children had two to five lesions, compared with the typical 250 to 500 lesions found in children who contract the actual illness, according to the Immunization Action Coalition (IAC), a nonprofit organization funded by the CDC that creates and distributes educational materials on vaccines.***
- ***Although chicken pox is usually a mild disease, it can cause serious complications, including bacterial infections of the skin, pneumonia, inflammation of the brain and blood stream infections, according to the CDC. Before the introduction of the chicken pox vaccine, there were about 4 million cases of chicken pox in the United States per year, and of these, an estimated 11,000 people went to the hospital with complications and 100 people died from the disease, the IAC said.***
- ***After the introduction of the chicken pox vaccine, cases of the disease fell nearly 80 percent in the U.S. over a decade, according to a 2012 study.***

http://bit.ly/2jwXAb6

U.S. Energy Agency Toughens Protections for Scientists

Revised scientific-integrity policy gives researchers more leeway to speak to the press and publish their findings

By Erin Ross, Nature magazine on January 12, 2017

The US Department of Energy (DOE) has released new guidelines to protect researchers from political interference—a move that many say is long overdue.

"DOE officials should not and will not ask scientists to tailor their work to any particular conclusion," said energy secretary Ernest Moniz, who announced the guidelines on 11 January.

The plan allows scientists to publicly state their opinions on science and policy, as long as they make clear that they are not speaking for the government. It requires researchers to notify their supervisors if they speak to the media or publish their findings, but does not require them to seek approval for such activities.

"It makes it absolutely clear that notification is the only thing required," says Wendy Wagner, a law professor at the University of Texas at Austin. "The tenor of the entire policy seems to be full bore about giving scientists and technical people the complete freedom to speak about their research and how it intersects with policy."

The plan—which applies to DOE employees, contractors and grant recipients—also calls for the department to appoint an independent ombudsperson to handle complaints.

That is a major shift from the DOE's previous scientific integrity policy, issued in 2012. That policy applied only to DOE employees, and required them to coordinate with their supervisors before talking to the media and receive approval before publishing their findings in peer-reviewed journals.

Climate of fear

"The old policy was extremely vague, barebones and had no structure for implementation," says Michael Halpern, deputy director of the Center for Science and Democracy at the Union of Concerned Scientists in Cambridge, Massachusetts. "When rights are not explicit, scientists that share personal opinions can be retaliated against."

The revised guidelines come amidst concerns that president-elect Donald Trump's administration will seek to limit federal support for science, including climate-change research. In December, Trump's team asked the DOE for the names of employees who have worked on climate-change issues; the department refused and Trump staffers later disavowed the request.

Moniz says the new policy is not a response to that incident or to Trump's election, and has been in the works for a while.

But Wagner thinks that the timing is significant. "The DOE might feel that if they don't get this policy out now, it won't be implemented," she says. But implementing the full plan is likely to fall to the administration of president-elect Donald Trump, who takes office on 20 January. His pick for energy secretary - former Texas governor Rick Perry - could soon be confirmed by the Senate.

"The Senate really needs to get details from Governor Perry, when they go through the confirmation process, about the specific implementation plans he has to ensure that this becomes a reality," Halpern says.

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Study finds association between eating hot peppers and decreased mortality

Consumption of hot red chili peppers is associated with 13% reduction in total mortality

Like spicy food? If so, you might live longer, say researchers at the Larner College of Medicine at the University of Vermont, who found that consumption of hot red chili peppers is associated with a 13 percent reduction in total mortality - primarily in deaths due to heart disease or stroke -- in a large prospective study.

The study was published recently in PLoS ONE.

Going back for centuries, peppers and spices have been thought to be beneficial in the treatment of diseases, but only one other study --

conducted in China and published in 2015 - has previously examined chili pepper consumption and its association with mortality. This new study corroborates the earlier study's findings.

Using National Health and Nutritional Examination Survey (NHANES) III data collected from more than 16,000 Americans who were followed for up to 23 years, medical student Mustafa Chopan '17 and Professor of Medicine Benjamin Littenberg, M.D., examined the baseline characteristics of the participants according to hot red chili pepper consumption. They found that consumers of hot red chili peppers tended to be "younger, male, white, Mexican-American, married, and to smoke cigarettes, drink alcohol, and consume more vegetables and meats . . . had lower HDL-cholesterol, lower income, and less education," in comparison to participants who did not consume red chili peppers. They examined data from a median follow-up of 18.9 years and observed the number of deaths and then analyzed specific causes of death.

"Although the mechanism by which peppers could delay mortality is far from certain, Transient Receptor Potential (TRP) channels, which are primary receptors for pungent agents such as capsaicin (the principal component in chili peppers), may in part be responsible for the observed relationship," say the study authors.

There are some possible explanations for red chili peppers' health benefits, state Chopan and Littenberg in the study. Among them are the fact that capsaicin - the principal component in chili peppers - is believed to play a role in cellular and molecular mechanisms that prevent obesity and modulate coronary blood flow, and also possesses antimicrobial properties that "may indirectly affect the host by altering the gut microbiota."

"Because our study adds to the generalizability of previous findings, chili pepper -- or even spicy food - consumption may become a dietary recommendation and/or fuel further research in the form of clinical trials," says Chopan.

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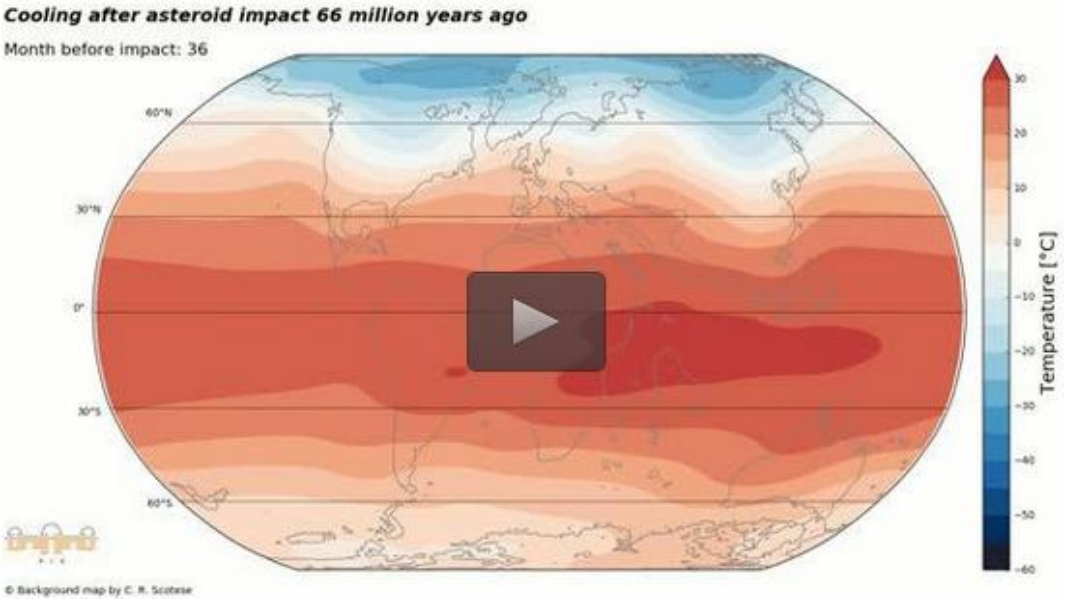
How the darkness and the cold killed the dinosaurs

New computer simulations show that the sulfuric acid droplets resulted in long-lasting cooling



***66 million years ago, the end-Cretaceous extinction event ended the reign of the dinosaurs. We have performed coupled climate model simulations showing severe cooling due to sulfate aerosols from the Chicxulub asteroid impact at that time. https://www.pik-potsdam.de/news/press-releases/how-the-darkness-and-the-cold-killed-the-dinosaurs.* Potsdam-Institute für Climate Impact Research (PIK)**

66 million years ago, the sudden extinction of the dinosaurs started the ascent of the mammals, ultimately resulting in humankind's reign on Earth. Climate scientists now reconstructed how tiny droplets of sulfuric acid formed high up in the air after the well-known impact of a large asteroid and blocking the sunlight for several years, had a profound influence on life on Earth. Plants died, and death spread through the food web. Previous theories focused on the shorter-lived dust ejected by the impact. The new computer simulations show that the droplets resulted in long-lasting cooling, a likely contributor to the

death of land-living dinosaurs. An additional kill mechanism might have been a vigorous mixing of the oceans, caused by the surface cooling, severely disturbing marine ecosystems.

"The big chill following the impact of the asteroid that formed the Chicxulub crater in Mexico is a turning point in Earth history," says Julia Brugger from the Potsdam Institute for Climate Impact Research (PIK), lead author of the study to be published today in the Geophysical Research Letters. "We can now contribute new insights for understanding the much debated ultimate cause for the demise of the dinosaurs at the end of the Cretaceous era." To investigate the phenomenon, the scientists for the first time used a specific kind of computer simulation normally applied in different contexts, a climate model coupling atmosphere, ocean and sea ice. They build on research showing that sulfur- bearing gases that evaporated from the violent asteroid impact on our planet's surface were the main factor for blocking the sunlight and cooling down Earth.

In the tropics, annual mean temperature fell from 27 to 5 degrees Celsius

"It became cold, I mean, really cold," says Brugger. Global annual mean surface air temperature dropped by at least 26 degrees Celsius. The dinosaurs were used to living in a lush climate. After the asteroid's impact, the annual average temperature was below freezing point for about 3 years. Evidently, the ice caps expanded. Even in the tropics, annual mean temperatures went from 27 degrees to mere 5 degrees. "The long-term cooling caused by the sulfate aerosols was much more important for the mass extinction than the dust that stays in the atmosphere for only a relatively short time. It was also more important than local events like the extreme heat close to the impact, wildfires or tsunamis," says co-author Georg Feulner who leads the research team at PIK. It took the climate about 30 years to recover, the scientists found.

In addition to this, ocean circulation became disturbed. Surface waters cooled down, thereby becoming denser and hence heavier. While these cooler water masses sank into the depths, warmer water from deeper ocean layers rose to the surface, carrying nutrients that likely led to massive blooms of algae, the scientists argue. It is conceivable that these algal blooms produced toxic substances, further affecting life at the coasts. Yet in any case, marine ecosystems were severely shaken up, and this likely contributed to the extinction of species in the oceans, like the ammonites.

"It illustrates how important the climate is for all lifeforms on our planet"

The dinosaurs, until then the masters of the Earth, made space for the rise of the mammals, and eventually humankind. The study of Earth's past also shows that efforts to study future threats by asteroids have more than just academic interest. "It is fascinating to see how evolution is partly driven by an accident like an asteroid's impact - mass extinctions show that life on Earth is vulnerable," says Feulner. "It also illustrates how important the climate is for all lifeforms on our planet. Ironically today, the most immediate threat is not from natural cooling but from human-made global warming."

Article: Brugger, J., Feulner, G., Petri, S. (2017): Baby, it's cold outside: Climate model simulations of the effects of the asteroid impact at the end of the Cretaceous. Geophysical Research Letters [DOI:10.1002/2016GL072241]

Weblink to the article: http://onlinelibrary.wiley.com/doi/10.1002/2016GL072241/abstract

Weblink to the VIDEO:https://www.pik-potsdam.de/research/earth-system-analysis/projects/flagships/ace/extinctions

http://bit.ly/2iz6CWP

Researcher hunts DNA on Mars

Alexandra Pontefract is part of a team working on a life-detection instrument – a DNA sequencer for Mars

January 13, 2017 by Adela Talbot

Astrobiologist alumna Alexandra Pontefract, PhD'13 (Geology), knows finding DNA on the Red Planet will be no easy feat. But it is possible. What's more, if DNA is found, it's not far-fetched to think it would be proof of shared ancestry between Earth and Mars.

"There is a really good argument for the fact that if there was life on Mars, it would have shared ancestry with Earth. That's because back

towards the origins of the solar system, between 4.1 and 3.8 billion years ago, Earth and Mars had formed, and there is evidence they were both habitable at that point in time," said Pontefract.

"At the time, there was something going on called the Late Heavy Bombardment, and meant the inner solar system was being hit with lots and lots of meteorites. There was a big exchange of rocks between Mars and Earth. There have been studies that have shown biology can survive being ejected from a planet and survive in space. We know it's possible; it's really amazing."

This is what Pontefract is working on now. With a background in microbiology and geology, she is a postdoctoral associate at the Massachusetts Institute for Technology (MIT), where she is part of a team working on a life detection instrument – a DNA sequencer for Mars. The project is funded by NASA.

Looking for DNA on Mars is not an oddity at all, Pontefract noted, and she is arguably among the best prepared to work on a project such as this. Her interest in impact cratering, biology and the intersection between the two – particularly impact craters and their potential to create habitats for life – was what brought Pontefract to Western, to work with Gordon Osinski in the Centre for Planetary Science and Exploration (CPSX). With CPSX, through a Mars analog mission in Utah, she gained knowledge and training into mission design and what is needed for flight readiness of an instrument.

"I've been very interested in life detection, and I've done a little bit of work in something called Raman spectroscopy, which looks at rational modes of molecules. Basically, it's a fingerprinting technique for molecules, it has a very high resolution and it is going to be used as a life detection instrument on Mars 2020 and ExoMars – the two rovers," Pontefract said.

"When I saw this job at MIT advertised and that they are building a life-detection instrument for Mars, a portable DNA sequence, that was really intriguing to me. The problem with looking for life on other planets is, you need to make sure you have an unambiguous signal. You think you find life. But what do you need to find, to say definitively, that you have found life? It's really difficult to do here on Earth, with all of the complex instruments available to us. It's even harder to do remotely with the instruments available to you on a rover," she continued.

Building a life-detection instrument with NASA also appealed to Pontefract from a medical point of view, she added.

"I want to be able to give back to the community, and the instrument they are developing is a portable DNA sequencer. You could bring it into the field, anywhere in the world – some small village in the middle of nowhere. If there's an outbreak and you need to know what it is, lots of times we take samples, send them out and it takes a couple of weeks to get it back. With the instrument we have, you could find out in a matter of hours what you're dealing with. I love that it has multiple applications aside from planetary science," Pontefract explained.

NASA instrument development programs are gauged on something called a Technical Readiness Level (TRL). There are two sets of programs: 'Picasso' funds an early stage idea (TRL 1-2) and 'Matisse' funds mid-stage ideas (TRL 3-6). TRL 7 means the instrument is ready for flight. The life-detection instrument Pontefract is working on is currently at TRL 4.

"We are going to be taking the instrument into the field in January in Argentina to test it at a site that is a Mars analog environment," she noted. "Finding DNA on the surface of Mars is definitely going to be difficult because it only has a residence time of 1 million to 2 million years and you need something fresh. We would prefer to go to places we're not currently allowed to go – to 'special regions on Mars.'"

'Special regions' on Mars are areas designated in the Committee on Space Research planetary protection policy as areas that may support Earth microbes inadvertently introduced to Mars, or may have a high probability of supporting indigenous martian life.

"We're working on trying to determine how to make that a reality within planetary protection, being able to access these regions that may host life, without contaminating Mars," Pontefract continued. "Being able to potentially sequence a living organism on the planet would be incredible."

http://nyti.ms/2jSAQFY

Why Do Our Recorded Voices Sound Weird to Us?

Many people have heard their recorded voices and reeled in disgust. Others are surprised how high their voices sound.

By Jonah Engel Bromwich Jan. 13, 2017

I have a big, dumb, deep, goofy voice.

But I'm reminded of it only when I hear a recording of myself while playing back an interview — or when friends do impressions of me, lowering their voices several octaves.

My high school classmate Walter Suskind has one of the deepest voices I've ever heard in person. His experience has been similar to mine.

"My voice sounds pretty normal in my head," he said. "It's when I catch the echo on the back of the phone or when I hear myself when it's been taped that I realize how deep it is. Also, when people come up to me and, to imitate my voice, go as deep as they possibly can and growl in my face."

He added, "I've been told that the one advantage to voices like ours is we make really good hostage negotiators." (Here's Walter on an episode of "Radiolab." His segment starts at about 12:20, and the host immediately comments on his voice.)

Many people have heard their recorded voices and reeled in disgust ("Do I really sound like that?") Others are surprised how high their voices sound.

The indie musician Mitski Miyawaki, who has earned praise for exceptional control over her singing voice, said that she, too, is often unpleasantly surprised by her speaking voice, which she perceives as "lower, more commanding," than it sounds to others.

"And then I listen to a radio interview and I'm like 'uuuch,' " she said, making a disgusted noise. "I listen to my voice and I go, 'Oh it sounds exactly like a young girl.' "

Why is that?

There's an easy explanation for experiences like Ms. Miyawaki's, said William Hartmann, a physics professor at Michigan State University who specializes in acoustics and psychoacoustics.

There are two pathways through which we perceive our own voice when we speak, he explained. One is the route through which we perceive most other sounds. Waves travel from the air through the chain of our hearing systems, traversing the outer, middle and inner ear.

But because our vocal cords vibrate when we speak, a second path is introduced internally, in which those vibrations are conducted through our bones and excite our inner ears directly.

"The effect of this is to emphasize lower frequencies, and that makes the voice sound deeper and richer to yourself," Professor Hartmann said.

Except when it doesn't: Professor Hartmann's explanation makes sense for many people, including Ms. Miyawaki. But it does not quite work for my classmate Walter or for me.

John J. Rosowski, a professor and researcher at Harvard Medical School who specializes in the middle ear, filled in the gap. He said that there might be variation in our perception given that, within the two pathways Professor Hartmann outlined, there were more nuanced ways for sounds to be perceived by the inner ear.

"There are multiple paths that these vibrations take to get to the skull," Dr. Rosowski said. "They include the vibrations of the skull itself, which can vary."

He said that other factors influencing the way vibrations of the voice could travel to the brain included interaction with cerebrospinal fluid, the clear liquid that sits within the brain and spine, and variations in sound pressure in the ear canal.

This variety of routes would naturally “introduce variation in how people perceive their own voices,” he said, and would probably explain why Walter and I are always surprised by our recorded voices. Professor Hartmann said, however, that he was surprised that I was always so surprised.

“You have a voice on the lower side of normal,” he conceded, “but it’s not enormously deep.”

http://bit.ly/2jdqrkQ

Bat Chatter Is More Than a Cry in the Dark

Using algorithms developed for human speech recognition, researchers decoded which bats in an experimental colony were arguing with each other, and what they were arguing about.

By Christopher Intagliata on January 14, 2017

Download MP3

When we humans talk to other humans, the sounds we make all have very specific meanings. "When I say apple you immediately imagine something that has the characteristics of an apple." Yossi Yovel, a neuroecologist at Tel Aviv University in Israel. "And the question is, do animals also have something like that?"

Yovel and his team chose to listen in on bats, which do a lot of vocalizing. In fact, in caves with vast numbers of bats, it's total cacophony. "It sounds like a crowd in a football stadium before the match has begun, or something like that." To simplify the problem, the researchers eavesdropped on a much smaller colony—just 22 Egyptian fruit bats.

Over several months, they recorded tens of thousands of calls, along with synched-up video—which allowed them to decipher the speaker, the intended recipient, the situation, and the behavior resulting from each call. They then fed their huge database of calls to computers, to test whether machine learning could help make sense of them, using algorithms like the ones used for human speech recognition.

Turns out, the algorithms could correctly identify which bat made each call, more often than chance would predict. "And I can say to some extent who is this bat shouting at, so who is the addressee of this vocalization?" They could even figure out what a bat might be angry about, like “hey, that’s my spot, or gimme some space] and how the addressee might respond—meaning there's really quite a lot of information embedded in bat vocalizations. Pretty useful, if you live in the dark. The study is in the journal Scientific Reports. *[Yosef Prat, Mor Taub & Yossi Yovel, Everyday bat vocalizations contain information about emitter, addressee, context, and behavior]*

As for whether we might someday have Google Translate for bat calls? "Well, Google, definitely not… but perhaps an iPhone." But seriously, "For sure in the next 100 years we will always be behind, we will never really be able to generate a bat to human dictionary. But definitely we will advance in that direction." And in doing so—it might shed a little light on animal communication in general. And how our own language evolved.