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Sodium's influence on blood pressure statistically insignificant

New research in the American Journal of Hypertension suggest sodium has less pervasive influence on health than once thought

A new study published in American Journal of Hypertension finds evidence that increased Body Mass Index, age, and non-sodium dietary factors are much more closely related to increases in systolic blood pressure than sodium intake.

The study, "Relationship between nutrition and blood pressure: A cross-sectional analysis from the NutriNet-Santé study, a French web-based cohort study," measured the effects of sodium intake, Body Mass Index, physical activity, alcohol consumption, and non-sodium dietary factors on the blood pressure of 8,670 French adults and concluded that Body Mass Index, age, and alcohol intake were all strongly linked to blood pressure increases. Sodium intake, however, was found to be statistically insignificant in relation to blood pressure outcomes. Higher consumption of fruits and vegetables was shown to significantly lower blood pressure, while increased physical activity showed no noticeable effect. None of the individuals measured received pharmacological treatment for hypertension during the study.

In a statement accompanying the publication of these findings, Dr. Jacques Blacher, the study's lead author, said that new research like this should play a prominent role in determining public health initiatives for reducing epidemic hypertension: "Hypertension is the world's most prevalent chronic disease. It affects more than 30% of adults aged 25 and above, and accounts for 9.4 million deaths every year. Given its increasing prevalence and the difficulty we as a global health community have in managing it, more should be done to identify causal behavioral relationships to blood pressure outcomes that can lead to better strategies for preventing hypertension."

"The observational study of Lelong et al. emphasizes the association of systolic blood pressure with BMI." said Dr. Theodore Kotchen, Associate Editor of American Journal of Hypertension. "Additionally, the study addresses the relative importance of BMI with specific components of the diet as possible contributors to hypertension."

The study's authors noted that, though the lifestyle factors measured in the study are often targeted by physicians as areas for adjustment in patients with hypertension, there is surprisingly little data on their individual effects on blood pressure within pharmacologically untreated populations.

Relationship between nutrition and blood pressure: A cross-sectional analysis from the NutriNet-Santé study, a French web-based cohort study

http://bit.ly/1rZm4LW

Egypt's Mammal Extinctions Tracked Through 6,000 Years of Art

Tomb goods and historical texts show how a drying climate and an expanding human population took their toll on the region's wildlife

By Sarah Zielinski

A lion stalks among the hieroglyphics at the temple of Karnak in Luxor, Egypt. **(Niels van Gijn/JAI/Corbis)**

Ancient Egypt's highly decorated tombs and funerary objects - meant to ensure a safe trip into the afterlife - also hold a rich record of the region's wildlife. Now scientists have used that art, along with other paleontological, archaeological and historical evidence, to map out the rise and fall of Egypt's large mammals and match those patterns to changes in climate and human interactions.

The results, published today in the *Proceedings of the National Academy of Sciences*, offer an unprecedented glimpse into the ways population growth and climate change can influence an ecosystem over millennia - perhaps giving scientists crucial insight into the long-term impacts of modern human activities. Justin Yeakel at the University of California, Santa Cruz, and his colleagues began with a book, *The Mammals of Ancient Egypt*, which documented the distribution of animal communities from their artistic representations and historical records. According to the book, for example, two species of rhinoceroses had once been present but had disappeared by the Late Predynastic or Early Dynastic periods, approximately 5,000 years ago. The researchers then combined this information with other animal records, such as ancient writings. Lions, for instance, were present during the time of Herodotus, around 2,400 years ago, but had become rare a little over a century later, according to Aristotle.

To analyze the patterns of extinctions, the scientists created a computer model that let them relate the disappearances to predator-prey dynamics and changes in local climate. Previous geological and paleontological research shows that the Egypt of 6,000 years ago was very different from the landscape today. That's because Earth is tilted on its axis with respect to the sun, and the planet wobbles slowly as it orbits, creating slight variations in its tilt that can affect global climate.

Millennia ago, northern Africa was much wetter and cooler. Monsoons struck periodically, and the Sahara was covered with lakes and vegetation. This greener version of Egypt was home to a mix of wildlife more like the one now found in East Africa, with 37 species of large mammals including lions, wildebeest, warthogs and spotted hyenas.

The region began to dry out about 5,000 years ago, a time that coincides with the fall of the Uruk Kingdom in Mesopotamia (located in present-day Iraq) and the rise of the pharaohs in Egypt.

A gilded leopard head carved from wood used to be attached to a cloth robe and is now part of the collection at the Egyptian Museum in Cairo. **(Sandro Vannini/Corbis)**

The Egyptian people at this time switched from a mobile, pastoral life to one of agriculture and subsistence hunting. The new research shows that several species of antelope, along with giraffes and rhinoceroses, disappeared around the same time - extinctions that could be due to overhunting of herbivores. Shortly afterward, the long-maned lion vanished.

Egypt became even drier around 4,200 years ago, during a time known as the "First Intermediate Period" or the "dark period." The region depended on yearly flooding of the Nile to inundate the land and leave behind nutrient-laden silt to feed agricultural fields. But during the dark period, this flooding became inconsistent, crop yields dropped and famine ensued. War and chaos reigned, and eventually the Old Kingdom - and with it, the "Age of the Pyramids" - ended. This is when the roan antelope and African wild dog disappeared from the records.

An inlaid alabaster unguent jar in the form of an ibex, with one natural horn, was found in the tomb of the pharaoh Tutankhamun. **(Robert Harding World Imagery/Corbis)**

A third aridification event occurred about 3,000 years ago, again bringing drought and an end to the New Kingdom, a time that included Tutankhamun and 12 kings named Ramses. Egypt's short-maned lions, revered as sacred and even occasionally mummified, vanished around this time.

Then about 150 years ago, as Egypt's growing population became more industrialized, more species disappeared, including leopards and wild boar. Today, only 8 of the original 37 large-bodied mammals remain.

Egypt's complex food web didn't suffer too badly from the first few species' disappearances, according to the study. When some herbivores were lost, most predators still had plenty of other prey animals to keep them fed. But as more species were removed, the ecosystem became increasingly unstable, and eventually most animals just couldn't survive in a dry landscape populated with an ever-growing human population.

While the team notes that they can't assign a specific cause to any particular extinction event, the model does show that the pattern of extinctions did not occur randomly, perhaps helping to refine theories about modern drops in biodiversity.

"The trajectory of extinctions over 6,000 [years] of Egyptian history is a window into the influence that both climatic and anthropogenic impacts have on animal communities," the researchers write.

http://www.eurekalert.org/pub_releases/2014-09/ciot-ttb090514.php

Textbook theory behind volcanoes may be wrong

The image of volcanoes erupting when magma gushes out as narrow jets from deep inside Earth is wrong,

In the typical textbook picture, volcanoes, such as those that are forming the Hawaiian islands, erupt when magma gushes out as narrow jets from deep inside Earth. But that picture is wrong, according to a new study from researchers at Caltech and the University of Miami in Florida.

New seismology data are now confirming that such narrow jets don't actually exist, says Don Anderson, the Eleanor and John R. McMillian Professor of Geophysics, Emeritus, at Caltech. In fact, he adds, basic physics doesn't support the presence of these jets, called mantle plumes, and the new results corroborate those fundamental ideas.

"Mantle plumes have never had a sound physical or logical basis," Anderson says. "They are akin to Rudyard Kipling's 'Just So Stories' about how giraffes got their long necks."

Anderson and James Natland, a professor emeritus of marine geology and geophysics at the University of Miami, describe their analysis online in the September 8 issue of the Proceedings of the National Academy of Sciences.

According to current mantle-plume theory, Anderson explains, heat from Earth's core somehow generates narrow jets of hot magma that gush through the mantle and to the surface. The jets act as pipes that transfer heat from the core, and how

exactly they're created isn't clear, he says. But they have been assumed to exist, originating near where the Earth's core meets the mantle, almost 3,000 kilometers underground - nearly halfway to the planet's center. The jets are theorized to be no more than about 300 kilometers wide, and when they reach the surface, they produce hot spots.

While the top of the mantle is a sort of fluid sludge, the uppermost layer is rigid rock, broken up into plates that float on the magma-bearing layers. Magma from the mantle beneath the plates bursts through the plate to create volcanoes. As the plates drift across the hot spots, a chain of volcanoes forms - such as the island chains of Hawaii and Samoa.

"Much of solid-Earth science for the past 20 years - and large amounts of money - have been spent looking for elusive narrow mantle plumes that wind their way upward through the mantle," Anderson says.

To look for the hypothetical plumes, researchers analyze global seismic activity. Everything from big quakes to tiny tremors sends seismic waves echoing through Earth's interior. The type of material that the waves pass through influences the properties of those waves, such as their speeds. By measuring those waves using hundreds of seismic stations installed on the surface, near places such as Hawaii, Iceland, and Yellowstone National Park, researchers can deduce whether there are narrow mantle plumes or whether volcanoes are simply created from magma that's absorbed in the sponge-like shallower mantle.

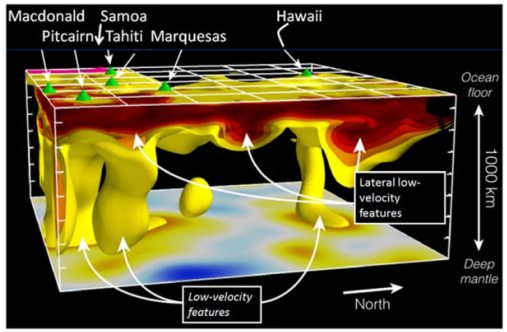
No one has been able to detect the predicted narrow plumes, although the evidence has not been conclusive. The jets could have simply been too thin to be seen, Anderson says. Very broad features beneath the surface have been interpreted as plumes or super-plumes, but, still, they're far too wide to be considered narrow jets.

But now, thanks in part to more seismic stations spaced closer together and improved theory, analysis of the planet's seismology is good enough to confirm that there are no narrow mantle plumes, Anderson and Natland say. Instead, data reveal that there are large, slow, upward-moving chunks of mantle a thousand kilometers wide.

In the mantle-plume theory, Anderson explains, the heat that is transferred upward via jets is balanced by the slower downward motion of cooled, broad, uniform chunks of mantle. The behavior is similar to that of a lava lamp, in which blobs of wax are heated from below and then rise before cooling and falling. But a fundamental problem with this picture is that lava lamps require electricity, he says, and that is an outside energy source that an isolated planet like Earth does not have.

The new measurements suggest that what is really happening is just the opposite: Instead of narrow jets, there are broad upwellings, which are balanced by narrow channels of sinking material called slabs. What is driving this motion is not heat from the core, but cooling at Earth's surface. In fact, Anderson says, the behavior is the regular mantle convection first proposed more than a century ago by Lord Kelvin. When material in the planet's crust cools, it sinks, displacing material deeper in the mantle and forcing it upward.

"What's new is incredibly simple: upwellings in the mantle are thousands of kilometers across," Anderson says. The formation of volcanoes then follows from plate tectonics - the theory of how Earth's plates move and behave. Magma, which is less dense than the surrounding mantle, rises until it reaches the bottom of the plates or fissures that run through them. Stresses in the plates, cracks, and other tectonic forces can squeeze the magma out, like how water is squeezed out of a sponge. That magma then erupts out of the surface as volcanoes. The magma comes from within the upper 200 kilometers of the mantle and not thousands of kilometers deep, as the mantle-plume theory suggests.



A 3D perspective of seismic model SEMum2, shear-velocity structure of the upper mantle beneath a portion the Pacific, viewed from the southeast. Low-velocity regions are yellow-orange. Active ends of linear volcanic chains at the surface are green triangles. Active ends of linear volcanic chains at the surface are green triangles. Active ends of linear volcanic chains at the surface are green triangles. Minimum and maximum isosurface levels are -3% and 1%, respectively. See caption to figure 4 in ref. 2 for details. The view shows several low-velocity features extending from 1,000 km in the mantle toward the surface, converging on widespread regions of least velocity (dark red) distributed beneath the lithospheric lid, and comprising the widespread lowvelocity region beneath the Pacific plate. The low-velocity features broaden into wide pedestals at 1,000 km (the lower mantle). **Adapted from ref. 2; reprinted with permission from AAAS.**

"This is a simple demonstration that volcanoes are the result of normal broad-scale convection and plate tectonics," Anderson says. He calls this theory "top-down tectonics," based on Kelvin's initial principles of mantle convection. In this picture, the engine behind Earth's interior processes is not heat from the core but cooling at the planet's surface. This cooling and plate tectonics drives mantle

convection, the cooling of the core, and Earth's magnetic field. Volcanoes and cracks in the plate are simply side effects.

The results also have an important consequence for rock compositions - notably the ratios of certain isotopes, Natland says. According to the mantle-plume idea, the measured compositions derive from the mixing of material from reservoirs separated by thousands of kilometers in the upper and lower mantle. But if there are no mantle plumes, then all of that mixing must have happened within the upwellings and nearby mantle in Earth's top 1,000 kilometers.

The paper is titled "Mantle updrafts and mechanisms of oceanic volcanism."

http://www.eurekalert.org/pub_releases/2014-09/lu-bfb090814.php

Bacteria from bees possible alternative to antibiotics

Raw honey has been used against infections for millennia, before honey - as we now know it - was manufactured and sold in stores.

So what is the key to its' antimicrobial properties? Researchers at Lund University in Sweden have identified a unique group of 13 lactic acid bacteria found in fresh honey, from the honey stomach of bees. The bacteria produce a myriad of active antimicrobial compounds.

These lactic acid bacteria have now been tested on severe human wound pathogens such as methicillin-resistant Staphylococcus aureus (MRSA), Pseudomonas aeruginosa and vancomycin-resistant Enterococcus (VRE), among others. When the lactic acid bacteria were applied to the pathogens in the laboratory, it counteracted all of them.

While the effect on human bacteria has only been tested in a lab environment thus far, the lactic acid bacteria has been applied directly to horses with persistent wounds. The LAB was mixed with honey and applied to ten horses; where the owners had tried several other methods to no avail. All of the horses' wounds were healed by the mixture. The researchers believe the secret to the strong results lie in the broad spectrum of active substances involved.

"Antibiotics are mostly one active substance, effective against only a narrow spectrum of bacteria. When used alive, these 13 lactic acid bacteria produce the right kind of antimicrobial compounds as needed, depending on the threat. It seems to have worked well for millions of years of protecting bees' health and honey against other harmful microorganisms. However, since store-bought honey doesn't contain the living lactic acid bacteria, many of its unique properties have been lost in recent times", explains Tobias Olofsson.

The next step is further studies to investigate wider clinical use against topical human infections as well as on animals. The findings have implications for developing countries, where fresh honey is easily available, but also for Western countries where antibiotic resistance is seriously increasing.

http://www.eurekalert.org/pub_releases/2014-09/uosc-wsi090814.php

Whale sex: It's all in the hips

New research turns a long-accepted evolutionary assumption on its head -- finding that far from being just vestigial, whale pelvic bones play a key role in reproduction

Both whales and dolphins have pelvic (hip) bones, evolutionary remnants from when their ancestors walked on land more than 40 million years ago. Common wisdom has long held that those bones are simply vestigial, slowly withering away like tailbones on humans.

New research from USC and the Natural History Museum of Los Angeles County (NHM) flies directly in the face of that assumption, finding that not only do those pelvic bones serve a purpose – but their size and possibly shape are influenced by the forces of sexual selection.

"Everyone's always assumed that if you gave whales and dolphins a few more million years of evolution, the pelvic bones would disappear. But it appears that's not the case," said Matthew Dean, assistant professor at the USC Dornsife College of Letters, Arts and Sciences, and co-corresponding author of a paper on the research that was published online by Evolution on Sept. 3.

Dean collaborated with fellow co-corresponding author Jim Dines, Collections Manager of Mammalogy at NHM and one-time a graduate student in Dean's lab, on a painstaking four-year project to analyze cetacean (whale and dolphin) pelvic bones.

The muscles that control a cetacean's penis – which has a high degree of mobility – attach directly to its pelvic bones. As such, it made sense to Dean and Dines that the pelvic bones could affect the level of control over the penis that an individual cetacean has, perhaps offering an evolutionary advantage.

To test this hypothesis, they examined hundreds of pelvic bones – first at the NHM, which has the second-largest collection of marine mammal specimens in North America; and then at the Smithsonian Institution, which has the largest.

"Cetacean skeletons are stored as boxes of bones on warehouse shelves, with each box containing an individual specimen. You have to comb through each box looking for the specific bone you need. The pelvic bones are comparatively small and aren't always collected with the rest of the skeleton, but after the first couple hundred boxes we got very good at finding them when they were present," said Dines, who graduated last spring from USC Dornsife's Integrative and Evolutionary Biology program while maintaining his role at NHM.

Using a 3D laser scanner, they created digital models of the curved bones, offering an unprecedented level of detail about their shape and size, as well as

giving them the option to computationally manipulate them – say, to compare two different bones.

Next, they gathered reams of data going as far back as the days of whalers about testis size relative to body mass in whales. Throughout nature, more "promiscuous" animal species – that is, those with females who mate with several males, creating a more competitive mating environment – develop larger testes relative to their body mass as a way of outperforming the competition.

Finally, they compared the size of the pelvic bones (relative to body size) to the size of the animal's testis (again, relative to body size). The results were clear: the bigger the relative testis, the bigger the relative pelvic bone – meaning that more competitive mating environments seem to drive the evolution of larger pelvic bones. Males from more promiscuous species also evolve larger penises, so larger pelvic bones appear necessary to attach larger muscles for penis control.

As a negative control, Dean and Dines also compared testis size to the size of one of the animal's ribs. If pelvic bone size were simply a reflection of overall skeletal size, there should be a corresponding correlation in the ribs – but there was not, strengthening the interpretation that whale pelvic bones are specifically targeted by selection related to mating system.

"Our research really changes the way we think about the evolution of whale pelvic bones in particular, but more generally about structures we call 'vestigial.' As a parallel, we are now learning that our appendix is actually quite important in several immune processes, not a functionally useless structure," Dean said.

Over the course of their four-year project, the team created a new way of measuring and quantifying the complicated 3D structures of bones, using laser scanners to generate 3D images of the bones and developing novel computational methods to analyze bones that lack obvious landmarks.

The process has significant potential for the recording and study of bones by museums, Dines said.

When doing their data collection, the team had to request loans from the Smithsonian and several other museums, which would ship out the bones themselves for study. However, if all specimens were recorded using Dean and Dines' system, digital copies could be sent anywhere in the world for free – without risking the loss or damage of the original specimen. The data that Dean and Dines collected are detailed enough to generate 3D printed versions of the bones, if desired.

"Cutting edge imaging technologies like 3D laser scanning are revolutionizing how museum collections are used. Not only do they give us a new way of analyzing bones and other specimens, they also allow us to make precise replicas of those specimens. The replicas can then, for example, be sent to colleagues abroad or placed on exhibit while the original specimen stays in the museum researcher's lab for further study," Dines said.

Their collaborators in this effort included Peter Ralph and Andrew Smith of USC Dornsife; E. Otarola-Castillo of Harvard University and Iowa State University; and Jesse Alas of West Adams Preparatory High School.

High school students are rarely listed as co-authors on peer-reviewed scientific journal articles, but Alas more than earned his place on the list, Dean said.

Currently a student at UC Irvine, Alas crossed Dean's path by chance when, on a tour of USC with other local high schoolers, he spotted a bit of Python programming language that Dean had written on a white board for his undergraduate students. Dean said, "when I asked where he learned it, it turned out he was self-taught."

Dean hired Alas to navigate much of the complicated computation that encoded 3D data of the pelvic bone structure.

This research was funded by USC startup funds, the National Institutes of Health (grant #1R01GM098536), and the William Cheney, Jr. Memorial Fund for Mammalogy.

http://www.eurekalert.org/pub_releases/2014-09/uoea-pro090814.php

Poor recording of physical health and medication could be causing dementia trials to fail

Dementia trials could be failing because they all-too-often overlook the physical health of patients – according to new research from the University of East Anglia and Aston University.

More than 60 per cent of people with dementia are estimated to have three or more other conditions (co-morbidities).

The research shows how the combined effects of co-morbidities including diabetes, lung disease, arthritis and chronic heart failure are not being adequately described in dementia trials. It investigates the extent of co-morbidities in people with dementia and the recording of medication usage in clinical trials, for the first time. Previous research has found that medication cocktails make it difficult to show whether new dementia drugs are working.

Researchers hope that the findings will lead to better reporting of co-morbidities and medication use in future trials, and benefit the search for a cure.

There are 36 million people worldwide with Alzheimer's disease and other forms of dementia and this expected to double by 2030 and reach 115 million by 2050 unless a major breakthrough is made.

Lead researcher Dr Chris Fox said: "To date, research on the specific physical healthcare needs of people with dementia has been neglected. "We took into account nine trials, all of which had recorded data about comorbidities. But a

further 15 studies had not recorded data on comorbidities. This shows that dementia trials are failing – which is why we are not making progress.

"Falls, malnutrition, frailty, incontinence, sleep disorders and sight problems are found to occur more frequently in dementia sufferers and untreated can lead to more severe health problems, pain and distress, as well as worsening the symptoms of dementia. And as the severity of the dementia worsens, so does the rate of comorbid conditions.

"But many physical comorbidities are often treatable and some may be reversible. Pneumonia, urinary tract infection, congestive cardiac failure and dehydration account for more than two thirds of preventable dementia admissions.

"The biggest problem is that it is often difficult for people with dementia to communicate that they have another medical complaint. This leads to poor reporting of medical comorbidities," he added.

Dr Ian Maidment from Aston University said: "We found that medication usage was poorly reported. This is important, because our previous research has found that many medications work against new drugs designed to treat dementia potentially making it difficult to prove whether or not these new drugs actually work. Ultimately this may undermine the commitment by the G8 to find new drugs to treat dementia."

The team from UEA, Aston University, the University of Hull and Bradford Institute for Health Research looked at information about 1474 people with dementia from nine randomised control trials. The study found that comorbidity was rife – the most prevalent conditions being neurological disorders (91 per cent) vascular disorders (91 per cent), cardiac disorders (74 per cent) and depression (59 per cent).

'Systematic review investigating the reporting of comorbidities and medication in randomized controlled trials of people with dementia' and published in the September edition of Age and Ageing alongside a commentary piece 'The importance of detecting and managing comorbidities in people with dementia'.

http://www.bbc.com/news/world-us-canada-29113939

Hundreds of US children treated for respiratory virus

Hundreds of children across the US have been treated for a rare respiratory virus and more cases are expected in the next few weeks, doctors have said.

The enterovirus, EV-D68, is believed to be the cause of the outbreak and can cause severe respiratory illness. Twelve states in the US Midwest have reported cases over the past month, with dozens of children admitted into intensive care.

Frequent hand washing and good hygiene help protect against the virus.

Enteroviruses are common and usually do not require hospital care. The symptoms typically manifest as an intense summer cold, with the number of infections declining in September. But EV-D68, which was first recorded in California in 1962, is less common in the US and can cause mild or severe respiratory illness.

Over the past month, doctors in a number of states have reported an unusually high number of cases where symptoms have developed into acute respiratory distress and where the patient has needed hospitalisation, and in some cases, intensive care. In a cluster of cases in Kansas City, 19 out of 22 children tested positive for EV-D68. In a similar cluster in Chicago, 11 out of 14 cases tested positive for the virus.

"We believe the unusual increases in Kansas City and Chicago might be occurring in other places in weeks ahead," said Anne Schuchat from the US National Center for Immunization and Respiratory Diseases. "We don't know as much as we would like to know, but we believe the virus is spread through respiratory secretions," she said.

Infants, children and teenagers are most at risk from the virus, said Dr Schuchat.

More than half of the children hospitalised in the outbreak already had a history of asthma or other breathing difficulties. No fatalities have been reported.

Dr Schuchat said 12 states had contacted the Centers for Disease Control for help in investigating clusters of the virus. These include Colorado, North Carolina, Georgia, Ohio, Iowa, Illinois, Missouri, Kansas, Oklahoma, and Kentucky.

Dr Schuchat urged parents who had children who were having difficulty breathing to contact a doctor. She also urged medics to consider laboratory testing if the cause of a respiratory illness was not clear. Frequent hand washing and good hygiene is believed to reduce the risk of infection, she said. She also advised parents who had children with asthma to make sure they take their medicine regularly.

http://bit.ly/1uLlQVV

How good is the fossil record?

Do all the millions of fossils in museums around the world give a balanced view of the history of life, or is the record too incomplete to be sure?

This question was first recognised by Charles Darwin and has worried scientists ever since.

Methods have been developed to try to identify and correct for bias in the fossil record but new research from the Universities of Bristol and Bath, suggests many of these correction methods may actually be misleading.

The study, led by Dr Alex Dunhill, formerly at the Universities of Bristol and Bath and now at the University of Leeds, explored the rich and well-studied fossil record of Great Britain. Professional geological work has been done in the British Isles for over 200 years and the British Geological Survey (dating from the 1830s)

has amassed enormous, detailed knowledge of every inch of the rocks and fossils of the islands.

Together with collaborators from the Universities of Bristol and Bergen, Dr Dunhill compared biodiversity through the last 550 million years of the British fossil record against a number of geological and environmental factors including the area of sedimentary rock, the number of recorded fossil collections and the number of named geological 'formations'. All of these measures have been used as yardsticks against which the quality of the fossil record can be assessed – but the new study casts doubt on their usefulness.

Dr Dunhill said: "We suspected that the similar patterns displayed by the rock and fossil records were due to external factors rather than the number of fossils being simply dictated by the amount of accessible rock. Our work shows this is true. Factors such as counts of geological formations and collections cannot be used to correct biodiversity in the fossil record."

The study benefits from the application of advanced mathematical techniques that not only identify whether two data sets correlate, but also whether one drives the other.

The results show that out of all the geological factors, only the area of preserved rock drives biodiversity. Therefore, the other geological factors – counts of fossil collections and geological formations – are not independent measures of bias in the fossil record.

Co-author, Bjarte Hannisdal from the University of Bergen, said: "We can learn more by analysing old data in new ways, than by analysing new data in old ways." This discovery fundamentally alters the way we view the diversity of life through time. It shows that both the preservation of rock and the preservation of fossils were probably driven by external environmental factors like climate change and sea level.

This better explains the similarities between the rock and fossil records, as both responding to the same external factors. The alternative idea, that rock preservation was driving the fossil record is now strongly queried by this study. Perhaps the record of biodiversity in the fossil record is more accurate than previously feared.

Professor Michael Benton from the University of Bristol, another co-author of the study, said: "Palaeontologists are right to be cautious about the quality of the fossil record, but perhaps some have been too cautious. The sequence of fossils in the rocks more or less tells us the story of the history of life, and we have sensible ways of dealing with uncertainty. Some recent work on 'correcting' the fossil record by using formation counts may produce nonsense results."

The research is published today in Nature Communications.

http://bit.ly/1uz20hr

At the Mayo Clinic, IBM Watson Takes Charge of Clinical Trials

The typical ways in which patients get matched up with clinical trials aren't exactly state of the art.

By Eliza Strickland

At hospitals, clinical coordinators painstakingly sort through patient records, looking for people that fit the requirements of a given experimental treatment; meanwhile, patients bring their own Internet research to their doctors, asking if some new drug might help them. The Mayo Clinic is now seeking to improve this process by putting IBM Watson on the job.

The artificial intelligence known as IBM Watson can scan enormous troves of written information thanks to its natural language processing skills, and its machine learning programming means it quickly gets better at using that information to complete a given task. Most famously, it quickly got better at answering Jeopardy questions, and tromped the human competition in a 2011 exhibition match. More recently, IBM has been promoting the AI as the killer app for health care, where so much information is contained in written medical records and medical journal articles. Several hospitals and research institutions are testing Watson's abilities to suggest personalized treatment plans for cancer patients.

At the Mayo Clinic, Watson will start by analyzing the medical records of patients with breast, colorectal, and lung cancer. (If all goes well, other patients will gradually be included in the project.) Watson will also be continuously scanning databases that list clinical trials, such as ClinicalTrials.gov, and will suggest appropriate matches for patients. There will be a lot to look through: The Mayo Clinic has about 8,000 clinical trials going on right now, in addition to the 170,000 that are ongoing worldwide. Mayo doctors will start consulting Watson in early 2015.

IBM vice-president of healthcare Sean Hogan says this system will provide new treatment options and new hope for patients, and will also speed the pace of medical research. And once Watson gets to work, it should get better and better at its job. "It's designed to learn and improve," he told IEEE Spectrum. "As it gets the iterative feedback, as it interacts with the experts, it gets better."

http://bit.ly/1tPojBn

Nicaragua 'Meteorite' Probably Wasn't a Meteorite

Big 'boom'? Check. Big crater? Check. It must be a meteorite!

Sep 9, 2014 11:40 AM ET // by Ian O'Neill

That was the key logic behind the "meteorite" that apparently narrowly missed Nicaragua's capital city over the weekend, but some craters can be deceiving.

Late on Saturday, the residents of Managua were rattled by a large boom. Seismic instruments at the nearby airport even registered the "impact." Later, a large crater, measuring 12 meters across, was discovered in a wooded area nearby.

Immediately, it was assumed that the event was caused by a meteorite and the errant space rock was associated with the flyby of asteroid 2014 RC. eismologists estimated the impact delivered an energy equivalent of one ton of TNT.

Alas, meteorite experts are skeptical that the Nicaraguan event was caused by a meteorite at all. "For something to produce a hole in the ground that big, it would have generated a very bright fireball. And nothing was reported … despite the population," said Bill Cooke, head of NASA's Meteoroid Environment Office. "So I'm very skeptical."

Mananua has a population of around 1.5 million people, so it seems odd that there were no reports of a bright meteor associated with the impact. Also, at time of writing, it appears no meteorite fragments have been recovered from the scene.

As for the "meteorite" being associated with asteroid 2014 RC, astronomers from NASA's Near-Earth Object Observations Program told the Associated Press that the two events were not linked. 2014 RC flyby happened 13 hours after the Nicaraguan event.

So the only two pieces of evidence that hint it was a meteorite impact is that 1) there's a crater and 2) there was a loud boom. Coincidentally, these two pieces of evidence are also associated with (you guessed it) bombs. Cooke pointed out that a more likely explanation is that it was "someone out blowing things up."

Therefore, for this to be a meteorite impact, we really need to recover some pieces of meteorite from the scene.

Personally, I'd like to think it was aliens taking potshots at the Nicaraguan countryside, but I have little supporting evidence to prove this hypothesis.

UPDATE: The crater is also located near a Nicaraguan air force base. An air force base. Let's think about that for a minute.

http://www.eurekalert.org/pub_releases/2014-09/sfsu-ssa090314.php

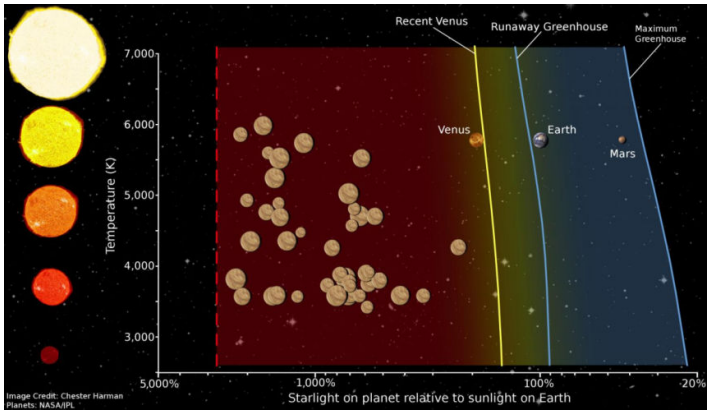
SF State astronomer pinpoints 'Venus Zone' around stars

Definition will aid Kepler astronomers looking for habitable planets outside solar system

SAN FRANCISCO -- San Francisco State University astronomer Stephen Kane and a team of researchers presented today the definition of a "Venus Zone," the area around a star in which a planet is likely to exhibit the unlivable conditions found on the planet Venus.

The research will help astronomers determine which planets discovered with NASA's Kepler telescope -- which has a primary mission of finding habitable planets similar to Earth -- are actually more analogous to Earth's similarly-sized sister planet. Knowing how common Venus-like planets are elsewhere will also help astronomers understand why Earth's atmosphere evolved in ways vastly different from its neighbor.

"We believe the Earth and Venus had similar starts in terms of their atmospheric evolution," said Kane, an assistant professor of physics and astronomy at SF State and lead author of the study published online today. "Something changed at one point, and the obvious difference between the two is proximity to the Sun."



This graphic shows the location of the 'Venus Zone,' the area around a star in which a planet is likely to exhibit atmospheric and surface conditions similar to the planet Venus. The zone is expressed in terms of how much solar energy a planet receives relative to the solar energy received by Earth. **Chester Harman, Pennsylvania State University**

The Kepler telescope is used to find planets outside our solar system, called exoplanets, located within or near the habitable zone in which a planet can hold liquid water on its surface. Earlier this year, Kane was part of an international team of researchers that discovered one such planet orbiting the dwarf star Kepler-186. The main way this search is conducted, however, is by looking for exoplanets that are roughly the same size as Earth. That, according to Kane, poses a problem because our own solar system contains two planets of the same size -- Earth and Venus -- that have vastly different atmospheric and surface conditions.

"The Earth is Dr. Jekyll and Venus is Mr. Hyde, and you can't distinguish between the two based only on size," said Kane, who runs a website tracking known exoplanets. "So the question then is how do you define those differences, and how many 'Venuses' is Kepler actually finding?"

Kane and his fellow researchers at Penn State University and the NASA Goddard Space Flight Center in Maryland used "solar flux" -- or the amount of a star's energy that a planet receives -- to define the inner and outer edges of the Venus Zone. The point at which a planet's atmosphere would experience runaway greenhouse-gas effects like those seen on Venus -- a point located just inside Earth's orbit in our solar system -- forms the outer boundary. The point at which

the planet's atmosphere would be completely eroded away by the stellar energy marks the inner boundary.

If Kepler astronomers discover a planet that is similar in size to Earth but located within the solar-flux range that makes up the Venus Zone, that could be a clue the planet is more like Venus than Earth, and therefore is uninhabitable. Future space-based telescopes will allow researchers to begin receiving data on these exoplanets' atmospheres, helping them confirm whether they are "Venuses" or "Earths."

"If we find all of these planets in the Venus Zone have a runaway greenhouse-gas effect, then we know that the distance a planet is from its star is a major determining factor," Kane added. "That's helpful to understanding the history between Venus and Earth."

Future research will look at whether the amount of carbon in a planet's atmosphere impacts the boundaries of the Venus Zone, for example by pushing the outer boundary farther away from the star for planets with greater concentrations of carbon.

"This is ultimately about putting our solar system in context," according to Kane. "We want to know if various aspects of our solar system are rare or common."

"On the frequency of potential Venus analogs from Kepler data" by Stephen R. Kane, Ravi Kumar Kopparapu and Shawn D. Domagal-Goldman was published online Sept. 10 in arXiv and has been accepted for publication in an upcoming issue of the Astrophysical Journal Letters.

http://www.eurekalert.org/pub_releases/2014-09/uons-stg090914.php

Study ties groundwater to human evolution

Our ancient ancestors' ability to move around and find new sources of groundwater during extremely dry periods in Africa millions of years ago may have been key to their survival and the evolution of the human species, a new study shows.

The research – published in the journal PLOS ONE – combines geological evidence from the Olduvai sedimentary basin in Northern Tanzania, which formed about 2.2 million years ago, and results from a hydrological model.

It shows that while water in rivers and lakes would have disappeared as the climate changed due to variations in the Earth's orbit, freshwater springs fed by groundwater could have stayed active for up to 1000 years without rainfall.

"A major unknown connected with human evolution in this climatically turbulent environment is the availability of resources, particularly freshwater," says lead author Dr Mark Cuthbert, holder of a European Community-funded Marie Curie Research Fellowship at UNSW's Connected Waters Initiative and University of Birmingham (UK).

Potable water in rivers or lakes in the region is likely to have been scarce, owing to salinity, drought and the short-lived flow of streams. Groundwater may have provided "a key alternative potable resource for sustaining life" in this environment. "Springs and groundwater-fed habitats could have played a decisive role in the survival and dispersal of hominins in times when potable surface water was limited," Dr Cuthbert said.

Geological evidence pointed to the springs being active during the driest periods of climate fluctuations that occurred around 1.8 million years ago, a critical period for hominin evolution. In addition, modelling by the researchers showed springs at Olduvai may have stayed active for hundreds of years without rainfall.

"As surface water sources became more scarce during a given climate cycle, the only species to survive may have been those with adaptations for sufficient mobility to discover a new and more persistent groundwater source, or those already settled within home range of such a resource," co-author Professor Gail Ashley, Rutgers University (US), said.

"Such groundwater refugia may have been sites for intense competition between hominin and other animal species and hence selective pressure favouring those who could maintain access to water, something for which there is no substitute.

"Furthermore we speculate that, during wetter periods, springs may have formed ways of 'bridging' longitudinal dispersal of hominins between larger freshwater bodies or rivers providing a critical resource during hominin migration within and out of Africa," Professor Ashley said.

Professor Andy Baker, Director of UNSW's Connected Waters Initiative, welcomed the study, adding, "Here in Australia we are very aware of the importance of groundwater to our national economy today.

"This study clearly suggests that we should consider the role of groundwater throughout the history of the settlement of our continent."

The scientists said more research is needed to test their theories about the role that groundwater may have played in human evolution and dispersal.

http://www.eurekalert.org/pub_releases/2014-09/f-sf-ptl091014.php

Pain tolerance levels between men and women are similar

More resilient people tend to have a higher pain tolerance

Resilience, a person's ability to overcome adverse circumstances, is the main quality associated with pain tolerance among patients and their adjustment to chronic pain. This is the result of a new study carried out at the University of Málaga that shows that the effect of gender on this ability is not as significant as originally thought.

Over the years a number of clinical trials have shown important gender differences with regard to susceptibility to pain through illness, effectiveness of

medications and recovery after anaesthetic. Furthermore, these results coincide with general lore where it is often said that women tolerate pain better than men. However, a new study led by researchers at Malaga University with the aim of analysing the differences between men and women in terms of their experience with chronic pain has dispelled this theory, revealing that these differences are minimal.

Quite the opposite, it is a person's resilience -the ability to overcome adverse circumstances- that determines the high or low acceptance of pain, as it is related to a series of characteristics that provide the individual with resources to cope with chronic pain.

400 patients with chronic spinal pain (190 men and 210 women) treated in primary care centres took part in this study and the findings show more similarities than differences between the two sexes.

"More resilient individuals tend to accept their pain, that is, they tend to understand that their ailment is chronic and they stop focusing on trying to get the pain to disappear, to focus their energy on enhancing their quality of life, despite the pain," Carmen Ramírez-Maestre, the main author and researcher at the Andalusian institution, told SINC.

"In this regard," continued Ramírez-Maestre, "patients who are able to accept their pain feel less pain, they are more active on a daily basis and have a better mood".

Fear of pain

Also, the findings, which were published recently in 'The Journal of Pain', showed that patients that feared pain also experienced significantly more anxiety and depression. "However, this fear was only related to a greater degree of pain in the samples of men and this was the only difference found between the sexes," concludes the author.

Citation: Carmen Ramírez-Maestre, Rosa Esteve. "The role of sex/gender in the experience of pain. Resilience, fear and acceptance as central variables in the adjustment of men and women with chronic pain". The Journal of Pain.

http://phys.org/news/2014-09-sloths-slouches-evolution.html

Sloths are no slouches when it comes to evolution

Sloth's ancestors developed large body sizes at an amazing rate

Today's sloths might be known as slow, small animals, but their ancestors developed large body sizes at an amazing rate, according to an evolutionary reconstruction published today in the open access journal BMC Evolutionary Biology. The fast rate of change suggests that factors such as environmental conditions, or competition with other species must have strongly favored the bigger sloths, before they died out.

Scientists from UCL (University College London) and University College Dublin looked at existing models for reconstructing how sloths diversified, with some species as large as elephants, and some shrinking down to their current small sizes from a large ancestor. The study showed that some sloth lineages increased in size by over 100 kilos every million years – some of the fastest rates of body size evolution known for mammals.

Dr Anjali Goswami (UCL Earth Sciences), an author on the paper, said: "Today's sloths are really the black sheep of the sloth family. If we ignore the fossil record and limit our studies to living sloths, as previous studies have done, there's a good chance that we'll miss out on the real story and maybe underestimate the extraordinarily complex evolution that produced the species that inhabit our world."

The two existing groups of sloth species bear very little resemblance to some of their extinct relatives. The species Megatherium americanum was an elephant-sized ground sloth which could reach up to four tonnes. Fossilised track marks suggest they could walk upright on their hind legs. Eremotherium eomigrans could weigh five tons and their claws grow to a foot long. All but two sloth groups died out around 11,000 years ago, with the sloths living today reaching a maximum of 13 lbs.

The team took information about all known sloth species, both living and in the fossil record, and tested how existing evolutionary models explained the range in body sizes. They showed that models based only on living species were inadequate to explain the changes in size. Models which incorporated fossil species showed that they evolved at an extremely fast rate, and that the environmental conditions at the time must have really favored larger body sizes, such as the climate, or competition between species. The authors say the method could be used to pry into the evolutionary past of other species.

Dr John Finarelli (University College Dublin Earth Institute), who co-authored the study, says: "There are many other groups, such as hyaenas, elephants and rhinos, that, like sloths, have only a few living species. But if we look into the distant past, these groups were much more diverse, and in many cases very different to their current forms."

http://www.bbc.com/news/health-29118656

Some patients 'wake up' during surgery

More than 150 people a year in the UK and Ireland report they have been conscious during surgery - despite being given general anaesthesia.

By Smitha Mundasad Health reporter, BBC News

In the largest study of its kind, scientists suggests this happens in one in every 19,000 operations. They found episodes were more likely when women were

given general anaesthesia for Caesarean sections or patients were given certain drugs. Experts say though rare, much more needs to be done to prevent such cases.

'Unable to move'

Led by the Royal College of Anaesthetists and Association of Anaesthetists of Great Britain and Ireland, researchers studied three million operations over a period of one year. More than 300 people reported they had experienced some level of awareness during surgery - some recalled experiences from years ago. Most episodes were short-lived and occurred before surgery started or after operations were completed. But some 41% of cases resulted in long-term psychological harm. Patients described a variety of experiences - from panic and pain to choking - though not all episodes caused concern. The most alarming were feelings of paralysis and being unable to communicate, the researchers say.

One patient, who wishes to remain anonymous, described her experiences of routine orthodontic surgery at the age of 12. She said: "I could hear voices around me and I realised with horror that I had woken up in the middle of the operation but couldn't move a muscle. "While they fiddled, I frantically tried to decide whether I was about to die."

'Rare but concerning'

She told researchers that for 15 years after her operation she had had nightmares of monsters leaping out to paralyse her. And it was only after she made the connection between this and her operation that the nightmares stopped.

Each person's experience was analysed to identify factors that could make these situations more likely. About 90% occurred when muscle-relaxant drugs - used to help paralyse muscles during surgery - were administered in combination with other drugs that normally dampen consciousness.

Researchers believe in some of these cases patients received an inappropriate balance of medication, leaving them paralysed but still aware. And there were several reports of awareness from women who had Caesarean sections while under general anaesthesia. Though this type of anaesthesia is most often used in emergency situations, researchers say women should be informed of the risks.

Drug errors

They calculate up to one in 670 people who have Caesarean sections with general anaesthesia could experience some levels of awareness. But experts argue this is partly due to the balance needed when achieving unconsciousness for the woman while still keeping the baby awake. Other common factors include lung and heart operations and surgery on patients who are obese. And some 17 cases were due to drug errors.

Researchers are calling for a checklist to be used at the start of operations and a nationwide approach to managing patients who have these experiences.

Prof Tim Cook, at the Royal United Hospital in Bath, who led the research, said: "For the vast majority it should be reassuring that patients report awareness so infrequently. "However for a small number of patients this can be a highly distressing experience. "I hope this report will ensure anaesthetists pay even greater attention to preventing episodes of awareness."

http://www.bbc.com/news/world-africa-29136594

Ebola outbreak 'threatens Liberia's national existence'

Liberia is facing a "serious threat" to its national existence as the deadly Ebola virus "spreads like wildfire" there, its defence minister says.

Brownie Samukai told the UN Security Council that the international response to the crisis was "less than robust".

The World Health Organization (WHO) has warned that thousands more cases could occur in Liberia, which has been worst hit by the West Africa outbreak. Some 2,288 people have died from Ebola in Liberia, Guinea and Sierra Leone.

Infected health workers

The WHO says half of these deaths occurred in the three weeks running up to 6 September. In Nigeria, eight people have died out of a total 21 cases. In Senegal, the only person to have been diagnosed with Ebola last month has recovered, a health official has said. The patient, a Guinean student, tested negative after receiving treatment, the official said.

Mr Samukai warned on Tuesday that the disease was "devouring everything in its path" in Liberia. The country's weak health system was already overwhelmed by the number of cases, he said. Mr Samukai told UN Security Council members that Liberia lacked "infrastructure, logistical capacity, professional expertise and financial resources to effectively address this disease". "Liberia is facing a serious threat to its national existence. The deadly Ebola virus has caused a disruption of the normal functioning of our state," he said.

Liberia at a glance:

Infrastructure devastated by a 14-year civil war

About 250,000 people killed in the conflict that ended in 2003

One doctor to treat nearly 100,000 people before Ebola outbreak

Ebola cases this year: 2,046

Ebola deaths this year: 1,224

Population: 4.4 million

Source: WHO

Separately on Tuesday, the UN's envoy in Liberia said that at least 160 Liberian health workers had contracted the disease and half of them had died.

Karin Landgren described the outbreak as a "latter-day plague" that was growing exponentially. She added that health workers were operating without proper protective equipment, training or pay, in comments to the UN Security Council. "Liberians are facing their gravest threat since their war," Ms Landgren said. "I don't think anybody can say right now that the international response to the Ebola

outbreak is sufficient," US ambassador to the UN Samantha Power said after the Security Council briefing.

'Insufficient response'

Ebola spreads between humans by direct contact with infected blood, bodily fluids or organs, or indirectly through contact with contaminated environments.

Unlike other West African nations affected by the outbreak, efforts to contain the virus in Liberia were not working well, the WHO has said.

The reason for this remains unclear; however, experts say it could be linked to burial practices, which can include touching the body and eating a meal near it.

There are also not enough beds to treat Ebola patients, particularly in the capital Monrovia, with many people told to go back home, where they may spread the virus.

The WHO is calling on organisations combating the outbreak in Liberia to scale up efforts "three-to-four fold" to control the outbreak. The US says it will help the African Union mobilise 100 African health workers to the region and contribute an additional $10m (£6.2m) in funds to deal with the outbreak.

The announcement comes as a fourth US aid worker infected with the deadly virus was transported to a hospital in Atlanta for treatment. The identity of the aid worker has not yet been revealed. Two other aid workers who were treated at the same hospital have since recovered from an Ebola infection.

UN Secretary General Ban Ki-moon says he will hold a meeting on the international response to the Ebola crisis on the sidelines of the UN General Assembly this month.

http://bit.ly/1qTIlqO

Industrial waste converted in coating for aircraft turbines

Specialists have developed nanostructured coatings capable of withstanding temperatures exceeding 1000 degrees Celsius

A group of specialists from the Center for Research in Advanced Materials (Cimav), have developed nanostructured coatings capable of withstanding temperatures exceeding 1000 degrees Celsius, which are used in aviation turbine components.

Dr. Ana Maria Arizmendi Morquecho, leader of the project, explained that through the development of coatings the team is looking to solve one of the most common problems in the aviation industry, which is the microstructural degradation of superalloys that integrate turbines due to the high temperatures reached by the devices.

"The components of the blade and nozzle in the hot zone of the turbines, which are made of Nickel-based superalloys, are exposed to temperatures above one thousand degrees Celsius, which causes very strong microstructural degradation of the substrates and impact on the thermal and mechanical properties of the structure by decreasing the energy efficiency of the turbines," explained the researcher.

The project consist in the development of advanced thermal barriers based nanocomposites that would protect the structures from the superalloys some components of the turbine are manufactured with. For this, the group of Arizmendi Morquecho uses fly ash as a ceramic matrix incorporating various nanoparticles to create new materials developed by researchers.

"We found that taking advantage of the large amount of mullite, which is a chemically and thermally stable compound found in the fly ash, we can use this material as a ceramic matrix, which by the addition of different particles have obtained novel nanocomposites that greatly diminish the thermal conductivity and are used in developing coatings for superalloys," said Arizmendi Morquecho.

Besides the application for the aviation industry, this technology seeks to impact in an environmental level with the use of a material that until now was considered polluting industrial waste, such as fly ash, which is mainly obtained from coal plants installed in northern Mexico.

According to Arizmendi Morquecho, after five years of analyzing the different materials that could be used as advanced thermal barrier systems, the team is expecting to make the final tests to validate the materials obtained at the laboratory , to continue with the process of scaling up the technology to be transferred to an interested company.

While this technology is considered basic research, its guidance hopes to solve industrial problems. "This is part of the focus of Cimav at the Park of Research and Technological Innovation located in the Moneterrey, north of Mexico. Therefore, we combine a multidisciplinary group of researchers to conduct basic and applied science, as well as having liaisons with industry, academy and research centers globally," explained Morquecho Arizmendi.

http://bit.ly/1m58nIK

When We're Lonely, Inanimate Faces Come Alive

Our minds are less particular about the source of comfort when we are craving contact with others

By Rachel Nuwer

When we're desperate for love or attention, we unconsciously lower our standards for what we'll try to connect with, according to new research. Loneliness, it seems, can cause the line between animate and inanimate to blur.

Katherine Powers, a psychologist at Dartmouth College and lead author of the new study, asked undergraduates to view images of faces on a computer. As Medical Express describes, most of the images were "morphs" - they were

rendered by blending real and digitally created faces (such as the image of a doll's face) together. They ranged in realism from 100 percent human to 100 percent inanimate.

After asking the students to rate which faces they found to be most realistic, the team then surreptitiously quizzed them about how they were feeling that day, by having them rank how much they agreed with phrases such as "I want other people to accept me," Medical Express writes. Those who felt desperate for social acceptance and attention, they found, had lower standards for which images qualified as animate.

In a second experiment, students took a personality test and then were randomly told their future, supposedly based on those results. The researchers told some hapless participants that they would lead a forlorn life marked by loneliness and isolation, while others were assured that they would find long-lasting friends and the love of their life, Medical Express reports. Then, the students viewed the same set of animate-to-inanimate faces. Again, those who thought they were cursed to die alone were less discerning about which faces counted as human. (Presumably, they were told at the end of the study that they were not, in fact, doomed to a life of loneliness.)

As Powers explained in a release published on Medical Express, the increased sensitivity to what is and is not alive "suggests that people are casting a wide net when looking for people they can possibly relate to—which may ultimately help them maximize opportunities to renew social connections."

These findings harken back to previous studies conducted on young children who develop intense attachment to inanimate objects, such as dolls, toys or even blankets. According to The Guardian, up to 70 percent of children exhibit such behaviors at some time or another, although "the phenomenon tends to be confined to the western world, where children usually sleep apart from their parents at an early age." Those children, researchers found, believe that their beloved object essentially possesses a life force or an essence—even if they contradictorily understand that it is in fact not alive.

Children, however, aren't the only ones who sometimes develop intense attachments to inanimate objects whose owners nonetheless treat them as though they were living. As one new owner of a RealDoll—the life size, ultra-realistic (usually female) dolls—recently noted on that company's website:

> Since receiving my doll I feel like the Frank Lloyd Wright client who so loved their house that they did not want to leave it.
>
> Enough cannot be said about the extent of realism to my doll. Photos do not convey the impact of see[ing] this doll with your own eyes sitting on your own furniture. I enjoy having a glass of wine while admiring her sitting nude on a chair.

http://bit.ly/1qU8PbO

Deadly Chinese Earthquake May Have Been Man-Made

More than 600 people died in the August 3 Yunnan earthquake

By Colin Schultz

In August a large earthquake hit China's Yunnan Province, killing more than 600 people and injuring nearly 2,000 as tens of thousands of buildings collapsed and the shaking, along with heavy rains, caused the land to slide.

Now, an engineer has laid out preliminary evidence suggesting that the earthquake was induced, that human activity pushed the fault to slip, says *Nature*.

Southwestern China is no stranger to earthquakes—the region has seen dozens of earthquakes stronger than magnitude 6 in the past 100 years.

But Fan Xiao, an engineer with the Bureau of Geology and Mineral Resources in neighboring Sichuan province, says *Nature*, is arguing that the magnitude 6.2 earthquake was part of the increasingly common crop of human-assisted earthquakes.

Seismologists call these "induced" earthquakes.

According to Xiao, the pressure put on the Earth's crust by filling a nearby reservoir with water may have caused an existing fault to slip.

Nature:

Criss-crossed by active faults, the upper Yangtze region is seeing a boom in dam-building for the generation of hydropower. But when water flows quickly into the resulting reservoirs, it can change the stress on faults deep underground, either from the sheer weight of the water, or when water infiltrates the rocks through cracks and pores. These events might accelerate a fault's natural 'seismic clock', hastening an earthquake that is already building, or increase the chance of one occurring at all.

The idea is not without precedent - not even close, says the United States Geological Survey:

Although it may seem like science fiction, man-made earthquakes have been a reality for decades. It has long been understood that earthquakes can be induced by impoundment of water in reservoirs, surface and underground mining, withdrawal of fluids and gas from the subsurface, and injection of fluids into underground formations.

As Smart News has written before, there is a long history of induced earthquakes in the scientific record. According to *Nature*, confirmation of Xiao's hypothesis will likely need to wait until other scientists can look at the more detailed seismic measurements captured of the earthquake, records which are, conveniently, "tightly controlled by hydropower companies."

http://bit.ly/ZldjPr

ASU astrophysicists to probe how early universe made chemical elements

In the beginning, all was hydrogen – and helium, plus a bit of lithium.

Three elements in all. Today's universe, however, has nearly a hundred naturally occurring elements, with thousands of variants (isotopes), and more likely to come.

Figuring out how the universe got from its starting batch of three elements to the menagerie found today is the focus of a new Physics Frontiers Center research grant to Arizona State University's School of Earth and Space Exploration (SESE).

The grant is from the National Science Foundation's Joint Institute for Nuclear Astrophysics – Center for the Evolution of the Elements. Of the full $11.4 million NSF grant, about $1 million will come to ASU over five years.

SESE astrophysicist Frank Timmes is the lead scientist for ASU's part of the Physics Frontiers Center research project. Timmes, ASU's director of advanced computing, focuses his astrophysical research on supernovae, cosmic chemical evolution, their impacts on astrobiology and high-performance computing. He is also a scientific editor of The Astrophysical Journal.

The evolution of elements project also includes Michigan State University in Lansing (the lead institution), the University of Notre Dame in South Bend, Indiana, and the University of Washington in Seattle.

Joining Timmes on the project will be astrophysicists Patrick Young, Evan Scannapieco and Sumner Starrfield, also from the School of Earth and Space Exploration. In addition, the award will fund two postdoctoral researchers to collaborate on the effort.

Take it from the top

Time started 13.7 billion years ago with the Big Bang, which produced the basic three elements. Yet by the time the Bang was a billion years old, essentially all the other chemical elements we know had formed. How did this happen?

"It takes place inside stars," says Timmes. "They're the element-factories of the universe. They take light stuff, such as hydrogen and helium, process it in nuclear reactions, and then crank out carbon, nitrogen, oxygen and all those good things that make you and me."

While the broad outline is clear, details are a lot murkier, he says, and that's where ASU's researchers enter the picture.

"ASU's contribution is to provide the glue between experimental low-energy nuclear astrophysics measurements and astronomical observations of stars," Timmes says.

Ancient stars were fundamentally different from those today, he notes, because they started off with a different collection of initial ingredients – no heavy elements. But those first-generation stars are gone.

As Timmes explains, "The stars that began back then went through their life cycles and died, so we naturally don't directly see them today. But when they died, they exploded and threw out little bits of carbon, oxygen and nitrogen, which ended up in the next generation of stars."

Round and round in cycles

In a process that still continues today, massive stars create more and more complex elements, then explode as supernovas and scatter the newly created elements into space for another generation of stars to use.

Cycle after stellar cycle, stars became steadily richer in heavier and more complex elements.

The sun, its planets and moons all formed about 4.5 billion years ago. Most of the elements they contain didn't exist when the universe was young, so what generation does the sun belong to?

Timmes explains, "A typical massive star, in round numbers, lives about a million years. The Big Bang occurred about 7 billion years before the sun formed. I need a thousand generations of massive stars to get us to a billion years, so I need on the order of 10,000 generations of massive stars to get one with the sun's composition.

"We are the product of many, many, many previous generations of stars."

The researchers at the School of Earth and Space Exploration plan to develop computer models of stars of all sizes, masses and chemical compositions, then set them on their life courses.

It's building stars in computers and comparing them to observations of stars to see how the universe builds them for real.

"The toughest theoretical problem we have to work on is how stars explode," says Timmes. "In a loose, hand-waving sense, we know that stars explode, of course, but exactly how it happens isn't well-known or understood."

The new research project fits well with the expertise of the school's astrophysicists. And there's another plus as well. With this project, ASU is joining a small group of research centers that deal with "Frontiers Physics." The entire country has only about ten such centers, Timmes explains. Highly competitive and highly sought-after, they cover subjects such as biological physics and theoretical physics.

But there's just one nuclear astrophysics center, he says. "And it's great that ASU is going to play a key role in it."

http://www.eurekalert.org/pub_releases/2014-09/afot-nmt090914.php

New molecular target is key to enhanced brain plasticity

Tel Aviv University researcher says discovery may lead to improved memory, cognitive function in Alzheimer's patients

As Alzheimer's disease progresses, it kills brain cells mainly in the hippocampus and cortex, leading to impairments in "neuroplasticity," the mechanism that affects learning, memory, and thinking. Targeting these areas of the brain, scientists hope to stop or slow the decline in brain plasticity, providing a novel way to treat Alzheimer's. Groundbreaking new research has discovered a new way to preserve the flexibility and resilience of the brain.

The study, led by Tel Aviv University's Prof. Illana Gozes and published in Molecular Psychiatry, reveals a nerve cell protective molecular target that is essential for brain plasticity. According to Prof. Gozes, "This discovery offers the world a new target for drug design and an understanding of mechanisms of cognitive enhancement."

Prof. Gozes is the incumbent of the Lily and Avraham Gildor Chair for the Investigation of Growth Factors and director of the Adams Super Center for Brain Studies at the Sackler Faculty of Medicine and a member of TAU's Sagol School of Neuroscience. Also contributing to the study were Dr. Saar Oz, Oxana Kapitansky, Yanina Ivashco-Pachima, Anna Malishkevich, Dr. Joel Hirsch, Dr. Rina Rosin-Arbersfeld, and their students, all from TAU. TAU staff scientists Dr. Eliezer Gildai and Dr. Leonid Mittelman provided the state-of-the-art molecular cloning and cellular protein imaging necessary for the study.

Building on past breakthroughs

The new finding is based on Prof. Gozes' discovery of NAP, a snippet of a protein essential for brain formation (activity-dependent neuroprotective protein [ADNP]). As a result of this discovery, a drug candidate that showed efficacy in mild cognitive impairment patients, a precursor to Alzheimer's disease, is being developed. NAP protects the brain by stabilizing microtubules — tiny cellular cylinders that provide "railways and scaffolding systems" to move biological material within cells and provide a cellular skeleton. Microtubules are of particular importance to nerve cells, which have long processes and would otherwise collapse. In neurodegenerative diseases like Alzheimer's, the microtubule network falls apart, hindering cellular communication and cognitive function.

"Clinical studies have shown that Davunetide (NAP) protects memory in patients suffering from mild cognitive impairment preceding Alzheimer's disease," said Prof. Gozes. "While the mechanism was understood in broad terms, the precise molecular target remained a mystery for years. Now, in light of our new research, we know why and we know how to proceed."

Stabilizing microtubules

The breakthrough was the discovery of the mechanism promoting microtubule growth at the tips of the tubes ("rails"). The researchers found that the NAP structure allows it to bind to the tip of the growing microtubule, the emerging "railway," through specific microtubule end-binding proteins, which adhere to microtubules a bit like locomotors to provide for growth and forward movement, while the other end of the microtubule may to be disintegrating. These growing tips enlist regulatory proteins that are essential for providing plasticity at the nerve cell connection points, the synapses.

"We have now revealed that ADNP through its NAP motif binds the microtubule end binding proteins and enhances nerve cell plasticity, providing for brain resilience. We then discovered that NAP further enhances ADNP microtubule binding," said Prof. Gozes.

Researchers hope their discovery will help move Davunetide (NAP) and related compounds into further clinical trials, increasing the potential of future clinical use. Prof. Gozes is continuing to investigate microtubule end-binding proteins to better understand their protective properties in the brain.

http://www.eurekalert.org/pub_releases/2014-09/sumc-roc090414.php

Re-analysis of clinical trial data can change conclusions, say Stanford researchers

1/3 of published randomized clinical trials could be re-analyzed in ways that modify the conclusions of how many or what types of patients need to be treated

As many as one-third of previously published randomized clinical trials could be re-analyzed in ways that modify the conclusions of how many or what types of patients need to be treated, according to a new study by researchers at the Stanford University School of Medicine.

A culture that fails to encourage data sharing makes such re-analysis of the data extremely rare, the researchers said. They were able to identify only 37 published re-analyses over more than three decades of research. Of these, only five were conducted by researchers who were not associated with the original studies.

The new study will be published Sept. 9 in the Journal of the American Medical Association.

"There is a real need for researchers to provide access to their raw data for others to analyze," said John Ioannidis, MD, DSc, professor of medicine and director of the Stanford Prevention Research Center. "Without this access, and possibly incentives to perform this work, there is increasing lack of trust in whether the

results of published, randomized trials are credible and can be taken at face value. The recent hot debates about whether oseltamivir works are only the tip of the iceberg in this crisis of confidence."

Oseltamivir is an antiviral medication marketed under the trade name Tamiflu. Although it is licensed to treat influenza A and influenza B, some subsequent analyses and trials conducted after the drug was approved have suggested that its benefits do not outweigh the risks of side effects in otherwise healthy adults.

Ioannidis is the senior author of the study.

Postdoctoral scholar Shanil Ebrahim, PhD, is the lead author. Ioannidis is co-director of the recently launched Meta-Research Innovation Center at Stanford, or METRICS, which aims to advance excellence in scientific research by evaluating and optimizing scientific practices. Enhancing reproducibility and data sharing could be instrumental in this regard.

Ebrahim and his colleagues used the MEDLINE database to conduct their study. MEDLINE is a bibliographic database maintained by the National Library of Medicine. It contains over 25 million citations of biomedical publications from roughly 5,600 journals worldwide. They searched for articles written in English describing the re-analysis of raw data used in previously published studies. Meta-analyses were excluded from the study, as were studies testing a different hypothesis than the original trial.

The researchers screened nearly 3,000 articles of potential interest and read the full text of 226. Of these, 38 were deemed eligible for their study. Two were subsequently excluded because the articles describing the original clinical trials on which they were based were unavailable, and one contained two re-analyses. Of these 37 re-analyses evaluated for the study, 32 had an overlap of at least one author from the original paper.

Thirteen of the re-analyses (35 percent of the total) came to conclusions that differed from those of the original trial with regard to who could benefit from the tested medication or intervention: Three concluded that the patient population to treat should be different than the one recommended by the original study; one concluded that fewer patients should be treated; and the remaining nine indicated that more patients should be treated.

The differences between the original trial studies and the re-analyses often occurred because the researchers conducting the re-analyses used different statistical or analytical methods, ways of defining outcomes or ways of handling missing data. Some re-analyses also identified errors in the original trial publication, such as the inclusion of patients who should have been excluded from the study.

The aims of the re-analyzed studies varied widely. For example, one study on the treatment of enlarged, bleeding veins in the esophagus concluded that sclerotherapy, in which physicians use an endoscope to inject the veins with chemicals to induce blood clots, reduced mortality even though it didn't prevent rebleeding.

The re-analysis, which used a different statistical model of risk, concluded the treatment did prevent rebleeding but didn't reduce mortality. The new conclusion suggested that the intervention would be best given to patients with rebleeding, rather than those at highest risk of death from the condition.

Another study investigated the best way to deliver a medication to stimulate the production of red blood cells in people with anemia by comparing a fixed dose administered once every three weeks with weight-based weekly dosing. In the re-analysis, the conclusion changed when investigators used an updated hemoglobin threshold level to determine when therapy should be initiated.

"The high proportion of re-analyses reaching different conclusions than the original papers may be partly an artifact," said Ioannidis, who is also the C.F. Rehnborg Professor in Disease Prevention.

"By that I mean that, in the current environment, re-analyses that reach exactly the same results as the original would have great difficulty getting published. However, making the raw data of trials available for re-analyses is essential not only for re-evaluating whether the original claims were correct, but also for using these data to perform additional analyses of interest and combined analyses."

In this way, existing raw data could be used to explore new clinical questions, and may sometimes eliminate the need to conduct new trials.

The fact that researchers conducting re-analyses often came to different conclusions doesn't indicate the original studies were necessarily biased or deliberately falsified, Ioannidis added. Instead, it emphasizes the importance of making the original data freely available to other researchers to encourage dialogue and consensus, and to discourage a culture of scientific research that rewards scientists only for novel or unexpected results.

"I am very much in favor of data sharing, and believe there should be incentives for independent researchers to conduct these kinds of re-analyses," said Ioannidis. "They can be extremely insightful."

Other Stanford co-authors of the study are Kristian Thorlund, PhD, and Edward Mills, PhD, visiting associate professors at the Stanford Prevention Research Center.

The research was supported by postdoctoral awards from MITACS Elevate and SickKids Restracomp; the Canadian Institutes of Health Research Canada Chair; and METRICS, which is supported by a grant from the Laura and John Arnold Foundation.

http://www.eurekalert.org/pub_releases/2014-09/ehs-gff090914.php

Growth factors found in breast milk may protect against necrotizing enterocolitis

ErbB4 receptor activation may be a novel therapeutic avenue for intestinal diseases involving epithelial cell death

Philadelphia, PA – Studies suggest that ErbB4 receptor activation may be a novel therapeutic avenue for intestinal diseases involving epithelial cell death, according to research published in The American Journal of Pathology

Necrotizing enterocolitis (NEC) is a devastating gastrointestinal illness affecting up to 10% of premature infants, with a 30% mortality rate, and formula feeding has been identified as a risk factor for NEC.

A study published in The American Journal of Pathology found that growth factors present in human breast milk, but not in formula, may explain the protection against intestinal damage. Further, supplementing the diet of newborn NEC-affected rodents with these growth factors promotes epithelial cell survival.

"NEC is a highly morbid disease that can lead to multiple complications, including intestinal strictures, short gut syndrome, repeated surgeries, and extended hospital stays. Advances in understanding the growth factor signaling cascades that maintain the healthy developing intestine could lead to new methods for treating or preventing this devastating illness," says Mark R. Frey, PhD, The Saban Research Institute of Children's Hospital Los Angeles and the Keck School of Medicine of the University of Southern California.

Driving this research is the quest to understand how human breast milk protects infants from NEC.

Soluble growth factors found in breast milk, such as epidermal growth factor (EGF) and heparin-binding EGF-like growth factor (HB-EGF), are thought to be possible protective molecules. Although both EGF and HB-EGF primarily activate the EGF receptor (EGFR), a member of the ErbB receptor tyrosine kinase family, HB-EGF also activates ErbB4 receptors.

"We have recently demonstrated that NRG4, an ErbB4-specific ligand that does not bind or activate other family members, specifically promotes survival but not migration or proliferation of mouse colon epithelial cells," says Dr. Frey.

Thus, NRG4 is a potentially unique and selective target for new therapies.

Because there is no one experimental model that replicates human NEC, the investigators conducted a series of in vivo and in vitro experiments using different animal models as well as analysis of human breast milk and intestinal tissue.

The results all suggest that NRG4-ErbB4 signaling may play a key role in protecting the developing intestine from inflammatory insults, says Dr. Frey.

Human NEC has been associated with the loss of Paneth cells in the ileum. Paneth cells are found throughout the small intestine and are thought to be important components in the defense of gland stem cells from microbial damage. The investigators showed that NRG4 blocked Paneth cell loss in experimental mouse NEC. "This suggests that protection of Paneth cells or Paneth cell progenitors may be part of the mechanism of protection against NEC," says Dr. Frey, though as yet the mechanisms by which ErbB4 could regulate Paneth cell survival are not well defined.

In final experiments, the researchers analyzed the whey fractions of human milk from six anonymous donors, as well as formula controls, to see whether NRG4 is present normally in breast milk. Western blot analysis showed that all six breast milk specimens were positive for NRG4, whereas NRG4 was not detected in formula control samples. The authors also demonstrated that ErbB4 receptors were present in neonatal human small intestine, including samples from infants who currently have or recently had NEC, supporting a functional role in the intestines.

http://www.medscape.com/viewarticle/831161

Coffee and Type 2 Diabetes -- Drink Up?

The topic: coffee and benefits you need to know about. A

Sandra Adamson Fryhofer, MD

Hello. I'm Dr. Sandra Fryhofer. Welcome to Medicine Matters. The topic: coffee and benefits you need to know about. A new study in the journal *Diabetologia* says your morning cup of joe may stave off type 2 diabetes.[1] Here is why it matters.

First, my disclaimer: I love my morning coffee and that is probably why this new observational study caught my eye. And the study has appeal for both sexes. It combines three large US cohorts: 48,000 women in the Nurses' Health Study (NHS), 47,000 women in NHS II, and 27,000 men in the Health Professionals Follow-up Study. This adds up to more than 1.6 million person-years of follow-up. Dietary assessments were done every four years, including details about coffee and tea intake. Patients were also asked to self-report a diagnosis of type 2 diabetes. More than 7000 of them did.

The results? Coffee lovers, rejoice. The highest coffee consumers had the lowest diabetes risk. Those who drank three or more cups of coffee per day had a 37% lower risk for diabetes as compared to those who limited their intake to one cup per day.

Drinking more may be better. Those who increased their daily coffee intake by one-and-a-half cups had an 11% lower risk of getting diabetes as compared to those who didn't boost their java intake.

If you are worried about getting diabetes, this study suggests that you not cut back on your morning pleasure. Those who cut coffee intake by two cups per day had a 17% higher risk of developing diabetes.

In this study, one cup was just eight ounces of straight-up black, regular, caffeinated coffee -- not decaf and no lattes, no cappuccinos, and not much milk and sugar. Which cuts into my daily routine of adding milk, half low-fat milk (but no added sugar), to boost my daily calcium intake.

So what about tea? In this study, tea intake had no effect on diabetes risk. But also in this study, not that many people drank tea and not that many changed the amount of tea they did drink.

I love the bottom line of this study. Moderate coffee consumption -- that is, up to 6 eight-ounce cups per day -- may help prevent type 2 diabetes. So drink up and enjoy. For Medicine Matters, I'm Dr. Sandra Fryhofer.

[1] *Bhupathiraju SN, Pan A, Manson JE, et al. Changes in coffee intake and subsequent risk of type 2 diabetes: three large cohorts of US men and women. Diabetologia. 2014;57:1346-1354.* Abstract

http://www.eurekalert.org/pub_releases/2014-09/nsfc-nrg091114.php

NASA research gives guideline for future alien life search

Astronomers searching the atmospheres of alien worlds for gases that might be produced by life can't rely on the detection of just one type

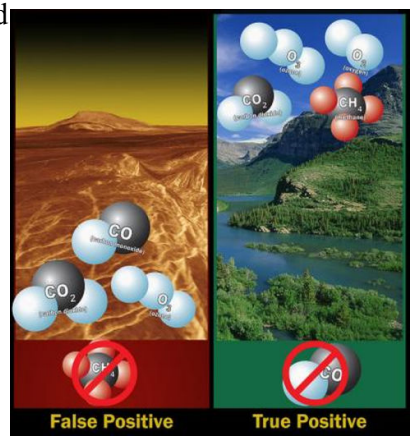
Astronomers searching the atmospheres of alien worlds for gases that might be produced by life can't rely on the detection of just one type, such as oxygen, ozone, or methane, because in some cases these gases can be produced non-biologically, according to extensive simulations by researchers in the NASA Astrobiology Institute's Virtual Planetary Laboratory.

The researchers carefully simulated the atmospheric chemistry of alien worlds devoid of life thousands of times over a period of more than four years, varying the atmospheric compositions and star types. "When we ran these calculations, we found that in some cases, there was a significant amount of ozone that built up in the atmosphere, despite there not being any oxygen flowing into the atmosphere," said Shawn Domagal-Goldman of NASA's Goddard Space Flight Center in Greenbelt, Maryland. "This has important implications for our future plans to look for life beyond Earth."

Methane is a carbon atom bound to four hydrogen atoms. On Earth, much of it is produced biologically (flatulent cows are a classic example), but it can also be made inorganically; for example, volcanoes at the bottom of the ocean can release the gas after it is produced by reactions of rocks with seawater.

Ozone and oxygen were previously thought to be stronger biosignatures on their own. Ozone is three atoms of oxygen bound together. On Earth, it is produced when molecular oxygen (two oxygen atoms) and atomic oxygen (a single oxygen atom) combine, after the atomic oxygen is created by other reactions powered by sunlight or lightning. Life is the dominant source of the molecular oxygen on our planet, as the gas is produced by photosynthesis in plants and microscopic, single-cell organisms. Because life dominates the production of oxygen, and oxygen is needed for ozone, both gases were thought to be relatively strong biosignatures. But this study demonstrated that both molecular oxygen and ozone can be made without life when ultraviolet light breaks apart carbon dioxide (a carbon atom bound to two oxygen atoms). Their research suggests this non-biological process could create enough ozone for it to be detectable across space, so the detection of ozone by itself would not be a definitive sign of life.

"However, our research strengthens the argument that methane and oxygen together, or methane and ozone together, are still strong signatures of life," said Domagal-Goldman. "We tried really, really hard to make false-positive signals for life, and we did find some, but only for oxygen, ozone, or methane by themselves." Domagal-Goldman and Antígona Segura from the Universidad Nacional Autónoma de México in Mexico City are lead authors of a paper about this research, along with astronomer Victoria Meadows, geologist Mark Claire, and Tyler Robison, an expert on what Earth would look like as an extrasolar planet. The paper appeared in the *Astrophysical Journal* Sept. 10, and is available online.



Left: ***Ozone molecules in a planet's atmosphere could indicate biological activity, but ozone, carbon dioxide and carbon monoxide -- without methane, is likely a false positive.*** **Right:** ***Ozone, oxygen, carbon dioxide and methane -- without carbon monoxide, indicate a possible true positive.*** **NASA**

Methane and oxygen molecules together are a reliable sign of biological activity because methane doesn't last long in an atmosphere containing oxygen-bearing molecules. "It's like college students and pizza," says Domagal-Goldman. "If you see pizza in a room, and there are also college students in that room, chances are the pizza was freshly delivered, because the students will quickly eat the pizza. The same goes for methane and oxygen. If both are seen together in an atmosphere, the methane was freshly delivered because the oxygen will be part of a network of reactions that will consume the methane. You know the methane is being replenished. The best way to replenish methane in the presence of oxygen is

with life. The opposite is true, as well. In order to keep the oxygen around in an atmosphere that has a lot of methane, you have to replenish the oxygen, and the best way to do that is with life."

Scientists have used computer models to simulate the atmospheric chemistry on planets beyond our solar system (exoplanets) before, and the team used a similar model in its research. However, the researchers also developed a program to automatically compute the calculations thousands of times, so they could see the results with a wider range of atmospheric compositions and star types.

In doing these simulations, the team made sure they balanced the reactions that could put oxygen molecules in the atmosphere with the reactions that might remove them from the atmosphere. For example, oxygen can react with iron on the surface of a planet to make iron oxides; this is what gives most red rocks their color. A similar process has colored the dust on Mars, giving the Red Planet its distinctive hue. Calculating the appearance of a balanced atmosphere is important because this balance would allow the atmosphere to persist for geological time scales. Given that planetary lifetimes are measured in billions of years, it's unlikely astronomers will happen by chance to be observing a planet during a temporary surge of oxygen or methane lasting just thousands or even millions of years.

It was important to make the calculations for a wide variety of cases, because the non-biological production of oxygen is subject to both the atmospheric and stellar environment of the planet. If there are a lot of gases that consume oxygen, such as methane or hydrogen, then any oxygen or ozone produced will be destroyed in the atmosphere. However, if the amount of oxygen-consuming gases is vanishingly small, the oxygen and the ozone might stick around for a while. Likewise, the production and destruction of oxygen, ozone, and methane is driven by chemical reactions powered by light, making the type of star important to consider as well. Different types of stars produce the majority of their light at specific colors. For example, massive, hot stars or stars with frequent explosive activity produce more ultraviolet light. "If there is more ultraviolet light hitting the atmosphere, it will drive these photochemical reactions more efficiently," said Domagal-Goldman. "More specifically, different colors (or wavelengths) of ultraviolet light can affect oxygen and ozone production and destruction in different ways."

Astronomers detect molecules in exoplanet atmospheres by measuring the colors of light from the star the exoplanet is orbiting. As this light passes through the exoplanet's atmosphere, some of it is absorbed by atmospheric molecules. Different molecules absorb different colors of light, so astronomers use these absorption features as unique "signatures" of the type and quantity of molecules present.

"One of the main challenges in identifying life signatures is to distinguish between the products of life and those compounds generated by geological processes or chemical reactions in the atmosphere. For that we need to understand not only how life may change a planet but how planets work and the characteristics of the stars that host such worlds", said Segura.

The team plans to use this research to make recommendations about the requirements for future space telescopes designed to search exoplanet atmospheres for signs of alien life. "Context is key – we can't just look for oxygen, ozone, or methane alone," says Domagal-Goldman. "To confirm life is making oxygen or ozone, you need to expand your wavelength range to include methane absorption features. Ideally, you'd also measure other gases like carbon dioxide and carbon monoxide [a molecule with one carbon atom and one oxygen atom]. So we're thinking very carefully about the issues that could trip us up and give a false-positive signal, and the good news is by identifying them, we can create a good path to avoid the issues false positives could cause. We now know which measurements we need to make. The next step is figuring out what we need to build and how to build it."

The research was funded in part by the NASA Astrobiology Institute's (NAI) Virtual Planetary Laboratory (VPL). The NAI is administered by NASA's Ames Research Center in Mountain View, California, and funded as part of the NASA Astrobiology Program at NASA Headquarters, Washington. The VPL is based at the University of Washington, and comprises researchers at 20 institutions working to understand how telescopic observations and modeling studies can determine if exoplanets are able to support life, or had life in the past. Additional support for the research was provided by the NASA Postdoctoral Program, managed by Oak Ridge Associated Universities.

The team represented an international collaboration that included researchers from NASA Goddard, NASA Ames, the NAI/VPL, the Instituto de Ciencias Nucleares, Universidad Nacional Autónoma de México, Mexico; the University of St. Andrews, St. Andrews, Scotland; and the University of Washington, Seattle.

The research paper is available online at: http://stacks.iop.org/0004-637X/792/90

http://www.eurekalert.org/pub_releases/2014-09/uoih-cpb091014.php

Compound protects brain cells after traumatic brain injury

Mice treated 24-36 hours after injury were protected from the harmful effects of blast-induced TBI, including problems with learning, memory, and movement

A new class of compounds has now been shown to protect brain cells from the type of damage caused by blast-mediated traumatic brain injury (TBI). Mice that were treated with these compounds 24-36 hours after experiencing TBI from a blast injury were protected from the harmful effects of TBI, including problems with learning, memory, and movement.

Traumatic brain injury caused by blast injury has emerged as a common health problem among U.S. servicemen and women, with an estimated 10 to 20 percent of the more than 2 million U.S. soldiers deployed in Iraq or Afghanistan having experienced TBI. The condition is associated with many neurological complications, including cognitive and motor decline, as well as acquisition of psychiatric symptoms like anxiety and depression, and brain tissue abnormalities that resemble Alzheimer's disease.

"The lack of neuroprotective treatments for traumatic brain injury is a serious problem in our society," says Andrew Pieper, M.D., Ph.D., senior study author and associate professor of psychiatry, neurology, and radiation oncology at the University of Iowa Carver College of Medicine. "Everyone involved in this work is motivated to find a way to offer hope for patients, which today include both military personnel and civilians, by establishing a basis for a new treatment to combat the deleterious neuropsychiatric outcomes after blast injury."

It is known that TBI, as well as certain neurodegenerative diseases, damages axons – the tendril-like fibers that sprout from brains cells (neurons) and form the connections called synapses. In TBI, axon damage is followed by death of the neuron. The new study, published Sept. 11 in the journal Cell Reports, shows that a group of compounds, called the P7C3 series, blocks axon damage and preserves normal brain function following TBI.

Pieper led the team of scientists that discovered the P7C3 compound several years ago at UT Southwestern Medical Center. Subsequent studies showed that the root compound and its active analogs protect newborn neurons from cell death and also protect mature neurons in animal models of neurodegenerative diseases, including Parkinson's disease and amyotrophic lateral sclerosis (ALS).

The researchers have also previously shown efficacy of P7C3 molecules in brain injury due to concussion, and plan to investigate whether these compound might be applicable in stroke as well, given that there appear to be common factors mediating neuronal cell death in these conditions.

By tweaking the structure of the original P7C3 compound, Pieper and his colleagues Joseph Ready, Ph.D., and Steven McKnight, Ph.D., at UT Southwestern Medical Center, have further improved its potency and drug-like properties. In the latest study, Pieper's team at the UI Carver College of Medicine, including co-first authors graduate student Terry Yin, senior technician Jeremy Britt, and graduate student Hector De Jesus-Cortes, tested the neuroprotective effects of the newest version, (-)-P7C3-S243, which can be given orally, in mice with blast-induced TBI.

In the study, blast-induced TBI caused learning, memory, and movement problems in the mice, which resemble the problems experienced by people affected by TBI. The researchers found that (-)-P7C3-S243 prevented acute memory and learning impairment caused by TBI. The compound also prevented TBI-associated balance and coordination problems in mice exposed to blast-injury. By examining the brain tissue at a cellular level, the team also found that the protection afforded to brain functions after injury was matched by preservation of normal neuronal axon structure and synaptic neurotransmission.

Importantly, the compound still produced its protective effects even when treatment was delayed until 24 to 36 hours after the blast injury.

"Seeing protection even when the compound was given this long after injury was important because it represents a liberal window of time within which almost all patients would be expected to be able to access treatment after injury," Pieper says.

The team also found that learning, memory, and coordination problems caused by the TBI persisted in untreated mice at least eight months after the single injury occurred, suggesting that the compound actually prevented these problems rather simply speeding up a normal recovery process.

In a separate study led by Pieper's colleagues McKnight and Ready at UT Southwestern, and also published on Sept. 11 in the journal Cell, the team has identified the biological mechanism by which P7C3 compounds act in the brain. The compounds activate the molecular pathway that preserves neuronal levels of an energy molecule known as nicotinamide adenine dinucleotide (NAD).

"Based on the well-established role of NAD in axonal degeneration, the ability of (-)-P7C3-S243 to protect mice after blast-mediated traumatic brain injury is likely related to preservation of NAD levels," Pieper explains. "Now that we understand the mechanism of action of the P7C3 class of compounds, we can see why they should have therapeutic utility in an unusually broad spectrum of neurodegenerative conditions, without impeding any of a number of other normal forms of cell death.

"Our ultimate goal is to facilitate development of a new class of neuroprotective drugs with wide applicability to treating patients with TBI and other currently untreatable forms of neurodegeneration," he adds.

In addition to Pieper, Yin, Britt, and Jesus-Cortes, the research team included UI researchers from the departments of psychiatry, pediatrics, neurology, and ophthalmology and visual sciences, and from the UI Central Microscopy Facility, as well as researchers from UT Southwestern Medical Center.

The research was funded in part by grants from the National Institutes of Health (MH087986, MH100086-01, NS064159-05); the Department of Veterans Affairs, Veterans Health Administration; and the National Science Foundation.

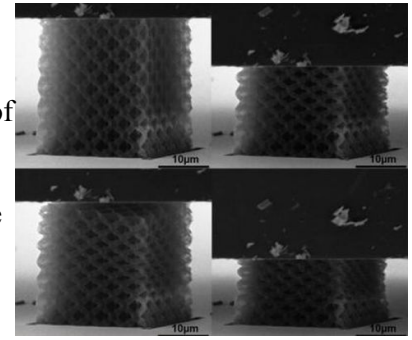
http://www.eurekalert.org/pub_releases/2014-09/ciot-cdh091014.php

Ceramics don't have to be brittle

Caltech materials scientists are creating materials by design

Imagine a balloon that could float without using any lighter-than-air gas. Instead, it could simply have all of its air sucked out while maintaining its filled shape. Such a vacuum balloon, which could help ease the world's current shortage of helium, can only be made if a new material existed that was strong enough to sustain the pressure generated by forcing out all that air while still being lightweight and flexible.

Caltech materials scientist Julia Greer and her colleagues are on the path to developing such a material and many others that possess unheard-of combinations of properties. For example, they might create a material that is thermally insulating but also extremely lightweight, or one that is simultaneously strong, lightweight, and nonbreakable—properties that are generally thought to be mutually exclusive.



This sequence shows how the Greer Lab's three-dimensional, ceramic nanolattices can recover after being compressed by more than 50 percent. Clockwise, from left to right, an alumina nanolattice before compression, during compression, fully compressed, and recovered following compression. **Lucas Meza/Caltech**

Greer's team has developed a method for constructing new structural materials by taking advantage of the unusual properties that solids can have at the nanometer scale, where features are measured in billionths of meters. In a paper published in the September 12 issue of the journal Science, the Caltech researchers explain how they used the method to produce a ceramic (e.g., a piece of chalk or a brick) that contains about 99.9 percent air yet is incredibly strong, and that can recover its original shape after being smashed by more than 50 percent.

"Ceramics have always been thought to be heavy and brittle," says Greer, a professor of materials science and mechanics in the Division of Engineering and Applied Science at Caltech. "We're showing that in fact, they don't have to be either. This very clearly demonstrates that if you use the concept of the nanoscale to create structures and then use those nanostructures like LEGO to construct larger materials, you can obtain nearly any set of properties you want. You can create materials by design."

The researchers use a direct laser writing method called two-photon lithography to "write" a three-dimensional pattern in a polymer by allowing a laser beam to crosslink and harden the polymer wherever it is focused. The parts of the polymer that were exposed to the laser remain intact while the rest is dissolved away, revealing a three-dimensional scaffold. That structure can then be coated with a thin layer of just about any kind of material—a metal, an alloy, a glass, a semiconductor, etc. Then the researchers use another method to etch out the polymer from within the structure, leaving a hollow architecture.

The applications of this technique are practically limitless, Greer says. Since pretty much any material can be deposited on the scaffolds, the method could be particularly useful for applications in optics, energy efficiency, and biomedicine. For example, it could be used to reproduce complex structures such as bone, producing a scaffold out of biocompatible materials on which cells could proliferate.

In the latest work, Greer and her students used the technique to produce what they call three-dimensional nanolattices that are formed by a repeating nanoscale pattern. After the patterning step, they coated the polymer scaffold with a ceramic called alumina (i.e., aluminum oxide), producing hollow-tube alumina structures with walls ranging in thickness from 5 to 60 nanometers and tubes from 450 to 1,380 nanometers in diameter.

Greer's team next wanted to test the mechanical properties of the various nanolattices they created. Using two different devices for poking and prodding materials on the nanoscale, they squished, stretched, and otherwise tried to deform the samples to see how they held up.

They found that the alumina structures with a wall thickness of 50 nanometers and a tube diameter of about 1 micron shattered when compressed. That was not surprising given that ceramics, especially those that are porous, are brittle. However, compressing lattices with a lower ratio of wall thickness to tube diameter—where the wall thickness was only 10 nanometers—produced a very different result.

"You deform it, and all of a sudden, it springs back," Greer says. "In some cases, we were able to deform these samples by as much as 85 percent, and they could still recover."

To understand why, consider that most brittle materials such as ceramics, silicon, and glass shatter because they are filled with flaws—imperfections such as small voids and inclusions. The more perfect the material, the less likely you are to find a weak spot where it will fail. Therefore, the researchers hypothesize, when you reduce these structures down to the point where individual walls are only 10 nanometers thick, both the number of flaws and the size of any flaws are kept to a minimum, making the whole structure much less likely to fail.

"One of the benefits of using nanolattices is that you significantly improve the quality of the material because you're using such small dimensions," Greer says.

"It's basically as close to an ideal material as you can get, and you get the added benefit of needing only a very small amount of material in making them."

The Greer lab is now aggressively pursuing various ways of scaling up the production of these so-called meta-materials.

The lead author on the paper, "Strong, Lightweight and Recoverable Three-Dimensional Ceramic Nanolattices," is Lucas R. Meza, a graduate student in Greer's lab. Satyajit Das, who was a visiting student researcher at Caltech, is also a coauthor. The work was supported by funding from the Defense Advanced Research Projects Agency and the Institute for Collaborative Biotechnologies. Greer is also on the board of directors of the Kavli Nanoscience Institute at Caltech.

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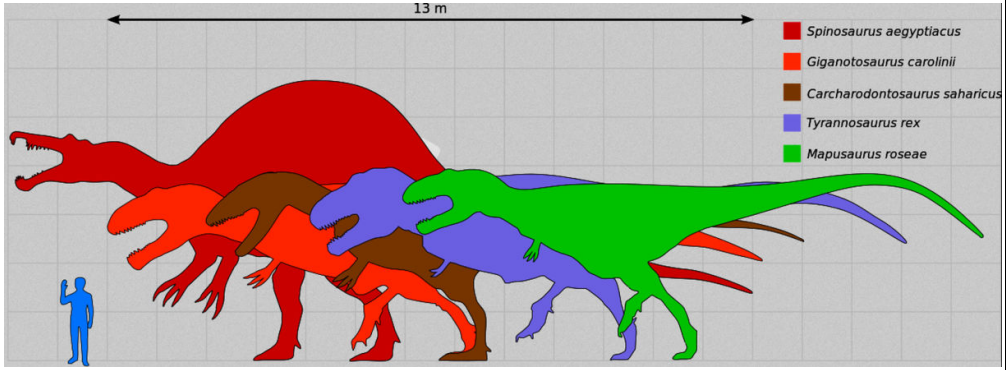
Scientists report first semiaquatic dinosaur, Spinosaurus

Massive predator was more than 9 feet longer than largest Tyrannosaurus rex

WASHINGTON - Scientists today unveiled what appears to be the first truly semiaquatic dinosaur, Spinosaurus aegyptiacus. New fossils of the massive Cretaceous-era predator reveal it adapted to life in the water some 95 million years ago, providing the most compelling evidence to date of a dinosaur able to live and hunt in an aquatic environment. The fossils also indicate that Spinosaurus was the largest known predatory dinosaur to roam the Earth, measuring more than 9 feet longer than the world's largest Tyrannosaurus rex specimen. These findings, published today in the journal Science, are also featured in the October National Geographic magazine cover story available online Sept. 11. In addition, Spinosaurus will be the subject of a new exhibition at the National Geographic Museum, opening Sept. 12, as well as a National Geographic/NOVA special airing on PBS Nov. 5 at 9 p.m.



An international research team — including paleontologists Nizar Ibrahim and Paul Sereno from the University of Chicago; Cristiano Dal Sasso and Simone Maganuco from the Natural History Museum in Milan, Italy; and Samir Zouhri from the Université Hassan II Casablanca in Morocco - found that Spinosaurus developed a variety of previously unknown aquatic adaptations. The researchers came to their conclusions after analyzing new fossils uncovered in the Moroccan Sahara and a partial Spinosaurus skull and other remains housed in museum collections around the world as well as historical records and images from the first reported Spinosaurus discovery in Egypt more than 100 years ago. According to lead author Ibrahim, a 2014 National Geographic Emerging Explorer, "Working on this animal was like studying an alien from outer space; it's unlike any other dinosaur I have ever seen."

The aquatic adaptations of Spinosaurus differ significantly from earlier members of the spinosaurid family that lived on land but were known to eat fish. These adaptations include:

Small nostrils located in the middle of the skull. The small size and placement of the nostrils farther back on the skull allowed Spinosaurus to breathe when part of its head was in water.

Neurovascular openings at the end of the snout. Similar openings on crocodile and alligator snouts contain pressure receptors that enable them to sense movement in water. It's likely these openings served a comparable function in Spinosaurus.

Giant, slanted teeth that interlocked at the front of the snout. The conical shape and location of the teeth were well-suited for catching fish.

A long neck and trunk that shifted the dinosaur's center of mass forward. This made walking on two legs on land nearly impossible, but facilitated movement in water.

Powerful forelimbs with curved, blade-like claws. These claws were ideal for hooking or slicing slippery prey.

A small pelvis and short hind legs with muscular thighs. As in the earliest whales, these adaptations were for paddling in water and differ markedly from other predatory dinosaurs that used two legs to move on land.

Particularly dense bones lacking the marrow cavities typical to predatory dinosaurs. Similar adaptations, which enable buoyancy control, are seen in modern aquatic animals like king penguins.

Strong, long-boned feet and long, flat claws. Unlike other predators, Spinosaurus had feet similar to some shorebirds that stand on or move across soft surfaces rather than perch. In fact, Spinosaurus may have had webbed feet for walking on soft mud or paddling.

Loosely connected bones in the dinosaur's tail. These bones enabled its tail to bend in a wave-like fashion, similar to tails that help propel some bony fish.

Enormous dorsal spines covered in skin that created a gigantic "sail" on the dinosaur's back. The tall, thin, blade-shaped spines were anchored by muscles and composed of dense bone with few blood vessels. This suggests the sail was meant for display and not to trap heat or store fat. The sail would have been visible even when the animal entered the water.

More than a century ago, German paleontologist Ernst Freiherr Stromer von Reichenbach first discovered evidence of Spinosaurus in the Egyptian Sahara. Sadly, all of Stromer's fossils were destroyed during the April 1944 Allied bombing of Munich, Germany. Ibrahim, however, was able to track down Stromer's surviving notes, sketches and photos in archives and at the Stromer family castle in Bavaria to supplement Stromer's surviving publications.

The new Spinosaurus fossils were discovered in the Moroccan Sahara along desert cliffs known as the Kem Kem beds. This area was once a large river system, stretching from present-day Morocco to Egypt. At the time, a variety of aquatic life populated the system, including large sharks, coelacanths, lungfish and crocodile-like creatures, along with giant flying reptiles and predatory dinosaurs.

The most important of the new fossils, a partial skeleton uncovered by a local fossil hunter, was spirited out of the country. As a result, critical information about the context of the find was seemingly lost, and locating the local fossil hunter in Morocco was nearly impossible. Remarked Ibrahim, "It was like searching for a needle in a desert." After an exhaustive search, Ibrahim finally found the man and confirmed the site of his original discovery.

To unlock the mysteries of Spinosaurus, the team created a digital model of the skeleton with funding provided by the National Geographic Society. The researchers CT scanned all of the new fossils, which will be repatriated to Morocco, complementing them with digital recreations of Stromer's specimens. Missing bones were modeled based on known elements of related dinosaurs. According to Maganuco, "We relied upon cutting-edge technology to examine, analyze and piece together a variety of fossils. For a project of this complexity, traditional methods wouldn't have been nearly as accurate."

The researchers then used the digital model to create an anatomically precise, life-size 3-D replica of the Spinosaurus skeleton. After it was mounted, the researchers measured Spinosaurus from head to tail, confirming their calculation that the new skeleton was longer than the largest documented Tyrannosaurus by more than 9 feet. According to Sereno, head of the University of Chicago's Fossil Lab, "What surprised us even more than the dinosaur's size were its unusual proportions. We see limb proportions like this in early whales, not predatory dinosaurs."

Added Dal Sasso, "In the last two decades, several finds demonstrated that certain dinosaurs gave origins to birds. Spinosaurus represents an equally bizarre evolutionary process, revealing that predatory dinosaurs adapted to a semiaquatic life and invaded river systems in Cretaceous North Africa."

Other authors of the Science paper are David Martill, University of Portsmouth, United Kingdom; Matteo Fabbri, University of Bristol, United Kingdom; Nathan Myhrvold, Intellectual Ventures; and Dawid Iurino, Sapienza Università di Roma in Italy. Important contributors to the making of the digital Spinosaurus include Tyler Keillor, Lauren Conroy and Erin Fitzgerald of the Fossil Lab at the University of Chicago.

http://www.eurekalert.org/pub_releases/2014-09/ez-ndm091114.php

New defense mechanism against viruses discovered

When it comes to defence against viruses, the immune system has an arsenal of weapons at its disposal including killer cells, antibodies and messenger molecules, to name just a few.

When a pathogen attacks the body, the immune system usually activates the appropriate mechanisms. However, some of the mechanisms do not have to be triggered; they are continuously active as a standing army. Researchers from ETH Zurich, in collaboration with scientists from the University of Bern, have now discovered a new form of this so-called innate immune defence. They have shown that it acts against particular viruses with a genome in the form of single-stranded, positive-sense RNA. Many known pathogens, such as hepatitis C, tick-borne encephalitis, polio, SARS, yellow fever and dengue fever viruses belong to this group, as well as potyviruses, a group of plant viruses that can cause severe damage to economically important crops.

Researchers led by Ari Helenius, Professor of Biochemistry at ETH Zurich, discovered the mechanism during their research with human cells in cell culture and a model virus that is frequently used in basic research, the Semliki Forest virus. In an extensive screening process, the scientists turned off individual genes inside host cells; they discovered that the cells were more susceptible to infection by the virus if the genes of a cellular quality control and regulatory system for RNA, known as NMD (nonsense-mediated mRNA decay), were turned off.

Viruses identified as incorrect cellular RNA

In a parallel large-scale screening effort, Olivier Voinnet, Professor of RNA Biology at ETH Zurich, and his colleagues realised that this mechanism is also acting against viruses in plants. They used the model plant Arabidopsis thaliana and potato virus X for their investigation. Helenius and Voinnet's groups have published their two research papers on human cells and plants in the latest edition of the journal *Cell Host & Microbe* – the former in collaboration with the group of Oliver Mühlemann, a professor at the University of Bern, who has dealt intensively with the NMD system in recent years.

The NMD system has been known for some time in biology as a quality control and regulatory mechanism that eliminates incorrectly fabricated and non-functional messenger RNA molecules in cells. However, the new studies show that this system also serves a second function: It ensures that the genome of certain RNA viruses is broken down, thereby preventing them from replicating in host cells. "The RNA genome of these viruses bears certain similarities to

incorrect messenger RNA molecules in human, animal and plant cells and is identified as such by the NMD system," explains Giuseppe Balistreri, post-doctoral fellow and lead author of one of the two studies.

Oldest defence mechanism

The researchers believe that the NMD system provides a first line of defence against infection by this class of viruses. "The mechanism attacks the viral genome directly before it can multiply in the host cell," say both Helenius and Voinnet. The ETH scientists also believe that this is one of the oldest defence mechanisms against viruses in evolutionary history, as the NMD system is so fundamental that it is found in all higher organisms; i.e. people, animals, plants and fungi.

However, the mechanism is not 100 per cent efficient. "If it were, then RNA viruses wouldn't exist at all," says Helenius. Instead, the viruses have evolved ways to avoid or actively suppress the NMD system, as both ETH research groups suggest in their respective studies. "Viruses and their hosts are engaged in an endless battle, of which the NMD system is a previously unsuspected yet significant component," says Voinnet. "In this battle, the NMD mechanism likely contributed to shape the genomes of RNA viruses as we see them today."

NCCR RNA & Disease

The two research projects were carried out within the National Centre for Competence in Research (NCCR) RNA & Disease. Sixteen research groups from five Swiss universities are working together in this focus area of the Swiss National Science Foundation. They are studying the role of RNA biology in diseases. The University of Bern is the NCCR's leading house and ETH Zurich is the co-leading house.

Balistreri G, Horvath P, Schweingruber C, Zünd D, McInerney G, Merits A, Mühlemann O, Azzalin C, Helenius A: The Host Nonsense-Mediated mRNA Decay Pathway Restrics Mammalian RNA Virus Replication. Cell Host & Microbe 2014, 16: 403-411, doi: 10.1016/j.chom.2014.08.007 [http://dx.doi.org/10.1016/j.chom.2014.08.007]

Garcia D, Garcia S, Voinnet O: Nonsense-Mediated Decay Serves as a General Virus Restriction Mechanism in Plants. Cell Host & Microbe, Online publication 21 August 2014, doi: 10.1016/j.chom.2014.08.001 [http://dx.doi.org/10.1016/j.chom.2014.08.001]

http://bit.ly/1m53PT0

Caffeine is so essential that the ability to produce it evolved twice

Coffee has lots of genes for making caffeine and other flavorful chemicals.

by Diana Gitig - Sept 11 2014, 11:55pm TST

The grand accomplishments of our genomic age—which are reliant to a large extent on unheralded, bleary-eyed graduate students staring at seemingly infinite bytes of data on their screens for hours on end—might never have come to pass were it not for the copious amounts of coffee fueling said students. So it's only fitting that some of them have now analyzed the genome of the coffee plant itself. An international team of researchers spanning both coffee growing and coffee consuming regions of the globe sequenced Coffea canephora, one of the parent strains of the heavily cultivated C. arabica. They found that the plant has extra copies of genes called N-methyltransferases (NMTs), which encode a class of enzymes that mediates the late steps in caffeine biosynthesis.

Coffee has a total of 23 NMT genes, which arose primarily via a series of gene duplication events. The collection of duplicated genes is distinct from the ones found in tea and cacao, two other caffeine-producing plants that are more closely related to each other. That suggests that these two lineages evolved the ability to give humans a jolt separately.

Coffee's NMTs also exhibited evidence of positive evolutionary selection, indicating that caffeine biosynthesis may serve an adaptive purpose only in coffee. The function of its convergent evolution in the other drinks was not explored.

The coffee plant is also enriched in a class of enzymes that makes linoleic acid, a polyunsaturated fatty acid that contributes to the aroma and flavor retention of coffee beans after roasting. There are also a lot of genes involved in secondary metabolites other than caffeine, like flavonoids, isoflavones, and alkaloids, including quinine. The quinine might explain the unfortunate inspiration for the coffee tonic.

Science, 2014. DOI: 10.1126/science.1255274.

http://bit.ly/1m7zcMs

Graphene Paint Makes Impermeable and Chemically Resistant Coatings

A thin layer of graphene paint can make impermeable and chemically resistant coatings

New research from the University of Manchester demonstrates how a thin layer of graphene paint can make impermeable and chemically resistant coatings, which could be used for packaging to keep food fresh for longer and protect metal structures against corrosion.

Photograph demonstrating water permeation through a brick (~20 cm long) with and without VC-RGO coating. Brick without the graphitic coating rapidly absorbs water but it can stay on top of the VC-RGO coated part for many hours. **Y. Su, et al. doi:10.1038/ncomms5843**

The surface of graphene, a one atom thick sheet of carbon, can be randomly decorated with oxygen to create graphene oxide; a form of graphene that could have a significant impact on the chemical, pharmaceutical and electronic industries. Applied as paint, it could provide an ultra-strong, non-corrosive coating for a wide range of industrial applications.

Graphene oxide solutions can be used to paint various surfaces ranging from glass to metals to even conventional bricks. After a simple chemical treatment, the resulting coatings behave like graphite in terms of chemical and thermal stability but become mechanically nearly as tough as graphene, the strongest material known to man.

The team led by Dr Rahul Nair and Nobel laureate Sir Andre Geim demonstrated previously that multilayer films made from graphene oxide are vacuum tight under dry conditions but, if expose to water or its vapor, act as molecular sieves allowing passage of small molecules below a certain size. Those findings could have huge implications for water purification.

This contrasting property is due to the structure of graphene oxide films that consist of millions of small flakes stacked randomly on top of each other but leave nano-sized capillaries between them. Water molecules like to be inside these nanocapillaries and can drag small atoms and molecules along.

In an article published in Nature Communications this week, the University of Manchester team shows that it is possible to tightly close those nanocapillaries using simple chemical treatments, which makes graphene films even stronger mechanically as well as completely impermeable to everything: gases, liquids or strong chemicals. For example, the researchers demonstrate that glassware or copper plates covered with graphene paint can be used as containers for strongly corrosive acids.

The exceptional barrier properties of graphene paint have already attracted interest from many companies who now collaborate with The University of Manchester on development of new protective and anticorrosion coatings.

Dr Nair said "Graphene paint has a good chance to become a truly revolutionary product for industries that deal with any kind of protection either from air, weather elements or corrosive chemicals. Those include, for example, medical, electronics and nuclear industry or even shipbuilding, to name but the few."

Dr Yang Su, the first author in this work added: "Graphene paint can be applied to practically any material, independently of whether it's plastic, metal or even sand. For example, plastic films coated with graphene could be of interest for medical packaging to improve shelf life because they are less permeable to air and water vapor than conventional coatings. In addition, thin layers of graphene paint are optically transparent."

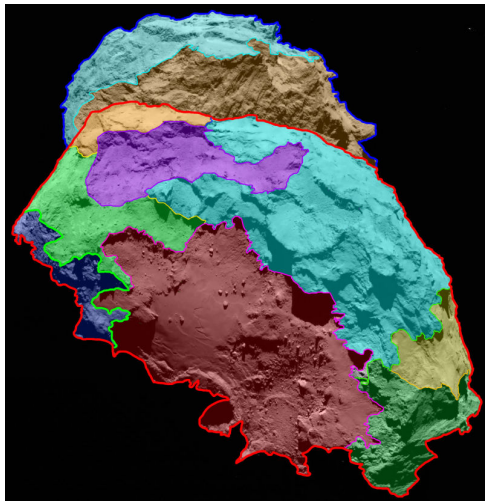
Publication: Y. Su, et al., "Impermeable barrier films and protective coatings based on reduced graphene oxide," Nature Communications 5, Article number: 4843; doi:10.1038/ncomms5843

PDF Copy of the Study: Impermeable Barrier Films and Protective Coatings Based on Reduced Graphene Oxide

http://bit.ly/1m7zQcM

High-Resolution Images Reveal Surface of Comet 67P/Churyumov-Gerasimenko

High-Resolution images taken by OSIRIS reveal a detailed scientific description of the surface of comet 67P/Churyumov-Gerasimenko.



High-resolution images of comet 67P/Churyumov-Gerasimenko reveal a unique, multifaceted world. ESA's Rosetta spacecraft arrived at its destination about a month ago and is currently accompanying the comet as it progresses on its route toward the inner solar system. Scientists have now analyzed images of the comet's surface taken by OSIRIS, Rosetta's scientific imaging system, and allocated several distinct regions, each of which is defined by special morphological characteristics. This analysis provides the basis for a detailed scientific description of 67P's surface.

In this view of the "belly" and part of the "head" of the comet, several morphologically different regions are indicated. **ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA**

"Never before have we seen a cometary surface in such detail", says OSIRIS Principal Investigator Holger Sierks from the Max Planck Institute for Solar System Science in Germany. In some of the images, one pixel corresponds to 75 centimeters scale on the nucleus. "It is a historic moment, we have an unprecedented resolution to map a comet," he adds.

With areas dominated by cliffs, depressions, craters, boulders or even parallel grooves, 67P displays a multitude of different terrains. While some of these areas appear to be quiet, others seem to be shaped by the comet's activity. As OSIRIS images of the comet's coma indicate, the dust that 67P casts into space is emitted there.

"This first map is, of course, only the beginning of our work," says Sierks. "At this point, nobody truely understands, how the morphological variations we are currently witnessing came to be." As both 67P and Rosetta travel closer to the Sun in the next months, the OSIRIS team will monitor the surface looking for changes. While the scientists do not expect the borderlines of the comet's regions to vary dramatically, even subtle transformations of the surface may help to explain how cometary activity created such a breathtaking world. The maps will also offer valuable insights for Rosetta's Lander Team and the Rosetta orbiter scientists to determine a primary and backup landing site from the earlier preselection of five candidates.

Source: Max Planck Institute

Images: ESA/Rosetta/MPS for OSIRIS Team PS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

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Vaginal Microbe Yields Novel Antibiotic

A new drug is one of thousands of drug-like molecules that may be produced by our microbiome

Sep 11, 2014 |By Erika Check Hayden and Nature magazine

Bacteria living on human bodies contain genes that are likely to code for a vast number of drug-like molecules — including a new antibiotic made by bacteria that live in the vagina, researchers report in this week's issue of Cell.

The drug, lactocillin, hints at the untapped medical potential of this microbial landscape.

"They have shown that there is a huge diverse potential of the microbiome for producing antimicrobial molecules," says Marc Ouellette, a microbiologist at the University of Laval's Hospital Centre (CHUL) in Quebec, Canada, who was not involved in the research.

Studies have suggested that the composition of our microbiomes — the whole suite of bacteria living on our bodies — has huge impacts on our health, but it has been difficult to show exactly how this works.

Michael Fischbach, a microbiologist and chemist at the University of California, San Francisco, led a team that aimed to fill in those blanks.

The researchers built a machine-learning algorithm, training a computer program to recognize genes that are already known to make small molecules that could act as drugs. Then they asked the program to hunt for similar genes in the human microbiome.

The search yielded thousands of these drug-making genes within microbes living on and in the body. Some are similar to drugs being tested in clinical trials, such as a class of antibiotics called thiopeptides.

"We used to think that drugs were discovered by drug companies and prescribed by a physician and then they get to you," Fischbach says. "What we've found here is that bacteria that live on and inside of humans are doing an end-run around that process; they make drugs right on your body."

Fischbach's team then purified one of these: a thiopeptide made by a bacterium that normally lives in the human vagina. The researchers found that the drug could kill the same types of bacteria as other thiopeptides — for instance, Staphylococcus aureus, which can cause skin infections.

The scientists did not actually show that the human vaginal bacteria make the drug on the body, but they did show that when they grew the bacteria, it made the antibiotic.

Big data boost

Finding specific molecules like these and studying what they do will help researchers to understand how the microbiome interacts with our bodies, says microbial genomicist Derrick Fouts of the J. Craig Venter Institute in Rockville, Maryland.

"This is a great example of the power of bioinformatics to not merely identify genes of interest from 'big data' 'omics, but to connect together cassettes of genes to increase our fundamental understanding of how commensal bacteria maintain a healthy human microbiome," Fouts says.

Other researchers say that the paper also demonstrates how the microbiome might be mined for new drugs.

Scientists have long argued that the suite of microbes living on human bodies could be a rich source of such drugs, and many drug companies are trying to capitalize on that idea; Fischbach advises two of them.

"To my knowledge, this is the first work that isolates new compounds with strong drug potential from the human microbiome," says Rob Knight, a microbial ecologist at the University of Colorado, Boulder. "This work provides an exciting platform for mining our microbiomes for new compounds of medical interest."

A similar drug is in development at Novartis, but Fischbach doesn't plan to develop the antibiotic that he has discovered into a drug.

Instead, he wants to find novel types of molecule that are made by the microbiome. Studying these molecules might help researchers to understand how the microbiome influences our susceptibility to disease, he says.

"People are eager to learn what exactly helpful bacteria are doing," Fischbach says. "Nobody had anticipated that they have the capability to make so many different kinds of drugs. I don't think this is the only thing they do, but it's a big thing."

http://bit.ly/1D9OfKX

Woman of 24 found to have no cerebellum in her brain

DON'T mind the gap. A woman has reached the age of 24 without anyone realising she was missing a large part of her brain. The case highlights just how adaptable the organ is.

10 September 2014 by Helen Thomson

The discovery was made when the woman was admitted to the Chinese PLA General Hospital of Jinan Military Area Command in Shandong Province complaining of dizziness and nausea. She told doctors she'd had problems walking steadily for most of her life, and her mother reported that she hadn't walked until she was 7 and that her speech only became intelligible at the age of 6.

Doctors did a CAT scan and immediately identified the source of the problem – her entire cerebellum was missing (see scan, below left). The space where it should be was empty of tissue. Instead it was filled with cerebrospinal fluid, which cushions the brain and provides defence against disease.

A hole at the back (top) where the cerebellum should be **(Top image: Feng Yu et al.; Bottom image: Zephyr/Science Photo Library)**

The cerebellum – sometimes known as the "little brain" – is located underneath the two hemispheres. It looks different from the rest of the brain because it consists of much smaller and more compact folds of tissue. It represents about 10 per cent of the brain's total volume but contains 50 per cent of its neurons.

Although it is not unheard of to have part of your brain missing, either congenitally or from surgery, the woman joins an elite club of just nine people who are known to have lived without their entire cerebellum. A detailed description of how the disorder affects a living adult is almost non-existent, say doctors from the Chinese hospital, because most people with the condition die at a young age and the problem is only discovered on autopsy (Brain, doi.org/vh7).

The cerebellum's main job is to control voluntary movements and balance, and it is also thought to be involved in our ability to learn specific motor actions and speak. Problems in the cerebellum can lead to severe mental impairment, movement disorders, epilepsy or a potentially fatal build-up of fluid in the brain.

However, in this woman, the missing cerebellum resulted in only mild to moderate motor deficiency, and mild speech problems such as slightly slurred pronunciation. Her doctors describe these effects as "less than would be expected", and say her case highlights the remarkable plasticity of the brain.

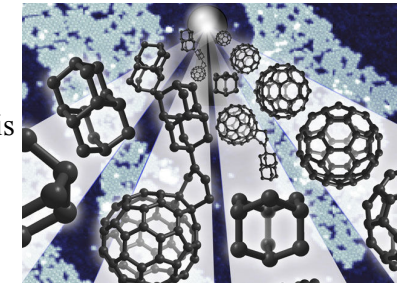
"These rare cases are interesting to understand how the brain circuitry works and compensates for missing parts," says Mario Manto, who researches cerebellar disorders at the Free University of Brussels in Belgium. The patient's doctors suggest that normal cerebellar function may have been taken over by the cortex – brain scans should reveal the answer.

http://bit.ly/YKF04v

Is the "Buckydiamondoid" the Future of Molecular Electronics?

What happens when you combine a buckyball with a diamondoid?

By Dexter Johnson



As it turns out something wonderful for the prospects of molecular electronics. In fact, you get a new kind of material that conducts electricity in just one direction.

This conducting of electricity in one direction is the role of rectifiers, which take the form of diodes in computer chips. By shrinking these diodes down to the size of a nanoparticle it could shrink chip size while making devices faster and more powerful.

Illustration: Manoharan Lab/Stanford University

In research published in the journal Nature Communications, an international team of scientists Catholic University of Louvain in Belgium, Kiev Polytechnic Institute in Ukraine and Justus-Liebig University in Germany built on research conducted at the Department of Energy's SLAC National Accelerator Laboratory back in 2007, which demonstrated that a single layer of diamondoids on a metal surface can efficiently emit a beam of electrons. Diamondoids are molecules found in petroleum that have the basic chemical structure of diamonds, but are coated on the outside in hydrogen molecules.

From that seven-year-old experiment, Hari Manoharan of the Stanford Institute for Materials and Energy Sciences (SIMES) at the Department of Energy's SLAC National Accelerator Laboratory, and his team wondered what would happen if they combined the diamondoid with another particle that could grab the electrons. They knew that buckyballs, which are hollow carbon spheres, had that capability.

"We wanted to see what new, emergent properties might come out when you put these two ingredients together to create a 'buckydiamondoid,'" said Manoharan in news release. "What we got was a basically a one-way valve for conducting electricity — clearly more than the sum of its parts."

The researchers discovered that the buckyball and diamonoid hybrid, dubbed a 'buckydiamonoid', allowed electrical current to flow through it up to 50 times stronger in one direction, from electron-spitting diamondoid to electron-catching buckyball, than in the opposite direction.

Although this is not the first molecule-size rectifier ever developed, it does mark the first time one has been constructed solely from carbon and hydrogen. The researchers are going to see if they can make the transistors from the same two materials.

"Buckyballs are easy to make — they can be isolated from soot — and the type of diamondoid we used here, which consists of two tiny cages, can be purchased commercially," said Manoharan. "And now that our colleagues in Germany have figured out how to bind them together, others can follow the recipe. So while our research was aimed at gaining fundamental insights about a novel hybrid molecule, it could lead to advances that help make molecular electronics a reality."

http://www.eurekalert.org/pub_releases/2014-09/waeh-nib091114.php

No innocent bystander: Cartilage contributes to arthritis

Melbourne researchers have discovered that cartilage plays an active role in the destruction and remodelling of joints seen in rheumatoid arthritis, rather than being an 'innocent bystander' as previously thought.

Dr Tommy Liu, Professor Ian Wicks, Dr Kate Lawler, Dr Ben Croker and colleagues from the Walter and Eliza Hall Institute made the discovery while investigating the role of the protein SOCS3 in controlling inflammation during rheumatoid arthritis. The study was published in the journal Arthritis and Rheumatology.

Rheumatoid arthritis affects more than 400,000 Australians, causing chronic pain and inflammation in joints such as those in the hands and feet, as well as knees and hips. Over time, rheumatoid arthritis can destroy the cartilage that lubricates and cushions the joints, while bones can be remodelled, leading to disfigurement, pain and reduced mobility.

Dr Liu said cartilage was previously thought to be a victim of an overzealous immune system rather than playing an active role in rheumatoid arthritis.

"Autoimmune diseases such as rheumatoid arthritis are the result of the immune system wrongly attacking normal, healthy tissue," he said. "Our study has shown for the first time that cartilage participates in the production of inflammation-signalling chemicals and contributes to its own destruction."

The study investigated how the molecules – known as suppressors of cytokine signalling (SOCS) molecules – that control the flow of chemical messages within and between cells regulate inflammation in rheumatoid arthritis. When the researchers created a model that lacked SOCS3 molecules in the cartilage, they found that tissue degradation increased.

"Without SOCS3, cartilage cells produced enzymes that drove tissue degradation and increased inflammation by releasing signalling molecules that triggered an increased autoimmune response," Dr Liu said. "We also found that cartilage could produce a protein called RANKL that triggers bone remodelling.

"These results show that cartilage is not an innocent bystander that gets damaged as a result of rheumatoid arthritis, but instead plays an active role in disease progression."

There is no cure for rheumatoid arthritis, and few treatments are effective in slowing the onset of the disease. "Targeting the action of these inflammatory chemical messages could boost the efficacy of current treatments," Dr Liu said.

The research was funded by the Reid Charitable Trusts, the Arthritis Foundation of Australia, the Australian National Health and Medical Research Council and the Victorian Government.

http://nyti.ms/1wlztMD

Ebola Cases Rise Rapidly in Congo

Ebola cases in the Democratic Republic of Congo doubled over the past week

By RICK GLADSTONESEPT. 11, 2014

The number of Ebola cases in the Democratic Republic of Congo doubled over the past week to 62, the World Health Organization reported Thursday, and more than half the afflicted patients have died.

The outbreak in the country, where the Ebola virus was first discovered nearly 40 years ago, is a distinct strain from the far more drastic Ebola crisis ravaging West Africa, where more than 2,200 people have died this year, the worst on record.

The Congo outbreak, by contrast, is confined to four villages in one county, and is linked to one initial case, first reported to the health organization on Aug. 26.

Still, the doubling of Congo cases during the week ending Tuesday, reported by the W.H.O. in an update on its website, reflected Ebola's contagious risks. The virus, which causes high fevers, vomiting, diarrhea and internal bleeding, with a fatality rate as high as 90 percent, is spread through person-to-person contact.

Thirty-five of the Congo patients have died, the W.H.O. said, including seven health care workers. Isolation facilities have been established in the four affected villages, the W.H.O. said, and international experts assisting local health officials have identified 386 people who may have been exposed.

The International Monetary Fund said Thursday that economic growth in Liberia and Sierra Leone, two of the three West African countries hit hardest by the outbreak, could decline by as much as 3.5 percentage points because of disruptions to the mining, agriculture and service industries. Economic growth in

Guinea, the third worst-afflicted country, where mining businesses have yet to be affected, could fall by 1.5 percentage points, the I.M.F. said.

In Nigeria, Africa's most populous country, where health officials have confirmed 19 Ebola cases, a South African woman in transit at Lagos airport on her way home from Morocco had been sent to a testing center as a suspected Ebola patient, according to Reuters. The woman, who was not identified, had visited Sierra Leone and Guinea.

http://www.eurekalert.org/pub_releases/2014-09/ru-awh091214.php

A wife's happiness is more crucial than her husband's in keeping marriage on track

Rutgers research offers insight into link between marital quality and well-being later in life

When it comes to a happy marriage, a new Rutgers study finds that the more content the wife is with the long-term union, the happier the husband is with his life no matter how he feels about their nuptials.

"I think it comes down to the fact that when a wife is satisfied with the marriage she tends to do a lot more for her husband, which has a positive effect on his life," said Deborah Carr, a professor in the Department of Sociology, School of Arts and Science.

"Men tend to be less vocal about their relationships and their level of marital unhappiness might not be translated to their wives."

Carr and Vicki Freedman, a research professor at the University of Michigan Institute for Social Research, co-authored a research study published in the October issue of the Journal of Marriage and Family on marital quality and happiness among older adults.

The study, done by the two Big Ten universities, differs from previous research, according to Carr, because it examines the personal feelings of both spouses to determine how these marital appraisals influence the psychological well-being of older adults. Researchers analyzed data of 394 couples who were part of a national study of income, health and disability in 2009. At least one of the spouses was 60 or older and on average, couples were married for 39 years.

In order to assess marital quality, those involved in the study were asked several questions, such as whether their spouse appreciates them, argues with them, understands their feelings or gets on their nerves. They were also asked to keep detailed diaries about how happy they were in the previous 24 hours doing selected activities like shopping, doing household chores and watching television.

Those involved in the study, on average, rated their general life satisfaction high, typically five out of six points – with husbands rating their marriage slightly more positive than their wives. "For both spouses being in a better-rated marriage was linked to greater life satisfaction and happiness," Carr said.

Still, she said, the study also found that while wives became less happy if their spouses became ill, the husbands' happiness level didn't change or reflect the same outcome if their wives got sick.

"We know that when a partner is sick it is the wife that often does the caregiving which can be a stressful experience," said Carr. "But often when a women gets sick it is not her husband she relies on but her daughter."

The study is important, the researchers said, because the quality of a marriage can affect the health and well-being of older individuals as they continue to age.

"The quality of a marriage is important because it provides a buffer against the health-depleting effects of later life stressors and helps couples manage difficult decisions regarding health and medical decision making," Carr said.

http://bit.ly/1m5eNbg

Researchers Reset Human Pluripotent Stem Cells to a Fully Pristine State

A newly published study details how scientists were able to successfully 'reset' human pluripotent stem cells to a fully pristine state.

Researchers at EMBL-EBI have resolved a long-standing challenge in stem cell biology by successfully 'resetting' human pluripotent stem cells to a fully pristine state, at the point of their greatest developmental potential. The study, published in Cell, involved scientists from the UK, Germany and Japan and was led jointly by EMBL-EBI and the University of Cambridge.

Embryonic stem (ES) cells, which originate in early development, are capable of differentiating into any type of cell. Until now, scientists have only been able to revert 'adult' human cells (for example, liver, lung or skin) into pluripotent stem cells with slightly different properties that predispose them to becoming cells of certain types. Authentic ES cells have only been derived from mice and rats.

"Reverting mouse cells to a completely 'blank slate' has become routine, but generating equivalent naïve human cell lines has proven far more challenging," says Dr Paul Bertone, Research Group Leader at EMBL-EBI and a senior author on the study.

"Human pluripotent cells resemble a cell type that appears slightly later in mammalian development, after the embryo has implanted in the uterus."

At this point, subtle changes in gene expression begin to influence the cells, which are then considered 'primed' towards a particular lineage. Although pluripotent human cells can be cultured from in vitro fertilized (IVF) embryos, until now there have been no human cells comparable to those obtained from the mouse.

Wiping cell memory

"For years, it was thought that we could be missing the developmental window when naïve human cells could be captured, or that the right growth conditions hadn't been found," Paul explains. "But with the advent of iPS cell technologies, it should have been possible to drive specialized human cells back to an earlier state, regardless of their origin – if that state existed in primates."

Taking a new approach, the scientists used reprogramming methods to express two different genes, NANOG and KLF2, which reset the cells. They then maintained the cells indefinitely by inhibiting specific biological pathways. The resulting cells are capable of differentiating into any adult cell type, and are genetically normal.

The experimental work was conducted hand-in-hand with computational analysis. "We needed to understand where these cells lie in the spectrum of the human and mouse pluripotent cells that have already been produced," explains Paul. "We worked with the EMBL Genomics Core Facility to produce comprehensive transcriptional data for all the conditions we explored. We could then compare reset human cells to genuine mouse ES cells, and indeed we found they shared many similarities."

Together with Professor Wolf Reik at the Babraham Institute, the researchers also showed that DNA methylation (biochemical marks that influence gene expression) was erased over much of the genome, indicating that reset cells are not restricted in the cell types they can produce. In this more permissive state, the cells no longer retain the memory of their previous lineages and revert to a blank slate with unrestricted potential to become any adult cell.

Unlocking the potential of stem cell therapies

The research was performed in collaboration with Professor Austin Smith, Director of the Wellcome Trust-Medical Research Council Stem Cell Institute. "Our findings suggest that it is possible to rewind the clock to achieve true ground-state pluripotency in human cells," said Professor Smith. "These cells may represent the real starting point for formation of tissues in the human embryo. We hope that in time they will allow us to unlock the fundamental biology of early development, which is impossible to study directly in people."

The discovery paves the way for the production of superior patient material for translational medicine. Reset cells mark a significant advance for human stem cell applications, such as drug screening of patient-specific cells, and are expected to provide reliable sources of specialized cell types for regenerative tissue grafts.

Publication: Yasuhiro Takashima, et al., "Resetting Transcription Factor Control Circuitry toward Ground-State Pluripotency in Human," Cell, 2014; 158 (6): 1254; doi:10.1016/j.cell.2014.08.029 Source: EMBL-EBI

http://bit.ly/1pgjIk4

Scientific Misconduct Should Be a Crime

It's as bad as fraud or theft, only potentially more dangerous.

By Rachel Nuwer

Richard Smith edited the BMJ from 1991 to 2004. He is a founding member of the Committee on Publication Ethics, a former trustee of the U.K. Research Integrity Office and author of The Trouble with Medical Journals. Research misconduct degrades trust in science and causes real-world harm. As such, Smith says, it should be a crime akin to fraud.

Why should research misconduct be illegal?

After 30 years of observing how science deals with the problem, I have sadly come to the conclusion that it should be a crime, for three main reasons. First, in a lot of cases, people have been given substantial grants to do honest research, so it really is no different from financial fraud or theft. Second, we have a whole criminal justice system that is in the business of gathering and weighing evidence—which universities and other employers of researchers are not very good at. And finally, science itself has failed to deal adequately with research misconduct.

A clear example of the harm of scientific misconduct is the infamous MMR-vaccine paper by Andrew Wakefield (above) that was published in The Lancet.

MacGregor/Reuters

How can we recognize honest mistakes?

It's quite difficult. Clearly not every minor misconduct should be regarded as a crime. And, as with all laws, it will take time to establish what merits prosecution and what can be dealt with by a reprimand. But we know peer review doesn't detect all misconduct. If research seems wrong or impossible, we start with the assumption that it's just an honest mistake and then look into it. You can sometimes detect fraud statistically, because if you invent data you tend to come up with a recurrent pattern. But in most cases, it is detected because somebody blows a whistle.

Are there cases in which you think researchers should have been prosecuted?

There are cases where someone demonstrated intent, not simply made a horrible mistake. For example, I was involved in the case of a researcher named Malcolm Pearce, who published two papers in the *British Journal of Obstetrics and Gynaecology*. One was a case report of successfully re-implanting an ectopic

pregnancy into a patient's womb and another was a randomised trial about treating recurrent miscarriage. It turned out the case study patient did not exist, and there was also no record that he had actually conducted this randomised trial. Those aren't honest errors. The facts speak for themselves.

Does scientific misconduct often cause real social harm?

To begin with, there is the loss of confidence in science. But another example of clear, obvious harm is the infamous MMR-vaccine paper by Andrew Wakefield that was published in The Lancet. It suggested that the vaccine was a cause of autism, and that idea absolutely took off, causing dramatic drops in childhood vaccinations. This in turn caused outbreaks of diseases such as measles. Eventually, when claims in the paper were proven to be false, The Lancet retracted it.

These types of things often ruin researchers' careers. Is that punishment enough? There are many examples in which researchers have simply carried on with their careers. I believe scientists should be held to a higher standard. Those who commit research misconduct cannot be trusted. It's too easy to be tempted into ignoring or destroying data that undermines your work. It may seem an inhuman way to be, but a true scientist is delighted when his or her favorite hypothesis is destroyed by good data.

http://www.wired.com/2014/09/r0-ebola/

The Mathematics of Ebola Trigger Stark Warnings: Act Now or Regret It

This now truly is a type of epidemic that the world has never seen before

By Maryn McKenna

The Ebola epidemic in Africa has continued to expand since I last wrote about it, and as of a week ago, has accounted for more than 4,200 cases and 2,200 deaths in five countries: Guinea, Liberia, Nigeria, Senegal and Sierra Leone. That is extraordinary: Since the virus was discovered, no Ebola outbreak's toll has risen above several hundred cases. This now truly is a type of epidemic that the world has never seen before. In light of that, several articles were published recently that are very worth reading.

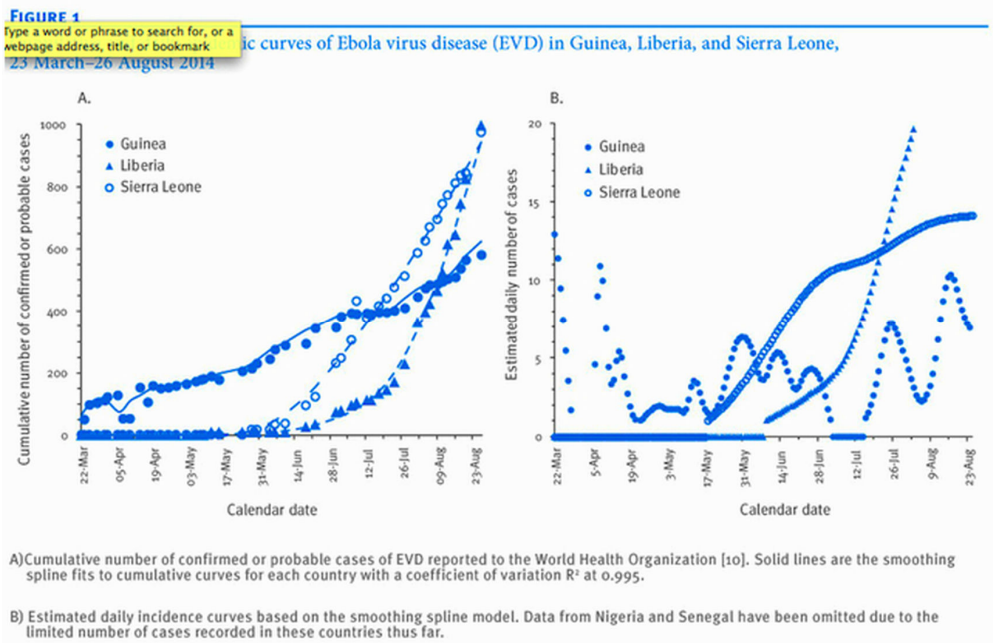
The most arresting is a piece published last week in the journal *Eurosurveillance*, which is the peer-reviewed publication of the European Centre for Disease Prevention and Control (the EU's Stockholm-based version of the US CDC). The piece is an attempt to assess mathematically how the epidemic is growing, by using case reports to determine the "reproductive number." (Note for non-epidemiology geeks: The basic reproductive number — usually shorted to R_0 or "R-nought" — expresses how many cases of disease are likely to be caused by any one infected person. An R_0 of less than 1 means an outbreak will die out; an R_0 of more than 1 means an outbreak can be expected to increase. If you saw the movie *Contagion*, this is what Kate Winslet stood up and wrote on a whiteboard early in the film.)

The *Eurosurveillance* paper, by two researchers from the University of Tokyo and Arizona State University, attempts to derive what the reproductive rate has been in Guinea, Liberia and Sierra Leone. (Note for actual epidemiology geeks: The calculation is for the effective reproductive number, pegged to a point in time, hence actually R_t.) They come up with an R of at least 1, and in some cases 2; that is, at certain points, sick persons have caused disease in two others.

You can see how that could quickly get out of hand, and in fact, that is what the researchers predict. Here is their stop-you-in-your-tracks assessment:

In a worst-case hypothetical scenario, should the outbreak continue with recent trends, the case burden could gain* an additional 77,181 to 277,124 cases *by the end of 2014.

That is a jaw-dropping number.



The epidemic curves of the Ebola epidemic; look especially at the line for Liberia. From Nishiura and Chowell; original here.

What should we do with information like this? At the end of last week, two public health experts published warnings that we need to act urgently in response.

First, Dr. Richard E. Besser: He is now the chief health editor of ABC News, but earlier was acting director of the US CDC, including during the 2009-10

pandemic of H1N1 flu; so, someone who understands what it takes to stand up a public-health response to an epidemic. In his piece in the *Washington Post*, "The world yawns as Ebola takes hold in West Africa," he says bluntly: "I don't think the world is getting the message."

He goes on:

The level of response to the Ebola outbreak is totally inadequate. At the CDC, we learned that a military-style response during a major health crisis saves lives…
We need to establish large field hospitals staffed by Americans to treat the sick. We need to implement infection-control practices to save the lives of health-care providers. We need to staff burial teams to curb disease transmission at funerals. We need to implement systems to detect new flare-ups that can be quickly extinguished. A few thousand U.S. troops could provide the support that is so desperately needed.

Aid ought to be provided on humanitarian grounds alone, he argues — but if that isn't adequate rationale, he adds that aid offered now could protect us in the West from the non-medical effects of Ebola's continuing to spread: "Epidemics destabilize governments, and many governments in West Africa have a very short history of stability. U.S. aid would improve global security."

Should we really be concerned about the global effect of this Ebola epidemic? In the *New York Times*, Dr. Michael T. Osterholm of the University of Minnesota* — an epidemiologist and federal advisor famous for inadvertently predicting the 2001 anthrax attacks — says yes, we should. In "What We're Afraid to Say About Ebola," he warns: "The Ebola epidemic in West Africa has the potential to alter history as much as any plague has ever done."

He goes on:

There are two possible future chapters to this story that should keep us up at night. The first possibility is that the Ebola virus spreads from West Africa to megacities in other regions of the developing world. This outbreak is very different from the 19 that have occurred in Africa over the past 40 years. It is much easier to control Ebola infections in isolated villages. But there has been a 300 percent increase in Africa's population over the last four decades, much of it in large city slums…
The second possibility is one that virologists are loath to discuss openly but are definitely considering in private: that an Ebola virus could mutate to become transmissible through the air… viruses like Ebola are notoriously sloppy in replicating, meaning the virus entering one person may be genetically different from the virus entering the next. The current Ebola virus's hyper-evolution is unprecedented; there has been more human-to-human transmission in the past four months than most likely occurred in the last 500 to 1,000 years. Each new infection represents trillions of throws of the genetic dice.

Like Besser, Osterholm says that the speed, size and organization of the response that is needed demands a governmental investment, but he looks beyond the US government alone:

We need someone to take over the position of "command and control." The United Nations is the only international organization that can direct the immense amount of medical, public health and humanitarian aid that must come from many different countries and nongovernmental groups to smother this epidemic. Thus far it has played at best a collaborating role, and with everyone in charge, no one is in charge.
A Security Council resolution could give the United Nations total responsibility for controlling the outbreak, while respecting West African nations' sovereignty as much as possible. The United Nations could, for instance, secure aircraft and landing rights…
The United Nations should provide whatever number of beds are needed; the World Health Organization has recommended 1,500, but we may need thousands more. It should also coordinate the recruitment and training around the world of medical and nursing staff, in particular by bringing in local residents who have survived Ebola, and are no longer at risk of infection. Many countries are pledging medical resources, but donations will not result in an effective treatment system if no single group is responsible for coordinating them.

I've spent enough time around public health people, in the US and in the field, to understand that they prefer to express themselves conservatively. So when they indulge in apocalyptic language, it is unusual, and notable.

When one of the most senior disease detectives in the US begins talking about "plague," knowing how emotive that word can be, and another suggests calling out the military, it is time to start paying attention.

**Disclosure: From 2006 to 2010, I worked part-time at the disease news site, CIDRAP, that Osterholm founded. For that matter, I used to be in a book club with Besser, too.*

http://bit.ly/1uzAL79

Brains can power up to get around Alzheimer's plaques

It's one of the biggest mysteries of Alzheimer's. The disease is associated with the formation of protein plaques in the brain, but why is it that some people with plaques seem not to have the disease?

Michael Slezak

Research suggests that some people's brains are able to reorganise during the early stages of Alzheimer's, delaying the appearance of initial symptoms.

The plaques in question are small mounds of a protein called beta-amyloid, and are found in the brains of people with Alzheimer's disease. Whether these plaques are a cause of the disease has been hotly debated. One reason for doubt is the appearance of plaques in many older people who have no symptoms of dementia at all.

Using fMRI to measure changes in blood flow around the brain, William Jagust from the University of California in Berkley and colleagues compared brain function in three groups of people without symptoms of dementia: 22 young people, 16 older people with beta-amyloid plaques and 33 older people without the plaques. He asked each of them to memorise a photographed scene while inside the machine.

Jagust found that older people with plaques had increased blood flow – which means stronger activation of that brain area – in the regions of the brain that are usually activated during memory formation, compared with the older people who did not have plaques. The team then analysed whether this extra brain activation might be helping to compensate for the plaques.

Ramping up

Fifteen minutes after the scanning and memory task, the team presented the participants with six written details about the scenes, and asked them whether they were true or false. "We can relate the pattern of activity to the amount of detail they remember from the picture," Jagust says. "If you do that for 100 or 150 pictures, you get a global sense of how brain activity relates to the richness of the memory or the amount of detail of the memory."

And the results were clear. In the case of the older people with beta-amyloid, the more accurate their memory of the picture, the more active their brain had been when they studied the image in the fMRI. "That suggested to us that they were able to ramp up activity to retain more information," says Jagust. "We interpret this as a compensation or plasticity. The older people who didn't have amyloid in the brain did not do it."

This boosting of brain activity seems to be related to the amount of plaques a person had. The more beta-amyloid protein someone had, the more they tended to ramp up their brain activity while memorising the scene. However, this effect tailed off in the people with the greatest amount of plaques. "It suggests this is a transitory phenomenon. Eventually, this sort of compensation becomes lost. And that might be something that happens in the progression to cognitive decline," Jagust says.

Business as usual

The results could also help explain why some people have the plaques without appearing to have dementia. "The fact that brain amyloid is detectable in cognitively normal elderly subjects has been used historically as an argument to support the idea that amyloid may not be as toxic as suggested by experimental studies," says Roger Nitsch, a neuroscientist at the University of Zurich in Switzerland. "This work challenges this view by addressing how elderly subjects can retain normal cognition despite the presence of brain amyloid."

Ideally, people with Alzheimer's would take the test next, to see whether their brain activity also increases, or if they are unable to compensate for the plaques once the disease has progressed. However, it is harder to study people with cognitive problems because the task might prove too difficult to complete.

Journal reference: Nature Neuroscience, DOI: 10.1038/nn.3806

http://www.bbc.com/news/world-asia-china-29201926

Ancient sturgeon in China's Yangtze 'nearly extinct'

The Chinese sturgeon, thought to have existed for more than 140 million years, is now on the brink of extinction, according to local media.

Xinhua reported that no wild sturgeon reproduced naturally last year in the Yangtze river. It was the first time since researchers began recording levels 32 years ago. Chinese researches say the fall is due to rising levels of pollution in the Yangtze river and the construction of dozens of dams.

Researchers from the Chinese Academy of Fishery Sciences also found that no young sturgeons were found swimming along the Yangtze toward the sea during the period they usually do so.

A researcher told Xinhua that in the 1980s, at least several thousand sturgeon could be found in the river. It is estimated only around 100 fish remain.

"Without natural reproduction, the fish population cannot replenish itself. If there are no further steps taken to strengthen conservation, the wild sturgeon faces the danger of extinction," he said.

In recent decades the Chinese authorities have built numerous dams along the 6,300km-long Yangtze river to boost the country's electricity supply. Such moves have drawn criticism of environmental degradation and displacement of villagers.

The finless porpoise, another native species to the Yangtze river, is said to be at risk as well

The WWF says that one of two species of dolphins native to the Yangtze river, the Baiji dolphin, went extinct in 2006 because of declining fish stocks.

The other species, the finless porpoise, is said to be at risk from illegal and intensive fishing practices and pollution. About 1,200 to 1,800 finless porpoises remain in the entire 1.8 million sq km Yangtze basin.