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Rice Farming Linked to Holistic Thinking

Historical agriculture practices predict modern mentalities

Oct 16, 2014 |By Esther Hsieh

Often we view Chinese culture through an East versus West lens.

But joint research from the U.S. and China indicates that northern Chinese may have a mind-set closer to individualistic Americans than their southern compatriots.

And the reason is rice.

The Yangtze River splits China into north and south and serves as an agricultural and cultural divide, explains University of Virginia doctoral candidate Thomas Talhelm, first author of the study, which appears in Science.

Farmers north of the Yangtze predominantly grow wheat, and those to the south grow rice.

Cultivating rice is very labor- and water-intensive, and it therefore requires sharing resources. Communities have to cooperate to plant and irrigate.

Growing wheat requires half the labor and depends more on rainfall patterns, so it can be managed with much less reliance on one's neighbors.

Talhelm wondered if agricultural practices could help explain the more individualistic, or Western, mind-set he found in the north compared with the more holistic, or Eastern, way of thinking in the south.

To investigate his "rice theory," Talhelm's team tested 1,162 students from 28 provinces in China for holistic thought, implicit individualism and loyalty.

As expected, the researchers found that holistic thought and loyalty were higher in provinces with rice cultivation and that individualism was more common in wheat-farming areas.

To see if the rice theory applied beyond students, the researchers also looked at provincial divorce rates, another indicator of individualism.

"Wheat regions had a 50 percent higher divorce rate than rice regions," Talhelm says.

The rice theory jibes with other cultural research into how agriculture influences thinking, explains Richard Nisbett, a professor of psychology at the University of Michigan, who was not involved in the study.

For example, Nisbett found that in Turkey, farmers (an interdependent occupation) were much more holistic than herders (an independent occupation).

The new results add to our growing understanding that a region's agricultural history may have a lasting influence on its modern citizens' mind-set.

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Scientists develop drug to reduce side-effects of 'binge drinking'

Drug that could reduce the harmful side-effects of binge drinking has been successfully developed and tested

A DRUG that could reduce the harmful side-effects of 'binge drinking', especially by teenagers, has been successfully developed and tested by a team of European scientists, including the University of Huddersfield's Professor Mike Page and Dr Karl Hemming. There is also the potential for new ways to treat Alzheimer's and other neurological diseases that damage the brain.

The key to the breakthrough is a compound developed by Professor Page and colleagues at the University of Huddersfield which is named ethane-beta-sultam. This is a taurine 'pro-drug' - an effective form of medication that easily enters the blood stream before it is processed by the body into its active form. It is difficult for drugs to get into the brain because of the 'blood-brain barrier', the natural defence mechanism that protects the brain, but which also presents a formidable obstacle to the medicinal treatment of neurological illness.

Scientists based at universities in Louvain in Belgium, Florence in Italy and Huddersfield and London in the UK, have discovered that when ethane-beta-sultam is administered to rats on a 'binge drinking' regime, it reduces the brain cell loss and inflammation that normally result from bouts of heavy binge drinking, leading to symptoms such as decreased memory. These effects can cause long-term damage, particularly to teenagers, whose brains are still in the process of development.

New compound ethane-beta-sultam

The findings of the 11-strong research team - which received EU funding for the project - are revealed in a new article published by the Journal of Alcoholism and Drug Dependence. The authors include Professor Page and his University of Huddersfield colleagues Dr Hemming - who is Reader in Organic Chemistry and Course Leader for Chemical Sciences - and a PhD research student Arnaud Pitard.

It has been shown how brain functions are impaired by alcohol and this is accompanied by inflammation and loss of cells in the brain. However, the effects were reduced or returned to normal in the rats that also received the new compound ethane-beta-sultam.

"One of things that alcohol does is to destroy some of the brain cells which are important for navigation and orientation," said Professor Page. "But a combination of alcohol and our compound could overcome this damage."

He explained that the brain protects itself using 'glial cells', which are increased when exposed to alcohol in a binge-drinking regime. "But a combination of our

ethane-beta-sultam given at the same time as the alcohol decreased these levels of glial cells."

Professor Page said that the collaboration leading to the latest article had been in place for about ten years. The project continues and could include research to find a compound that performed even better than ethane-beta-sultam. In the longer term, there is a possibility that such compounds could help with the treatment of diseases such as Alzheimer's and dementia which also result from a loss of brain activity.

Many issues surround the prospect of a drug that masks the effects of binge drinking. "But if you accept that alcohol abuse is going to continue, then it might be sensible for society to try and treat it in some way," says Professor Page.

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Singapore scientists uncover gene associated with an aggressive breast cancer

Over-expressed gene in triple negative breast cancer offers new diagnostics for risk assessment

Singapore - Scientists at A*STAR's Genome Institute of Singapore (GIS), in collaboration with local clinicians and colleagues in the USA, have identified a biomarker which is strongly associated with triple negative breast cancer (TNBC), a highly aggressive carcinoma that often has early relapse and metastasis following chemotherapy. The newly identified biomarker, a gene called RASAL2, provides a target for developing new therapeutics designed to treat this often deadly disease.

TNBC is deadly because, unlike other types of breast cancers such as estrogen receptor (ER) positive or HER2 amplified breast tumours which have effective targeted therapy, TNBC tumours do not respond to targeted therapy.

Breast cancer has many subtypes, each with its own genetic makeup. As such, different subtypes behave differently in invasion and metastasis. Using breast cancer cell lines and genomic data from patient samples, molecular biologist Min Feng and her colleagues at the GIS adopted an integrated approach to search for genes whose deregulation may help explain the high metastatic potential of TNBC cells.

Dr Feng found that a small RNA, often called microRNA, is lost in highly metastatic TNBC cells but not in luminal breast cancer. As a result, RASAL2, which is negatively regulated by this microRNA, is up-regulated in a set of TNBC tumours. The study showed that TNBC patients whose tumours have high expression of RASAL2 tend to have a lower survival rate as compared to patients whose tumours have low levels of this gene. Additionally, the study showed that genetic knockdown of RASAL2 gene can lead to reduced metastasis in breast cancer mouse model.

The findings were published recently in the Journal of Clinical Investigation (JCI). Intriguingly, previous research found that RASAL2 was lost in some of the luminal type of breast tumours, where it acts as a tumour suppressor.

Project leader of the study, Prof Qiang Yu, Senior Group Leader of Cancer Therapeutics and Stratified Oncology Programme at the GIS, said, "Cancer is an extremely heterogeneous disease, where many molecular processes have gone wrong in their own ways. Rather than a tumour suppressor, we show here that RASAL2 actually acts as a cancer promoting molecule in TNBC. This reminds us that the same molecule can function very differently in different subtypes of cancers, a phenomenon which has often been seen before."

The study is the result of intensive collaboration with both local and international colleagues, including Dr Ern Yu Tan at Tan Tock Seng Hospital, Singapore, and Dr Dave Hoon at the John Wayne Cancer Institute in Santa Monica, California.

Dr Tan, a breast cancer doctor, said, "Therapeutic options remain limited and women with TNBC have a higher risk of disease relapse, with prognosis being generally poor after a relapse. With this finding, RASAL2 could be a new potential biomarker that is associated with the high risk of TNBC, rather than all types of breast tumours. This illustrates an important aspect of breast cancer biology. With a better understanding of the genetic makeup of tumours, it is now recognized that breast cancer comprises a diverse mix of tumours. This explains why not everyone with tumours of the same disease stage responds the same way to similar treatment."

GIS Executive Director Prof Huck Hui Ng, said, "The study is a reflection of an adaptation of our efforts towards translational research. We are working hard to build up an ecosystem to allow close collaborations between researchers and clinicians. Because the laboratory findings do not always replicate the 'real world' of human tumours, validation with samples derived from actual human tumours remains the 'final proof' of whether novel laboratory findings can be applied to clinical practice."

Prof Yu emphasised the necessity of further clinical validation for the study. He is also seeking industrial collaboration to develop diagnostic assays for high risk TNBC patients.

The research findings described in the media release can be found in the Journal of Clinical Investigation, under the title, "RASAL2 activates RAC1 to promote triple negative breast cancer progression" by Min Feng1, Yi Bao1, Zhimei Li1, Juntao Li2, Min Gong1, Stella Lam3, Jinhua Wang3, Diego M. Marzese3, Nicholas Donovan3, Ern Yu Tan4, Dave S.B. Hoon3, and Qiang Yu1,5,6

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Triple-negative breast cancer patients should undergo genetic screening: Mayo Clinic

Most patients with triple-negative breast cancer should undergo genetic testing for mutations in known breast cancer predisposition genes

ROCHESTER, Minn. - Most patients with triple-negative breast cancer should undergo genetic testing for mutations in known breast cancer predisposition genes, including BRCA1 and BRCA2, a Mayo Clinic-led study has found. The findings come from the largest analysis to date of genetic mutations in this aggressive form of breast cancer. The results of the research appear in the Journal of Clinical Oncology.

"Clinicians need to think hard about screening all their triple-negative patients for mutations because there is a lot of value in learning that information, both in terms of the risk of recurrence to the individual and the risk to family members. In addition, there may be very specific therapeutic benefits of knowing if you have a mutation in a particular gene," says Fergus Couch, Ph.D., professor of laboratory medicine and pathology at Mayo Clinic and lead author of the study.

The study found that almost 15 percent of triple-negative breast cancer patients had deleterious (harmful) mutations in predisposition genes. The vast majority of these mutations appeared in genes involved in the repair of DNA damage, suggesting that the origins of triple-negative breast cancer may be different from other forms of the disease. The study also provides evidence in support of the National Comprehensive Cancer Network (NCCN) guidelines for genetic testing of triple-negative breast cancer patients.

Triple-negative breast cancer is a specific subset of breast cancer that makes up about 12 to 15 percent of all cases. The disease is difficult to treat because the tumors are missing the estrogen, progesterone and HER-2 receptors that are the target of the most common and most effective forms of therapy.

However, recent studies have suggested that triple-negative breast cancer patients might harbor genetic mutations that make them more likely to respond to alternative treatments like cisplatin, a chemotherapy agent, or PARP inhibitors, anti-cancer agents that inhibit the poly (ADP-ribose) polymerase (PARP) family of enzymes.

Dr. Couch and his colleagues decided to assess the frequency of mutations in predisposition genes in patients with triple-negative breast cancer to further delineate the role of genetic screening for individuals with the disease. The researchers sequenced DNA from 1,824 triple-negative breast cancer cases seen at 12 oncology clinics in the U.S. and Europe, as part of the Triple-Negative Breast Cancer Consortium.

They found deleterious mutations in almost 15 percent of triple-negative breast cancer patients. Of these, 11 percent had mutations in the BRCA1 and BRCA2 genes and the rest had mutations in 15 other predisposition genes, including the DNA repair genes PALB2, BARD1, and RAD51C. No mutations were found in predisposition genes involved in other processes like the cell cycle.

"Triple-negative breast cancers are different from all the other breast cancers," says Dr. Couch. "Other studies have suggested that this form of the disease might be associated with some defect in DNA repair, and our study verifies that. Our findings generate a whole new set of hypotheses about how triple-negative breast cancer might be arising, which could give us better ideas for prevention or new therapies for this disease."

The study also found that individuals with mutations in predisposition genes were diagnosed at an earlier age and had higher-grade tumors than those without mutations.

The researchers used their dataset to assess whether the current screening guidelines would identify all the triple-negative individuals with mutations in the two most common predisposition genes, BRCA1 and BRCA2.

They found that the NCCN guidelines, which recommend screening when there is a family history of cancer or a diagnosis under age 60, missed only 1 percent of patients carrying mutations.

In contrast, the UK's National Institute for Clinical Excellence (NICE) guidelines, which use the probability of actually finding a mutation to determine who should be tested, missed 24 percent of mutation carriers.

"Our results confirm that the NCCN guidelines are good, and provide evidence to support what they have recommended," says Dr. Couch. "But we think the NICE guidelines could be expanded to include more of the triple-negative breast cancer patients with mutations."

Co-authors from Mayo Clinic include, Steven N. Hart, Ph.D. , Curtis Olswold, Seth Slettedahl, Emily Hallberg, Jaime I. Davila, Susan L. Slager, Ph.D., Celine M. Vachon, Ph.D.

The National Institutes of Health, the Breast Cancer Research Foundation and the David F. and Margaret T. Grohne Family Foundation funded the study.

About Mayo Clinic Cancer Center

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Most of Earth's carbon may be hidden in the planet's inner core, new model suggests

As much as two-thirds of Earth's carbon may be hidden in the inner core, making it the planet's largest carbon reservoir

ANN ARBOR - As much as two-thirds of Earth's carbon may be hidden in the inner core, making it the planet's largest carbon reservoir, according to a new model that even its backers acknowledge is "provocative and speculative."

In a paper scheduled for online publication in the Proceedings of the National Academy of Sciences this week, University of Michigan researchers and their colleagues suggest that iron carbide, Fe_7C_3, provides a good match for the density and sound velocities of Earth's inner core under the relevant conditions.

The model, if correct, could help resolve observations that have troubled researchers for decades, according to authors of the PNAS paper.

The first author is Bin Chen, who did much of the work at the University of Michigan before taking a faculty position at the University of Hawaii at Manoa. The principal investigator of the project, Jie Li, is an associate professor in U-M's Department of Earth and Environmental Sciences.

"The model of a carbide inner core is compatible with existing cosmochemical, geochemical and petrological constraints, but this provocative and speculative hypothesis still requires further testing," Li said. "Should it hold up to various tests, the model would imply that as much as two-thirds of the planet's carbon is hidden in its center sphere, making it the largest reservoir of carbon on Earth."

It is now widely accepted that Earth's inner core consists of crystalline iron alloyed with a small amount of nickel and some lighter elements. However, seismic waves called S waves travel through the inner core at about half the speed expected for most iron-rich alloys under relevant pressures.

Some researchers have attributed the S-wave velocities to the presence of liquid, calling into question the solidity of the inner core. In recent years, the presence of various light elements - including sulfur, carbon, silicon, oxygen and hydrogen - has been proposed to account for the density deficit of Earth's core.

Iron carbide has recently emerged as a leading candidate component of the inner core. In the PNAS paper, the researchers conclude that the presence of iron carbide could explain the anomalously slow S waves, thus eliminating the need to invoke partial melting.

"This model challenges the conventional view that the Earth is highly depleted in carbon, and therefore bears on our understanding of Earth's accretion and early differentiation," the PNAS authors wrote.

In their study, the researchers used a variety of experimental techniques to obtain sound velocities for iron carbide up to core pressures. In addition, they detected the anomalous effect of spin transition of iron on sound velocities.

They used diamond-anvil cell techniques in combination with a suite of advanced synchrotron methods including nuclear resonant inelastic X-ray scattering, synchrotron Mössbauer spectroscopy and X-ray emission spectroscopy.

Other U-M authors of the PNAS paper are Zeyu Li and Jiachao Liu of the Department of Earth and Environmental Sciences. The study was supported by the National Science Foundation and the U.S. Department of Energy. It also benefited from a Crosby Award from the U-M ADVANCE program and U-M's Associate Professor Support Fund.

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UW team explores large, restless volcanic field in Chile

Rate of uplift is among the highest ever observed by satellite measurement for a volcano that is not actively erupting

MADISON, Wis. - If Brad Singer knew for sure what was happening three miles under an odd-shaped lake in the Andes, he might be less eager to spend a good part of his career investigating a volcanic field that has erupted 36 times during the last 25,000 years. As he leads a large scientific team exploring a region in the Andes called Laguna del Maule, Singer hopes the area remains quiet.

But the primary reason to expend so much effort on this area boils down to one fact: The rate of uplift is among the highest ever observed by satellite measurement for a volcano that is not actively erupting.

That uplift is almost definitely due to a large intrusion of magma - molten rock - beneath the volcanic complex. For seven years, an area larger than the city of Madison has been rising by 10 inches per year.

That rapid rise provides a major scientific opportunity: to explore a mega-volcano before it erupts. That effort, and the hazard posed by the restless magma reservoir beneath Laguna del Maule, are described in a major research article in the December issue of the Geological Society of America's GSA Today.

"We've always been looking at these mega-eruptions in the rear-view mirror," says Singer. "We look at the lava, dust and ash, and try to understand what happened before the eruption. Since these huge eruptions are rare, that's usually our only option. But we look at the steady uplift at Laguna del Maule, which has a history of regular eruptions, combined with changes in gravity, electrical conductivity and swarms of earthquakes, and we suspect that conditions necessary to trigger another eruption are gathering force."

Laguna del Maule looks nothing like a classic, cone-shaped volcano, since the high-intensity erosion caused by heavy rain and snow has carried most of the evidence to the nearby Pacific Ocean. But the overpowering reason for the

absence of "typical volcano cones" is the nature of the molten rock underground. It's called rhyolite, and it's the most explosive type of magma on the planet.

The eruption of a rhyolite volcano is too quick and violent to build up a cone. Instead, this viscous, water-rich magma often explodes into vast quantities of ash that can form deposits hundreds of yards deep, followed by a slower flow of glassy magma that can be tens of yards tall and measure more than a mile in length.

The next eruption could be in the size range of Mount St. Helens - or it could be vastly bigger, Singer says. "We know that over the past million years or so, several eruptions at Laguna del Maule or nearby volcanoes have been more than 100 times larger than Mount St. Helens," he says. "Those are rare, but they are possible." Such a mega-eruption could change the weather, disrupt the ecosystem and damage the economy.

Trying to anticipate what Laguna del Maule holds in store, Singer is heading a new $3 million, five-year effort sponsored by the National Science Foundation to document its behavior before an eruption. With colleagues from Chile, Argentina, Canada, Singapore, and Cornell and Georgia Tech universities, he is masterminding an effort to build a scientific model of the underground forces that could lead to eruption. "This model should capture how this system has evolved in the crust at all scales, from the microscopic to basinwide, over the last 100,000 years," Singer says. "It's like a movie from the past to the present and into the future."

Over the next five years, Singer says he and 30 colleagues will "throw everything, including the kitchen sink, at the problem - geology, geochemistry, geochronology and geophysics - to help measure, and then model, what's going on."

One key source of information on volcanoes is seismic waves. Ground shaking triggered by the movement of magma can signal an impending eruption. Team member Clifford Thurber, a seismologist and professor of geoscience at UW-Madison, wants to use distant earthquakes to locate the underground magma body. As many as 50 seismometers will eventually be emplaced above and around the magma at Laguna del Maule, in the effort to create a 3-D image of Earth's crust in the area.

By tracking multiple earthquakes over several years, Thurber and his colleagues want to pinpoint the size and location of the magma body - roughly estimated as an oval measuring five kilometers (3.1 miles) by 10 kilometers (6.2 miles).

Each seismometer will record the travel time of earthquake waves originating within a few thousand kilometers, Thurber explains. Since soft rock transmits sound less efficiently than hard rock, "we expect that waves that pass through the presumed magma body will be delayed," Thurber says. "It's very simple. It's like a CT scan, except instead of density we are looking at seismic wave velocity."

As Singer, who has been visiting Laguna del Maule since 1998, notes, "The rate of uplift - among the highest ever observed - has been sustained for seven years, and we have discovered a large, fluid-rich zone in the crust under the lake using electrical resistivity methods. Thus, there are not many possible explanations other than a big, active body of magma at a shallow depth."

The expanding body of magma could freeze in place - or blow its top, he says. "One thing we know for sure is that the surface cannot continue rising indefinitely."

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Vitamin D reduces lung disease flare-ups by over 40 percent

Vitamin D supplements can reduce COPD lung disease flare-ups by over 40% in patients with a vitamin D deficiency - according to new research from Queen Mary University of London.

COPD (chronic obstructive pulmonary disease) includes conditions such as chronic bronchitis and emphysema, and is thought to affect more than 3 million people in the UK.

The NIHR-funded randomised trial, published in the journal Lancet Respiratory Medicine, included 240 patients with COPD in and around London. Half of the patients (122) received vitamin D supplements (6 x 2-monthly oral doses of 3mg) and the other half (118) received an equivalent placebo. The risk, severity and duration of flare-ups was then compared between the two groups.

Flare-ups (also referred to as 'exacerbations') are when a COPD patient's usual symptoms (coughing, excess mucus, shortness of breath, tightness in chest) get worse and stay worse, sometimes resulting in hospitalisation.

Patients with a vitamin D deficiency benefited dramatically from taking the supplements but the striking reduction in flare-ups was not seen among patients who had a higher vitamin D status at the start of the trial. However, researchers did find vitamin D supplementation modestly reduced the severity and duration of flare-up symptoms in all patients in the vitamin D group, regardless of their baseline vitamin D levels, compared to the placebo group.

This is the first clinical trial to investigate the impact of vitamin D supplementation on severity and duration of COPD symptoms. One previous trial has linked vitamin D to a reduction in COPD disease flare ups but this was limited to patients with very severe conditions. This trial is larger and studied patients with a much broader spectrum of diseases, ranging from mild to severe.

Professor Adrian Martineau, Lead Author, Queen Mary University of London, comments: "Flare-ups of chronic bronchitis and emphysema (COPD) can be

debilitating for patients, sometimes leading to hospitalisation and even death. Our research has shown how an inexpensive vitamin supplement can significantly reduce the risk of flare-ups for patients who are vitamin D deficient, which could have a major public health benefit. Our findings suggest that patients with COPD should have their vitamin D status tested and should begin taking supplements if their levels are found to be low."

This study is funded by the National Institute for Health Research Programme Grants for Applied Research (NIHR PGfAR) Programme (Reference Number RP-PG-0407-10398).

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Plant used in traditonal Chinese medicine may treat metabolic diseases and obesity

New research published in the Journal of Leukocyte Biology suggests that a component of a flowering plant used in traditional Chinese medicine thwarts development of obesity, type 2 diabetes and hepatic steatosis

New research published in the December 2014 issue of the Journal of Leukocyte Biology, shows that a component found in in the plant, Glycyrrhiza uralensis, may inhibit the development of metabolic disorders by stopping the activation of NLRP3, a protein involved in the disease process. Specifically, the researchers identified isoliquiritigenin as having the ability to attenuate high-fat, diet-induced obesity, type 2 diabetes and hepatic steatosis in mice.

"Identification of small compounds that inhibit the NLRP3 inflammasome is required to design effective therapeutics," said Kiyoshi Takatsu, Ph.D., a researcher involved in the work from the Department of Immunobiology and Pharmacological Genetics, Graduate School of Medicine and Pharmaceutical Science for Research at the University of Toyama in Toyama Japan. "We hope that our findings will provide new information and strategy that can be exploited for development of new herbal medication of those diseases."

To make this find, scientists stimulated mouse macrophages with different inflammasome activators in the presence of isoliquiritigenin. Then, activation of NLRP3 inflammasome was examined by measuring IL-1beta production in the culture supernatants. Results showed that relatively low concentrations of isoliquiritigenin were highly effective in inhibiting IL-1beta production compared with known NLRP3 inflammasome inhibitors, such as parthenolide and sulfonylurea drug glyburide. For animal studies, three groups of mice were used. The first group of mice was fed a normal diet and the second group of mice was fed a high-fat diet. The third group of mice was fed a high-fat diet supplemented with 0.5 percent isoliquiritigenin. High-fat diet feeding for 20 weeks induced obesity, type 2 diabetes and hepatic steatosis in mice, but supplementation of ILG markedly improved these disorders. Finally, supplementation of isoliquiritigenin inhibited high-fat diet-induced IL-1beta production in adipose tissue.

"Obesity and associated metabolic disorders are one of the most important emerging medical conditions. Recent work demonstrates a critical role for obesity-driven inflammation in a multitude of medical problems arising from obesity with a central role for the inflammasome," said John Wherry, Ph.D., Deputy Editor of the Journal of Leukocyte Biology. "This new work not only identifies a novel class of potential inflammasome inhibitors, but also demonstrates effectiveness in a preclinical model of obesity induced disease."

Hiroe Honda, Yoshinori Nagai, Takayuki Matsunaga, Naoki Okamoto, Yasuharu Watanabe, Koichi Tsuneyama, Hiroaki Hayashi, Isao Fujii, Masashi Ikutani, Yoshikatsu Hirai, Atsushi Muraguchi, and Kiyoshi Takatsu. Isoliquiritigenin is a potent inhibitor of NLRP3 inflammasome activation and diet-induced adipose tissue inflammation. J. Leukoc. Biol., December 2014 96:1087-1100; doi:10.1189/jlb.3A0114-005RR ; http://www.jleukbio.org/content/96/6/1087.abstract

http://www.eurekalert.org/pub_releases/2014-12/acoc-fca112414.php

For cardiac arrest, epinephrine may do more harm than good

Study questions current international guidelines for resuscitation

WASHINGTON - For patients in cardiac arrest, administering epinephrine helps to restart the heart but may increase the overall likelihood of death or debilitating brain damage, according to a study published today in the Journal of the American College of Cardiology.

The study offers new data in an ongoing debate over the risks and benefits of using epinephrine to treat cardiac arrest, an often-fatal condition in which the heart stops beating. Epinephrine, also known as adrenaline, is a hormone that stimulates the heart and promotes the flow of blood. Current international guidelines recommend administering 1 milligram of epinephrine every 3-5 minutes during resuscitation.

"The role of epinephrine is more and more questionable in cardiac arrest," said the study's lead author Florence Dumas, M.D., Ph.D., of the Parisian Cardiovascular Research Center in France. "We need to constantly assess our procedures and protocols to make sure that the use of epinephrine is effective and done at the correct time."

She added that this study underscores the need for caution when using epinephrine. Administering epinephrine to patients in cardiac arrest has been shown to improve the chance of restarting the heart, known as return of spontaneous circulation or ROSC. But the new study adds to mounting evidence suggesting the drug harms patients' chances of surviving past the post-resuscitation period with brain function intact.

Dumas and colleagues analyzed hospital records for more than 1,500 people admitted to a large Parisian hospital over a 12-year period. Patients included in the analysis had suffered out-of-hospital cardiac arrest, been resuscitated and achieved ROSC. Nearly three-quarters of the patients had received at least one dose of epinephrine.

The primary outcome measured was discharge from the hospital with normal or only moderately compromised brain functioning. Sixty-three percent of patients who did not receive epinephrine achieved this outcome, compared to only 19 percent of those who received epinephrine. Patients receiving higher doses of epinephrine fared worse than those with lower doses. As compared to patients who received no epinephrine, those receiving 1-milligram doses were 52 percent more likely to have a bad outcome and those receiving 5-milligram or larger doses were 77 percent more likely to have a bad outcome.

Timing also appears to be an important factor. Patients receiving epinephrine in the later stages of resuscitation were more likely to die than those who got their first epinephrine dose shortly after collapsing. The adverse effects of epinephrine appeared to be unaffected by the use of post-resuscitation medical treatments, such as techniques to cool the body to reduce tissue damage or interventions to restore the flow of blood through blocked arteries.

The patients who had not received epinephrine typically had other characteristics that improved their outlook. For example, patients in this group were generally younger and more likely to have been near a witness when they collapsed. However, the research team employed a variety of robust statistical methods to account for these differences.

Dumas said the results do not necessarily indicate an immediate need to change the guidelines, however. "It's very difficult, because epinephrine at a low dose seems to have a good impact in the first few minutes, but appears more harmful if used later," said Dumas. "It would be dangerous to completely incriminate this drug, because it may well be helpful for certain patients under certain circumstances. This is one more study that points strongly to the need to study epinephrine further in animals and in randomized trials."

In addition to further research on epinephrine, Dumas said the study reinforces the need to continue investigating other drugs and drug combinations that might offer safer alternatives to epinephrine during cardiac arrest.

Each year, more than 420,000 cardiac arrests occur in the United States. Its immediate cause is typically an abnormality in the heart's rhythm, which can result from numerous risk factors including coronary artery disease, heart attack, an enlarged heart or other heart conditions. Cardiopulmonary resuscitation and defibrillation are the primary treatments.

http://www.eurekalert.org/pub_releases/2014-12/aiob-clb112614.php

Ciliopathies lie behind many human diseases

Offer insight into a variety of human diseases and syndromes

In recent years, cilia, microscopic, tentacle-like extensions from biological cells, have risen from relative obscurity and are now considered important to the understanding of many human afflictions. In a December BioScience article, George B. Witman, of the University of Massachusetts Medical School, and Jason M. Brown, of Salem State University, describe recent discoveries involving cilia-related diseases (called "ciliopathies") and highlight "model" species that could be useful for systematic study of ciliopathies.

Cilia perform a broad range of functions, including a starring role in cell signalling. Motile ones wiggle and so move fluids within the body, including cerebrospinal fluid in the brain. In humans, cilia are found on almost every cell in the body. Because of this, ciliopathies often make themselves known as syndromes with widely varying effects on a number of tissue types. For instance, the ciliopathy Jeune asphyxiating thoracic dystrophy involves the development of abnormally short ribs, accompanied by short limbs and, occasionally, the development of extra digits.

In primary ciliary dyskinesia, motile cilia are dysfunctional and fail to beat. This can lead to bronchitis resulting from the failure to clear mucus from the sufferer's airways. Male patients with primary ciliary dyskinesia are infertile because of impaired motility of the sperm's flagellum (flagella and cilia are structurally similar).

The article's authors point to a number of other human diseases in which cilia may play a role; for example, some cancers and neurological diseases may be related to ciliopathies. Because of the limitations placed on research involving humans, the authors propose the use of model species ranging from the green alga Chlamydomonas to the house mouse to further study the role of cilia. They write, "We can anticipate that new and improved techniques will open new avenues for gaining further insight into these immensely important and ever more fascinating cell organelles."

This article is part of a Special Section in BioScience on the topic of cilia and flagella.

http://bit.ly/1vnnN96

Synthetic enzymes hint at life without DNA or RNA

Enzymes that don't exist in nature have been made from genetic material that doesn't exist in nature either, called XNA, or xeno nucleic acid.

17:35 01 December 2014 by Andy Coghlan

It's the first time this has been done and the results reinforce the possibility that life could evolve without DNA or RNA, the two self-replicating molecules

considered indispensible for life on Earth."Our work with XNA shows that there's no fundamental imperative for RNA and DNA to be prerequisites for life," says Philipp Holliger of the Laboratory of Molecular Biology in Cambridge, UK, the same laboratory where the structure of DNA was discovered in 1953 by Francis Crick and James Watson.

It's not all about the base

Holliger's team has made XNAs before. Their unnatural XNA contains the same bases – adenine, thymine, guanine, cytosine and uracil – on which DNA and RNA rely for coding hereditary information. What's different is the sugar to which each base is attached.

In DNA and RNA, the sugars are deoxyribose and ribose, respectively. Holliger made new types of genetic material by replacing these with different sugars or other molecules.

Now, they have taken a step closer to mimicking early life on the planet by showing that XNAs can also serve as enzymes – indispensible catalysts for speeding up chemical reactions vital for life. One of the first steps towards life on Earth is thought to be the evolution of RNA into self-copying enzymes.

Big steps

So by showing that XNAs can act as enzymes, on top of being able to store hereditary information, Holliger has recreated a second major step towards life. The XNA enzymes can't yet copy themselves but they can cut and paste RNA, just like natural enzymes do, and even paste together fragments of XNA.

It's the first demonstration that, like prehistoric RNA, XNA can catalyse reactions on itself, even if it can't yet copy itself as RNA can.

Holliger argues that RNA and DNA may have come to dominate Earth by chance, simply because they were the best evolutionary materials to hand. "You could speculate that on other planets, XNAs would dominate instead," he says.

Primal molecules

"This work is another nice step towards demonstrating the functional capabilities of XNAs," says Nobel prizewinner Jack Szostak of Harvard University, who studies the origins of life on Earth .

"The possibility that life elsewhere, on exoplanets, could have started with something other than RNA or DNA is quite interesting, but the primordial biopolymer for any form of life must satisfy other constraints as well, such as being something that can be generated by prebiotic chemistry and replicated efficiently," Szostak says. "Whether XNA can satisfy these constraints, as well as providing useful functions, remains an open question."

Holliger says that XNAs may also have roles to play in medicine. Because they do not occur naturally, they can't be broken down in the human body. And since they can be designed to break and destroy RNA, they could work as drugs for treating RNA viruses or disabling RNA messages that trigger cancers.

"We've made XNA enzymes that cut RNA at specific sites, so you could make therapies for cleaving viral or oncogenic messenger RNA," says Holliger. "And because they can't be degraded, they could give long-lasting protection."

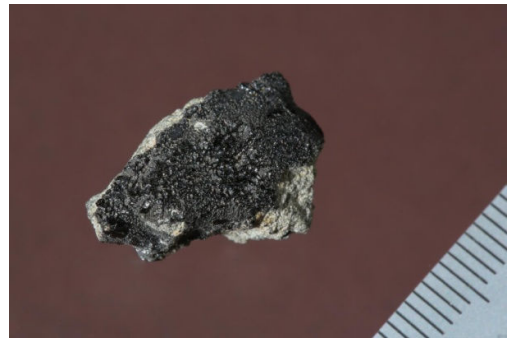
Journal reference: *Nature, DOI: 10.1038/nature13982*

http://www.eurekalert.org/pub_releases/2014-12/epfd-tom120214.php

Traces of Martian biological activity could be locked inside a meteorite

Did Mars ever have life? Does it still? A meteorite from Mars has reignited the old debate

"So far, there is no other theory that we find more compelling," says Philippe Gillet, director of EPFL's Earth and Planetary Sciences Laboratory. He and his colleagues from China, Japan and Germany performed a detailed analysis of organic carbon traces from a Martian meteorite, and have concluded that they have a very probable biological origin. The scientists argue that carbon could have been deposited into the fissures of the rock when it was still on Mars by the infiltration of fluid that was rich in organic matter.



This meteorite has been found in Morocco in 2011. It's tiny cracks contain carbon of organic nature. This carbon has been deposited on Mars and could have been originated by a biological activity. **Alain Herzog / EPFL 2014**

Ejected from Mars after an asteroid crashed on its surface, the meteorite, named Tissint, fell on the Moroccan desert on July 18, 2011, in view of several eyewitnesses. Upon examination, the alien rock was found to have small fissures that were filled with carbon-containing matter. Several research teams have already shown that this component is organic in nature. But they are still debating where the carbon came from.

Maybe biological, but not from our planet

Chemical, microscopic and isotope analysis of the carbon material led the researchers to several possible explanations of its origin. They established characteristics that unequivocally excluded a terrestrial origin, and showed that the carbon content were deposited in the Tissint's fissures before it left Mars.

The researchers challenged previously described views (Steele et al., Science, 2012) proposing that the carbon traces originated through the high-temperature crystallization of magma. According to the new study, a more likely explanation is that liquids containing organic compounds of biological origin infiltrated Tissint's "mother" rock at low temperatures, near the Martian surface.

These conclusions are supported by several intrinsic properties of the meteorite's carbon, e.g. its ratio of carbon-13 to carbon-12. This was found to be significantly lower than the ratio of carbon-13 in the CO2 of Mars's atmosphere, previously measured by the Phoenix and Curiosity rovers. Moreover, the difference between these ratios corresponds perfectly with what is observed on Earth between a piece of coal - which is biological in origin - and the carbon in the atmosphere. The researchers note that this organic matter could also have been brought to Mars when very primitive meteorites - carbonated chondrites - fell on it. However, they consider this scenario unlikely because such meteorites contain very low concentrations of organic matter.

"Insisting on certainty is unwise, particularly on such a sensitive topic," warns Gillet. "I'm completely open to the possibility that other studies might contradict our findings. However, our conclusions are such that they will rekindle the debate as to the possible existence of biological activity on Mars - at least in the past."

http://www.eurekalert.org/pub_releases/2014-12/acoa-iya112414.php

If you are having a severe allergic reaction, you need epinephrine first and fast

New practice parameters advise epinephrine as first line of defense

ARLINGTON HEIGHTS, Ill. - If you are one of the millions of Americans who experiences a severe allergic reaction to food, latex or an insect sting, you should know the first line of defense in combating the reaction is epinephrine. Unfortunately, not all medical personnel know how important epinephrine is in bringing an allergic reaction under control.

According to new guidelines published in the Annals of Allergy, Asthma and Immunology, the scientific publication of the American College of Allergy, Asthma and Immunology (ACAAI), the fast administration of epinephrine is essential to the treatment of a severe allergic reaction.

"Since emergency department physicians are often the first to see patients who are suffering from anaphylaxis, it's especially important that they not only correctly diagnose the problem, but understand that epinephrine should be administered as soon as possible," said Ronna L. Campbell, MD, PhD, an emergency department physician and lead author on the guidelines. "In addition, following a severe, allergic reaction, patients should be referred to an allergist, as allergists provide the most comprehensive follow-up care and guidance."

Anaphylaxis symptoms occur suddenly and can progress quickly. The early symptoms may be mild, such as a runny nose, a skin rash or a "strange feeling," but these symptoms can quickly lead to more serious problems, including trouble breathing, hives or swelling, tightness of the throat, nausea, abdominal pain or even cardiac arrest. Anaphylaxis can be fatal if left untreated.

According to the new guidelines, there is virtually no reason not to use epinephrine on a patient believed to be suffering a severe allergic reaction.

"The collaboration between emergency department personnel and allergists is vital," said Stanley Fineman, MD, ACAAI past president. "At our recent Annual Scientific Meeting, we convened an anaphylaxis roundtable discussion between emergency room physicians and allergists. We discussed how, together, we can get the word out about the importance of rapid epinephrine administration for those suffering from anaphylaxis. It's a message we want to get out to everyone dealing with severe allergies."

A recent study released at the 2014 ACAAI Annual Scientific Meeting showed that not all doctors know that epinephrine needs to be used first when treating an allergic reaction. Another recent study presented at the ACAAI Annual Scientific Meeting proved that emergency supplies of epinephrine in schools save lives.

http://www.eurekalert.org/pub_releases/2014-12/miot-la120214.php

Losing air

New study finds a barrage of small impacts likely erased much of the Earth's primordial atmosphere

Written by Jennifer Chu, MIT News Office

CAMBRIDGE, MA - Today's atmosphere likely bears little trace of its primordial self: Geochemical evidence suggests that Earth's atmosphere may have been completely obliterated at least twice since its formation more than 4 billion years ago. However, it's unclear what interplanetary forces could have driven such a dramatic loss.

Now researchers at MIT, Hebrew University, and Caltech have landed on a likely scenario: A relentless blitz of small space rocks, or planetesimals, may have bombarded Earth around the time the moon was formed, kicking up clouds of gas with enough force to permanently eject small portions of the atmosphere into space.

Tens of thousands of such small impacts, the researchers calculate, could efficiently jettison Earth's entire primordial atmosphere. Such impacts may have also blasted other planets, and even peeled away the atmospheres of Venus and Mars.

In fact, the researchers found that small planetesimals may be much more effective than giant impactors in driving atmospheric loss. Based on their calculations, it would take a giant impact - almost as massive as the Earth slamming into itself - to disperse most of the atmosphere. But taken together, many small impacts would have the same effect, at a tiny fraction of the mass.

Hilke Schlichting, an assistant professor in MIT's Department of Earth, Atmospheric and Planetary Sciences, says understanding the drivers of Earth's ancient atmosphere may help scientists to identify the early planetary conditions that encouraged life to form.

"[This finding] sets a very different initial condition for what the early Earth's atmosphere was most likely like," Schlichting says. "It gives us a new starting point for trying to understand what was the composition of the atmosphere, and what were the conditions for developing life."

Schlichting and her colleagues have published their results in the journal Icarus.

Efficient Ejection

The group examined how much atmosphere was retained and lost following impacts with giant, Mars-sized and larger bodies and with smaller impactors measuring 25 kilometers or less - space rocks equivalent to those whizzing around the asteroid belt today.

The team performed numerical analyses, calculating the force generated by a given impacting mass at a certain velocity, and the resulting loss of atmospheric gases. A collision with an impactor as massive as Mars, the researchers found, would generate a shockwave through the Earth's interior, setting off significant ground motion - similar to simultaneous giant earthquakes around the planet - whose force would ripple out into the atmosphere, a process that could potentially eject a significant fraction, if not all, of the planet's atmosphere.

However, if such a giant collision occurred, it should also melt everything within the planet, turning its interior into a homogenous slurry. Given the diversity of noble gases like helium-3 deep inside the Earth today, the researchers concluded that it is unlikely that such a giant, core-melting impact occurred.

Instead, the team calculated the effects of much smaller impactors on Earth's atmosphere. Such space rocks, upon impact, would generate an explosion of sorts, releasing a plume of debris and gas. The largest of these impactors would be forceful enough to eject all gas from the atmosphere immediately above the impact's tangent plane - the line perpendicular to the impactor's trajectory. Only a fraction of this atmosphere would be lost following smaller impacts.

To completely eject all of Earth's atmosphere, the team estimated, the planet would need to have been bombarded by tens of thousands of small impactors - a scenario that likely did occur 4.5 billion years ago, during a time when the moon was formed. This period was one of galactic chaos, as hundreds of thousands of space rocks whirled around the solar system, frequently colliding to form the planets, the moon, and other bodies. "For sure, we did have all these smaller impactors back then," Schlichting says. "One small impact cannot get rid of most of the atmosphere, but collectively, they're much more efficient than giant impacts, and could easily eject all the Earth's atmosphere."

Runaway Effect

However, Schlichting realized that the sum effect of small impacts may be too efficient at driving atmospheric loss. Other scientists have measured the atmospheric composition of Earth compared with Venus and Mars. These measurements have revealed that while each planetary atmosphere has similar patterns of noble gas abundance, the budget for Venus is similar to that of chondrites - stony meteorites that are primordial leftovers of the early solar system. Compared with Venus, Earth's noble gas budget has been depleted 100-fold.

Schlichting realized that if both planets were exposed to the same blitz of small impactors, Venus' atmosphere should have been similarly depleted. She and her colleagues went back over the small-impactor scenario, examining the effects of atmospheric loss in more detail, to try and account for the difference between the two planets' atmospheres.

Based on further calculations, the team identified an interesting effect: Once half a planet's atmosphere has been lost, it becomes much easier for small impactors to eject the rest of the gas. The researchers calculated that Venus' atmosphere would only have to start out slightly more massive than Earth's in order for small impactors to erode the first half of the Earth's atmosphere, while keeping Venus' intact. From that point, Schlichting describes the phenomenon as a "runaway process - once you manage to get rid of the first half, the second half is even easier."

Time Zero

During the course of the group's research, an inevitable question arose: What eventually replaced Earth's atmosphere? Upon further calculations, Schlichting and her team found the same impactors that ejected gas also may have introduced new gases, or volatiles. "When an impact happens, it melts the planetesimal, and its volatiles can go into the atmosphere," Schlichting says. "They not only can deplete, but replenish part of the atmosphere."

The group calculated the amount of volatiles that may be released by a rock of a given composition and mass, and found that a significant portion of the atmosphere may have been replenished by the impact of tens of thousands of space rocks. "Our numbers are realistic, given what we know about the volatile content of the different rocks we have," Schlichting notes.

Going forward, Schlichting hopes to examine more closely the conditions underlying Earth's early formation, including the interplay between the release of volatiles from small impactors and from Earth's ancient magma ocean.

"We want to connect these geophysical processes to determine what was the most likely composition of the atmosphere at time zero, when the Earth just formed, and hopefully identify conditions for the evolution of life," Schlichting says.

http://www.eurekalert.org/pub_releases/2014-12/uorm-bth120114.php

Blows to head damage brain's 'garbage truck,' accelerate dementia

A new study out today in the Journal of Neuroscience shows that traumatic brain injury can disrupt the function of the brain's waste removal system.

When this occurs, toxic proteins may accumulate in the brain, setting the stage for the onset of neurodegenerative diseases such as Alzheimer's and chronic traumatic encephalopathy.

"We know that traumatic brain injury early in life is a risk factor for the early development of dementia in the decades that follow," said Maiken Nedergaard, M.D., D.M.Sc., co-director of the University of Rochester Center for Translational Neuromedicine and senior author of the article. "This study shows that these injuries set into motion a cascading series of events that impair the brain's ability to clear waste, allowing proteins like tau to spread throughout the brain and eventually reach toxic levels."

The findings are the latest in a series of new insights that are fundamentally changing the way scientists understand neurological disorders. These discoveries are possible due to a study published in 2012 in which Nedergaard and her colleagues described a previously unknown system of waste removal that is unique to the brain which researchers have dubbed the glymphatic system.

The brain is essentially closed off from the rest of the body by a complex system of molecular gateways, called the blood-brain barrier, that tightly control what enters and exits the brain. Consequently, the body's normal waste removal system does not extend to the brain.

As with the rest of the body, the timely removal of waste from the brain is essential to prevent the unchecked accumulation of toxic proteins and other debris. However, until recently no one was entirely clear how the brain accomplished this.

Nedergaard and her colleagues showed that mice, whose brains are remarkably similar to humans, possess what amounts to a plumbing system that piggybacks on blood vessels to pump cerebral spinal fluid (CSF), the fluid surrounding the brain, through brain tissue, flushing away the waste from the spaces between the brain's cells.

Recent studies have shown that the glymphatic system is more active during sleep, which may explain why sleep is so refreshing to the mind, and that its function declines with age.

"The failure of the glymphatic system may be one of the reasons that the aging brain is so vulnerable to diseases like Alzheimer's," said Jeffrey Iliff, Ph.D., co-author of study, a member of Nedergaard's research team, and an assistant professor at Oregon Health and Science University. "It's striking that the same changes that we see in the aging brain are mirrored in the young brain after traumatic brain injury. It suggests that these events may be the common link to neurodegeneration, between what happens in the elderly and what happens after brain trauma."

The new research focuses on the impact that traumatic brain injury has on the glymphatic system. It has been long observed that the protein tau plays an important role in the long-term damage sustained by the brain after a trauma. Tau helps stabilize the fibers, or axons, that nerve cells send out to communicate with their neighbors.

However, during trauma, large numbers of these proteins are shaken free from the axons to drift in the space between the brain's cells. Once unmoored from nerve cells, these sticky proteins are attracted to each other and, over time, form increasingly larger "tangles" that can become toxic to brain function.

Under normal circumstances, the glymphatic system is able to clear stray tau from the brain. However, when the researchers studied the brains of mice with traumatic brain injury, they found that the trauma damaged the glymphatic system, specifically the ability of astrocytes - a support cell found in the brain - to regulate the cleaning process.

Astrocytes play a critical role in organizing the flow of CSF into the brain. Branches from the cells enclose the brain's blood vessels creating a space-essentially a pipe within a pipe - into which CSF can follow the path of the blood vessels and flow into the interior of the brain. The branches of the astrocytes that form the outer "pipe" are lined with a massive number of structures known as water channels - or aquaporins - that help ensure the efficient flow of CSF along the blood vessels into and out of the brain. The researchers observed that after traumatic brain injury, the aquaporins lose their organization, impairing the flow of CSF into the brain.

"In order to clear waste the glymphatic system must pump CSF through the brain," said Nedergaard. "This study would seem to indicate that the system is very delicate and that small changes in the organization of water channels can cause it to lose function."

Long after the injury, the researchers noted that the excess tau was not being cleared from the animals' brains and that tau had begun to aggregate throughout the brain. In animals with impaired aquaporin water channels, tau accumulated far more rapidly.

The researchers also had the animals perform a series of experiments to test their memory and cognitive abilities. The animals with traumatic brain injury all performed far worse than controls. Animals with impaired water channels function did even worse and showed no improvement over time.

"For a long time, we have viewed neurodegenerative diseases like Alzheimer's as a supply problem, meaning that we believed the brain was producing too much tau or amyloid beta," said Benjamin Plog, an M.D./Ph.D. student in Nedergaard's lab and a co-author of the study. "It now appears that these conditions may ultimately be linked to a clearance problem, where something is preventing the glymphatic system from removing waste from the brain fast enough."

Additional co-authors include Michael Chen, Lijun Yang, Itender Singh, and Rashid Deane with the University of Rochester, and Douglas Zeppenfeld with the Oregon Health and Science University. The study was supported with funding from the National Institute of Neurological Disorders and Stroke and the American Heart Association.

http://www.eurekalert.org/pub_releases/2014-12/uomh-alt120114.php

Antacids linked to better survival in head and neck cancer

Patients with head and neck cancer who used antacid medicines to control acid reflux had better overall survival, according to a new study from the University of Michigan Comprehensive Cancer Center.

ANN ARBOR, Mich. - Reflux can be a common side effect of chemotherapy or radiation treatment for head and neck cancer. Doctors at the University of Michigan frequently prescribe two types of antacids - proton pump inhibitors or histamine 2 blockers - to help treat this side effect. The researchers looked at 596 patients who were treated for head and neck cancer. More than two-thirds of the patients took one or both types of antacid medication after their diagnosis.

Patients who were taking antacids had significantly better overall survival than those who did not take them. Proton pump inhibitors, which include drugs such as Prilosec, Nexium and Prevacid, had the biggest effect: a 45 percent decreased risk of death, compared to patients who did not take antacids. Patients taking histamine 2 blockers, such as Tagamet, Zantac or Pepcid, saw a 33 percent decreased risk of death.

"We had suspicions that these medications somehow had a favorable impact on patient outcomes. This led us to review our large cohort of patients and screen them for common medications, focusing on antacids. In fact, our study did show that people taking antacids are doing better," says lead study author Silvana Papagerakis, M.D., Ph.D., research assistant professor of otolaryngology--head and neck surgery at the University of Michigan Medical School and an adjunct clinical assistant professor at the U-M School of Dentistry. Results of the study are published in the December issue of Cancer Prevention Research.

The researchers are not clear why these medications affect the cancer, although they have begun additional work to understand the mechanisms involved.

"Currently, patients might be on and off of this medication according to their symptoms of acid reflux. We believe this medication can also be beneficial at stopping cancer progression. Perhaps longer duration of treatments may have significant effect in terms of outcome survival," Papagerakis says.

In addition, the researchers would like to understand if using antacids in people with reflux disease or people with precancerous lesions might reduce their risk of developing head and neck cancer.

Antacids are seen as relatively safe and typically have little or no adverse side effects. More importantly, Papagerakis notes, head and neck cancer patients are already taking these medications. "What this study makes clear is these medications may be more beneficial to the patients than just controlling side effects," she says.

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http://www.bbc.com/news/technology-30290540

Stephen Hawking warns artificial intelligence could end mankind

Prof Stephen Hawking, one of Britain's pre-eminent scientists, has said that efforts to create thinking machines pose a threat to our very existence.

Rory Cellan-Jones By Rory Cellan-Jones Technology correspondent

He told the BBC:"The development of full artificial intelligence could spell the end of the human race." His warning came in response to a question about a revamp of the technology he uses to communicate, which involves a basic form of AI. But others are less gloomy about AI's prospects.

The theoretical physicist, who has the motor neurone disease amyotrophic lateral sclerosis (ALS), is using a new system developed by Intel to speak.

Machine learning experts from the British company Swiftkey were also involved in its creation. Their technology, already employed as a smartphone keyboard app, learns how the professor thinks and suggests the words he might want to use next.

Prof Hawking says the primitive forms of artificial intelligence developed so far have already proved very useful, but he fears the consequences of creating something that can match or surpass humans. "It would take off on its own, and re-design itself at an ever increasing rate," he said. "Humans, who are limited by slow biological evolution, couldn't compete, and would be superseded."

But others are less pessimistic. "I believe we will remain in charge of the technology for a decently long time and the potential of it to solve many of the world problems will be realised," said Rollo Carpenter, creator of Cleverbot. Cleverbot's software learns from its past conversations, and has gained high scores in the Turing test, fooling a high proportion of people into believing they are talking to a human.

Rise of the robots

Mr Carpenter says we are a long way from having the computing power or developing the algorithms needed to achieve full artificial intelligence, but believes it will come in the next few decades.

"We cannot quite know what will happen if a machine exceeds our own intelligence, so we can't know if we'll be infinitely helped by it, or ignored by it and sidelined, or conceivably destroyed by it," he says.

But he is betting that AI is going to be a positive force.

Prof Hawking is not alone in fearing for the future.

In the short term, there are concerns that clever machines capable of undertaking tasks done by humans until now will swiftly destroy millions of jobs.

In the longer term, the technology entrepreneur Elon Musk has warned that AI is "our biggest existential threat".

Robotic voice

In his BBC interview, Prof Hawking also talks of the benefits and dangers of the internet.

He quotes the director of GCHQ's warning about the net becoming the command centre for terrorists: "More must be done by the internet companies to counter the threat, but the difficulty is to do this without sacrificing freedom and privacy."

He has, however, been an enthusiastic early adopter of all kinds of communication technologies and is looking forward to being able to write much faster with his new system.

But one aspect of his own tech - his computer generated voice - has not changed in the latest update. Prof Hawking concedes that it's slightly robotic, but insists he didn't want a more natural voice. "It has become my trademark, and I wouldn't change it for a more natural voice with a British accent," he said.

"I'm told that children who need a computer voice, want one like mine."

http://bit.ly/1yW51ui

Origins of Human Alcohol Consumption Revealed

Human ancestors may have begun evolving the knack for consuming alcohol about 10 million years ago, long before modern humans began brewing booze, researchers say.

by Charles Q. Choi, Live Science Contributor

The ability to break down alcohol likely helped human ancestors make the most out of rotting, fermented fruit that fell onto the forest floor, the researchers said. Therefore, knowing when this ability developed could help researchers figure out when these human ancestors began moving to life on the ground, as opposed to mostly in trees, as earlier human ancestors had lived.

"A lot of aspects about the modern human condition - everything from back pain to ingesting too much salt, sugar and fat - goes back to our evolutionary history," said lead study author Matthew Carrigan, a paleogeneticist at Santa Fe College in Gainesville, Florida. "We wanted to understand more about the modern human condition with regards to ethanol," he said, referring to the kind of alcohol found in rotting fruit and that's also used in liquor and fuel.

To learn more about how human ancestors evolved the ability to break down alcohol, scientists focused on the genes that code for a group of digestive enzymes called the ADH4 family. ADH4 enzymes are found in the stomach, throat and tongue of primates, and are the first alcohol-metabolizing enzymes to encounter ethanol after it is imbibed.

The researchers investigated the ADH4 genes from 28 different mammals, including 17 primates. They collected the sequences of these genes from either genetic databanks or well-preserved tissue samples.

The scientists looked at the family trees of these 28 species, to investigate how closely related they were and find out when their ancestors diverged. In total, they explored nearly 70 million years of primate evolution. The scientists then used this knowledge to investigate how the ADH4 genes evolved over time and what the ADH4 genes of their ancestors might have been like.

Then, Carrigan and his colleagues took the genes for ADH4 from these 28 species, as well as the ancestral genes they modeled, and plugged them into bacteria, which read the genes and manufactured the ADH4 enzymes. Next, they tested how well those enzymes broke down ethanol and other alcohols.

This method of using bacteria to read ancestral genes is "a new way to observe changes that happened a long time ago that didn't fossilize into bones," Carrigan said.

The results suggested there was a single genetic mutation 10 million years ago that endowed human ancestors with an enhanced ability to break down ethanol. "I

remember seeing this huge difference in effects with this mutation and being really surprised," Carrigan said.

The scientists noted that the timing of this mutation coincided with a shift to a terrestrial lifestyle. The ability to consume ethanol may have helped human ancestors dine on rotting, fermenting fruit that fell on the forest floor when other food was scarce.

"I suspect ethanol was a second-choice item," Carrigan said. "If the ancestors of humans, chimps and gorillas had a choice between rotten and normal fruit, they would go for the normal fruit. Just because they were adapted to be able to ingest it doesn't mean ethanol was their first choice, nor that they were perfectly adapted to metabolize it. They might have benefited from small quantities, but not to excessive consumption."

In people today, drinking in moderation can have benefits, but drinking in excess can definitely cause health problems, experts agree. Scientists have suggested that problems people have with drinking, such as heart disease, liver disease, and mental health problems, result because humans have not evolved genes to sufficiently process ethanol. Similarly, humans have not evolved genes to handle large amounts of sugar, fat and salt, which, in turn, have given way to obesity, diabetes, high blood pressure and many other health problems.

One model for the evolution of alcohol consumption suggests that ethanol only entered the human diet after people began to store extra food, potentially after the advent of agriculture, and that humans subsequently developed ways to intentionally direct the fermentation of food about 9,000 years ago. Therefore, the theory goes, alcoholism as a disease resulted because the human genome has not had enough time to fully adapt to alcohol.

Another model suggests that human ancestors began consuming alcohol as early as 80 million years ago, when early primates occasionally ate rotting fermented fruit rich in ethanol. This model suggests that the attraction to alcohol started becoming a problem once modern humans began intentionally fermenting food because it generated far more ethanol than was normally found in nature. The new findings support this model.

In the future, Carrigan and his colleagues want to investigate what the ethanol content of fallen fruit might be, and find out whether apes, such as chimpanzees or gorillas, are willing to consume fermented fruit with varying levels of ethanol.

"We also want to look at other enzymes involved in alcohol metabolism, to see if they're co-evolving with ADH4 at the same time," Carrigan said.

The scientists detailed their findings online today (Dec. 1) in the journal Proceedings of the National Academy of Sciences.

http://bit.ly/1wa2qyO

This Plant-Based Gel Stops Bleeding in Seconds

A salve that seals severe wounds is making its way to veterinary clinics. Military and trauma testing may soon follow

By Matt Safford

Whether it's brought on by a bullet wound, a vehicle accident or some other form of trauma, severe blood loss can kill in just a few minutes. Even when medical professionals arrive on the scene quickly, keeping the victim alive long enough to reach a hospital in extreme cases is often difficult, if not impossible.

A small company called Suneris has developed VetiGel, a plant-based polymer that the founders say can stop bleeding of both skin and organ injuries in 20 seconds or less. While they're still working on ways to simplify the application process, the gel essentially just needs to be spread on the wound, with no need for pressure. Co-founder and CEO, Joe Landolina, says his team's eventual goal is to make the product as easy to use as an EpiPen.

Of course, there are competing products aiming to quickly stop blood loss, including QuickClot, which works by absorbing water, thus concentrating coagulants, and Xstat, which is made up of pill-sized sponges. But Landolina says most of these products either take minutes to stop blood flow or require pressure to be applied while the clot forms.

VetiGel is different in that it's formed from plant cell wall polymers that, according to the company, form a mesh when exposed to blood or tissue. The mesh quickly collects fibrin, a protein that's key to the clotting of blood. And because it's plant-based, the mesh can be left in the wound to be absorbed by the body as it heals.

"Other products are constrained to the geometry of wounds, meaning that certain products can only work on a bullet wound or on a specific type of wound," says Landolina. "A gel like ours can work on anything. It will always trigger a durable clot and will always form without pressure."

VetiGel isn't yet approved for human use. But Landolina says that his company is researching and developing the gel at its manufacturing facility in Brooklyn, while releasing it for use in a few veterinary clinics to get feedback and further tweak the product.

At the moment, the main goal is to make sure VetiGel works well for common veterinary procedures, to give it a wide appeal. But Landolina and his team are also getting feedback from vets about specific procedures, some of which can't currently be done safely because of fear of blood loss. An in-house design engineer tailors syringe tips to fit those needs.

"We can have a tip that's designed specifically to work on neural tissue, or a tip that is specifically made for the extraction of teeth in animals," says Landolina. "All of these are awesome ideas that came out of working with veterinarians that have been confronted with these problems without solutions."

While the idea for VetiGel came to Landolina about four years ago, when he was a freshman at New York University, it was earlier life experiences that set him on the path to the gel's discovery. His grandfather was a wine maker who worked in a chemistry lab, and every day after school, since about the age of 11, Landolina says he would go there to learn and experiment.

"My mom would always tell me to work with safer chemicals," says Landolina, "which meant that I had to work with plants and plant extracts. I spent a lot of time just playing around and mixing things." In that time, he says he stumbled on a material that reacted in visual and physical ways when placed next to animal tissue. "That initial spark," says Landolina, "sent me down the research path to find what became the underlying technology that we have today."

While this sounds immensely promising for the field of wound treatment, very little information about VetiGel is available outside Suneris' website and various news stories about the technology. Landolina and Suneris, a private company, are keeping many details about the material from the public for now, to safeguard their intellectual property. He says they have been working with outside researchers to validate the company's claims.

But that will likely change soon, as more veterinarians use the gel and the company works toward human trials, which could come as early as late 2015. The Department of Defense has shown interest in VetiGel for treating wounded soldiers in the field. The gel will likely land there and with trauma doctors before seeing any wide-scale approval. But Landolina hopes it will one day be found in ambulances, even purses.

"In the coming months, our focus is to begin publishing," says Landolina. "We've finally gotten to a point where we're comfortable, and now it's about getting everything we have peer reviewed and open, so that we can not only build up a commercial case for the product, but also a scientific case."

http://bit.ly/1s5b7DH

Most College Students Don't Graduate on Time

The vast majority of students take more than 4 years to earn a bachelor's degree

By Colin Schultz

From a purely dollars and cents perspective, going to college is an investment. Students are trading years of their working lives and tens of thousands of dollars (if not more) for the prospect of a better paying job in the future. But the economic valuation of a college degree loses some of its luster for every extra year students have to stay on campus. Yet as the New York Times reports, taking extra time to graduate has somehow become the norm - a trend that's only adding to student's often-crippling debt.

According to a report put out by Complete College America, a nonprofit organization, the vast majority of bachelor's degree students fail to graduate in the expected 4 years. Instead, says the Times, only 19 percent of undergraduate students graduate on time. At the community college level "the problem is even worse," says the Times: "5 percent of full-time students earned an associate degree within two years, and 15.9 percent earned a one- to two-year certificate on time." Every extra year of tuition adds to the cost of getting educated, with students who stick around often adding to their accumulating debt.

The report only looked at public universities and college in the U.S., but according to the census bureau public college students outnumber private ones by roughly 2.6 to 1. Even if all private college students graduated on time, this would still mean the bulk of American college students are taking extra time. But with the often higher tution fees for private colleges, the extra costs would rack up even faster for students who take their time.

Part of the cause for student's slipping schedules is indecision, says the Times, with students switching schools or programs midstream. Some students don't take a full course load (perhaps because they're working part-time). But some of the delays are institutional: "Some of the causes of slow student progress, the report said, are inability to register for required courses, credits lost in transfer and remediation sequences that do not work."

According to CNN, 40 million Americans are carrying student loan debt with an average value of $29,000, a cumulative sum of $1.2 trillion

http://www.eurekalert.org/pub_releases/2014-12/uoc--sdb120314.php

Scientists detect brain network that gives humans superior reasoning skills

When it comes to problem-solving, humans have an evolutionary edge over other primates

When it comes to getting out of a tricky situation, we humans have an evolutionary edge over other primates. Take, as a dramatic example, the Apollo 13 voyage in which engineers, against all odds, improvised a chemical filter on a lunar module to prevent carbon dioxide buildup from killing the crew.

UC Berkeley scientists have found mounting brain evidence that helps explain how humans have excelled at "relational reasoning," a cognitive skill in which we discern patterns and relationships to make sense of seemingly unrelated information, such as solving problems in unfamiliar circumstances.

Their findings, reported in the Dec. 3 issue of the journal Neuron, suggest that subtle shifts in the frontal and parietal lobes of the brain are linked to superior cognition. Among other things, the frontoparietal network plays a key role in analysis, memory retrieval, abstract thinking and problem-solving, and has the fluidity to adapt according to the task at hand.

"This research has led us to take seriously the possibility that tweaks to this network over an evolutionary timescale could help to explain differences in the way that humans and other primates solve problems," said UC Berkeley neuroscientist Silvia Bunge, the study's principal investigator. "It's not just that we humans have language at our disposal. We also have the capacity to compare and integrate several pieces of information in a way that other primates don't."

In reviewing dozens of studies - including their own - that use neuroimaging, neuropsychology, developmental cognitive and other investigative methods, Bunge and fellow researchers concluded that anatomical changes in the lateral frontoparietal network over millennia have served to boost human reasoning skills.

"Given the supporting evidence across species, we posit that connections between these frontal and parietal regions have provided the necessary support for our unique ability to reason using abstract relations," said Michael Vendetti, co-author of the study and a postdoctoral researcher in neuroscience at UC Berkeley.

Relational reasoning is a high-level cognitive process in which we make comparisons and find equivalencies, as one does in algebra, for example. First-order comparisons identify the relationship between two items or activities in the following ways: semantic (hammer is used to hit a nail); numeric (four is greater than two); temporal (we get out of bed before we go to work) or visuospatial (the bird is on top of the house). Second-order or higher-order comparisons take this a step further by equating two or more sets of first-order relations (a chain is to a link as a bouquet is to a flower).

To test their hypothesis that the human gift for relational reasoning can be traced to developmental and evolutionary changes in the brain's lateral frontoparietal network, the researchers examined studies that track anatomical changes in the developing human brain; compare neural patterns in human and non-human primates, and compare how human and non-human primates tackle various reasoning tasks.

Their exhaustive meta-analysis identified three parts of the brain that play key roles in relational reasoning, the rostrolateral prefrontal cortex, the dorsolateral prefrontal cortex and the inferior parietal lobule, with the rostrolateral region more actively engaged in second-order relational reasoning.

In looking at brain development, they found that "synaptic pruning," which usually takes place in adolescence when white matter replaces gray matter and signals between neurons speed up, was more evident in the inferior parietal regions of the brain.

Also crucial to their finding was a study led by Oxford University neuroscientist Matthew Rushworth that compared neural patterns in humans and macaque monkeys. While human and non-human primates were found to share similarities in the frontal and parietal brain regions, activity in the human rostrolateral prefrontal cortex differed significantly from that of the macaque monkey's frontal cortex, the study found.

"We had hypothesized that there could have been evolutionary changes to this region to support our reasoning ability, so we were really excited when Rushworth and his colleagues came out with these findings," Vendetti said.

Meanwhile, in the behavioral studies they analyzed, humans were found to use higher-order strategies to guide their judgment while non-human primates relied more heavily on perceptual similarities and were slower at reasoning and problem-solving.

"These results do not necessarily prove that non-human primates are unable to reason using higher-order thinking, but if it is possible to train non-humans to produce human-like performance on tasks associated with higher-order relational thinking, it is certainly not something that comes naturally to them," the study concluded.

Overall, Bunge said, "The findings allow us to gain insights into human intelligence by examining how we got to where we are by examining our changes across both evolution and development."

http://bit.ly/1u3DIsL

Proper Copper Levels Essential to Spontaneous Neural Activity

Proper copper levels are essential to the health of a brain at rest

A new study from the Berkeley Lab reveals that proper copper levels are essential to the health of a brain at rest and suggests that mismanagement of copper in the brain linked to Alzheimer's and other neurological disorders can also contribute to misregulation of signaling in cell−to-cell communications.

In recent years it has been established that copper plays an essential role in the health of the human brain. Improper copper oxidation has been linked to several neurological disorders including Alzheimer's, Parkinson's, Menkes' and Wilson's. Copper has also been identified as a critical ingredient in the enzymes that activate the brain's neurotransmitters in response to stimuli. Now a new study by researchers with the U.S. Department of Energy (DOE)'s Lawrence Berkeley National Laboratory (Berkeley Lab) has shown that proper copper levels are also essential to the health of the brain at rest.

"Using new molecular imaging techniques, we've identified copper as a dynamic modulator of spontaneous activity of developing neural circuits, which is the baseline activity of neurons without active stimuli, kind of like when you sleep or daydream, that allows circuits to rest and adapt," says Chris Chang, a faculty chemist with Berkeley Lab's Chemical Sciences Division who led this study. "Traditionally, copper has been regarded as a static metabolic cofactor that must be buried within enzymes to protect against the generation of reactive oxygen species and subsequent free radical damage. We've shown that dynamic and loosely bound pools of copper can also modulate neural activity and are essential for the normal development of synapses and circuits."

Chang , who also holds appointments with the University of California (UC) Berkeley's Chemistry Department and the Howard Hughes Medical Institute (HHMI), is the corresponding author of a paper that describes this study in the Proceedings of the National Academy of Sciences (PNAS). The paper is titled "Copper is an endogenous modulator of neural circuit spontaneous activity." Co-authors are Sheel Dodani, Alana Firl, Jefferson Chan, Christine Nam, Allegra Aron, Carl Onak, Karla Ramos-Torres, Jaeho Paek, Corey Webster and Marla Feller.

Although the human brain accounts for only two-percent of total body mass, it consumes 20-percent of the oxygen taken in through respiration. This high demand for oxygen and oxidative metabolism has resulted in the brain harboring the body's highest levels of copper, as well as iron and zinc. Over the past few years, Chang and his research group at UC Berkeley have developed a series of fluorescent probes for molecular imaging of copper in the brain.

"A lack of methods for monitoring dynamic changes in copper in whole living organisms has made it difficult to determine the complex relationships between copper status and various stages of health and disease," Chang said. "We've been designing fluorescent probes that can map the movement of copper in live cells, tissue or even model organisms, such as mice and zebra fish."

For this latest study, Chang and his group developed a fluorescent probe called Copper Fluor-3 (CF3) that can be used for one- and two-photon imaging of copper ions. This new probe allowed them to explore the potential contributions to cell signaling of loosely bound forms of copper in hippocampal neurons and retinal tissue.

"CF3 is a more hydrophilic probe compared to others we have made, so it gives more even staining and is suitable for both cells and tissue," Chang says. "It allows us to utilize both confocal and two-photon imaging methods when we use it along with a matching control dye (Ctrl-CF3) that lacks sensitivity to copper."

With the combination of CF3 and Ctrl-CF3, Chang and his group showed that neurons and neural tissue maintain stores of loosely bound copper that can be attenuated by chelation to create what is called a "labile copper pool." Targeted disruption of these labile copper pools by acute chelation or genetic knockdown of the copper ion channel known as CTR1 (for copper transporter 1) alters spontaneous neural activity in developing hippocampal and retinal circuits.

"We demonstrated that the addition of the copper chelator bathocuproine disulfonate (BCS) modulates copper signaling which translates into modulation of neural activity," Chang says. "Acute copper chelation as a result of additional BCS in dissociated hippocampal cultures and intact developing retinal tissue removed the copper which resulted in too much spontaneous activity."

The results of this study suggest that the mismanagement of copper in the brain that has been linked to Wilson's, Alzheimer's and other neurological disorders can also contribute to misregulation of signaling in cell−to-cell communications.

"Our results hold therapeutic implications in that whether a patient needs copper supplements or copper chelators depends on how much copper is present and where in the brain it is located," Chang says. "These findings also highlight the continuing need to develop molecular imaging probes as pilot screening tools to help uncover unique and unexplored metal biology in living systems."

This research was supported by the National Institutes of Health and the Howard Hughes Medical Institute.

Publication: Sheel C. Dodani, et al., "Copper is an endogenous modulator of neural circuit spontaneous activity," PNAS, 2014, vol. 111 no. 46, 16280–16285; doi: 10.1073/pnas.1409796111

Source: Lynn Yarris, Lawrence Berkeley National Laboratory

http://www.eurekalert.org/pub_releases/2014-12/cwru-psg120114.php

Peptide shows great promise for treating spinal cord injury

Case Western Reserve scientists design intracellular sigma peptide to promote functional recovery following spinal cord injury

Case Western Reserve scientists have developed a new chemical compound that shows extraordinary promise in restoring function lost to spinal cord injury. The compound, which the researchers dubbed intracellular sigma peptide (ISP), allowed paralyzed muscles to activate in more than 80 percent of the animals tested. The remarkable study, partly funded by the National Institutes of Health, appears in the December 3 edition of the journal Nature.

Case Western Reserve University School of Medicine Professor of Neurosciences Jerry Silver, PhD, the senior author, led an international team of scientists in the research in which 21 of 26 animals with spinal cord injury regained the ability to

urinate, move or both. In the experiments, the peptide appears to allow nerve fibers to overcome scarring that normally blocks their regrowth.

"This recovery is unprecedented," Silver said. "Each of the 21 animals got something back in terms of function. For any spinal cord-injured patient today, it would be considered extraordinary to regain even one of these functions, especially bladder function. ISP additionally has treatment potential for diseases where the body produces destructive scarring such as heart attack, peripheral nerve injury and multiple sclerosis (MS)." (Silver's team now is testing the effectiveness of ISP in animal models of these disorders.)

Immediately after a central nervous system (CNS) injury, molecules known as proteoglycans collect in scar tissue at the injury site and in the perineuronal net (PNN). In healthy tissue, proteoglycans are key components in the matrix between cells and play a key role in maintaining the structure of the nervous system. However, following injury, proteoglycans are overly abundant in scar tissue and the impenetrable nets around synapses throughout the brain and spinal cord. The consequence is a formidable barrier preventing regeneration and new nerve connections. Proteoglycans produce a sticky quagmire, trapping and restricting the cut nerve fiber tips (called growth cones) from making their journey back to their proper synaptic connections. It is these connections that transmit critical information through electrical impulses to nerve cells that enable a person or animal to control bodily functions.

"There are currently no drug therapies available that improve the very limited natural recovery from spinal cord injuries that patients experience," said Lyn Jakeman, PhD, a program director at the NIH's National Institute of Neurological Disorders and Stroke, Bethesda, Md. "This is a great step toward identifying a novel agent for helping people recover."

The investigators designed the ISP peptide to turn off the neuron's proteoglycan receptor on/off switch. In addition, they added a shuttle called TAT (trans-activator of transcription) to send ISP throughout the nervous system and across cell membranes. ISP travels to and penetrates the membranes of cells, including the scar tissue-covered injury site. Because the peptides can penetrate tissue, ISP can be delivered systemically rather than with a direct injection to the spinal cord.

"Our treatment strategy was designed to be easily translatable," said Bradley Lang, a Silver lab graduate student and lead author on the study. "Our goal is to progress this treatment forward for use as a therapeutic following spinal cord injury."

For this study, 26 severely spinal cord-injured animals (rats) received daily injections for seven weeks. During that time, the animals were assessed for their ability to walk, to balance and to control when and how much they urinate. The results showed that 21 of the 26 animals regained one or more of the functions well after injections began. Some animals regained all three behaviors and others one or two out of three. "We don't know why a particular animal regained a specific function," Silver said. "That is one of the big remaining questions."

One clue may be the small amounts of nerve tracts spared in the animals' spinal cords. These remaining tracts are differentially damaged by bleeding or inflammation sustained just after the original injury. One especially important tract that responded robustly to ISP contains serotonergic fibers. These fibers release the neurotransmitter serotonin into the spinal cord, which, in turn, greatly enhances functional activity of the scant numbers of remaining fiber tracts that control the behaviors that were restored.

Each animal had different serotonergic sprouting patterns and variable tract sparing, which probably accounts for the different functions they were able to regain. "Sprouting is a critical phenomenon," Silver said. "Even if there are just a few intact fibers left after the injury, it could be one critical piece that brings back an important function." Silver also commented about a next research step regarding ISP. "Our goal is to progress this treatment forward for use as a therapeutic following spinal cord injury," he said.

Joining Silver and Lang in this research effort are contributing authors Jared Cregg, Marc DePaul, Amanda Tran and Kathryn Madalena, all of the Department of Neurosciences, Case Western Reserve University School of Medicine; Sarah Busch, PhD, of Athersys; Kui Xu and Yingjie Shen, PhD, both of the Center for Brain and Spinal Cord Repair, Department of Neuroscience, Wexner Medical Center at The Ohio State University; Scott Dyck and Soheila Karimi-Abdolrezaee, PhD, both of the Regenerative Medicine Program and Department of Physiology, University of Manitoba; Benjamin Brown, Baldwin Wallace University; Yi-Lan Weng, PhD, Institute for Cell Engineering, Johns Hopkins University School of Medicine; and Shuxin Li, PhD, Shriners Hospital's Pediatric Research Center (Center for Neural Repair and Rehabilitation), Temple University School of Medicine.

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Barrier-breaking drug may lead to spinal cord injury treatments

NIH-funded scientists take first step towards developing promising new drug

Injections of a new drug may partially relieve paralyzing spinal cord injuries, based on indications from a study in rats, which was partly funded by the National Institutes of Health

The results demonstrate how fundamental laboratory research may lead to new therapies. "We're very excited at the possibility that millions of people could, one

day, regain movements lost during spinal cord injuries," said Jerry Silver, Ph.D., professor of neurosciences, Case Western Reserve University School of Medicine, Cleveland, and a senior investigator of the study published in Nature.

Every year, tens of thousands of people are paralyzed by spinal cord injuries. The injuries crush and sever the long axons of spinal cord nerve cells, blocking communication between the brain and the body and resulting in paralysis below the injury.

On a hunch, Bradley Lang, Ph.D., the lead author of the study and a graduate student in Dr. Silver's lab, came up with the idea of designing a drug that would help axons regenerate without having to touch the healing spinal cord, as current treatments may require.

"Originally this was just a side project we brainstormed in the lab," said Dr. Lang.

After spinal cord injury, axons try to cross the injury site and reconnect with other cells but are stymied by scarring that forms after the injury. Previous studies suggested their movements are blocked when the protein tyrosine phosphatase sigma (PTP sigma), an enzyme found in axons, interacts with chondroitin sulfate proteoglycans, a class of sugary proteins that fill the scars.

Dr. Lang and his colleagues designed a drug called ISP to block the enzyme and facilitate the drug's entry into the brain and spinal cord. Injections of the drug under the skin of paralyzed rats near the injury site partially restored axon growth and improved movements and bladder functions.

"There are currently no drug therapies available that improve the very limited natural recovery from spinal cord injuries that patients experience," said Lyn Jakeman, Ph.D., a program director at the NIH's National Institute of Neurological Disorders and Stroke, Bethesda, MD. "This is a great step towards identifying a novel agent for helping people recover."

Initially, the goal of the study was to understand how interactions between PTP sigma and chondroitin sulfate proteoglycans prevent axon growth. Drugs were designed to mimic the shape of a critical part of PTP sigma, called the wedge. Different designs were tested on neurons grown in petri dishes alongside impenetrable barriers of proteoglycans. Treatment with ISP freed axon growth.

"It was amazing. The axons kept growing and growing," said Dr. Silver.

Next the researchers tested the potential of the drug on a rat model of spinal cord injury. For seven weeks they injected rats with the drug or a placebo near the site of injury. A few weeks later the rats that received the drug showed improvements in walking and urinating while the placebo treatments had no effect. The results suggested the drug passed into the brain and spinal cord.

When the researchers looked at the spinal cords under a microscope they found that the drug induced sprouting of axons that use the neurochemical serotonin to communicate. The sprouting axons were seen below the injury site. Treating some rats with a blocker of serotonin communication partially reversed the beneficial effects of ISP injections, suggesting the newly sprouting axons helped the rats recover.

The ISP drug did not cause spinal cord axons known to control movements to cross the scar and reconnect with brain neurons above the injury site. Dr. Silver and his colleagues think this means the ISP-induced sprouting helped the rats recover by increasing the signal sent by the few remaining intact axons.

"This is very promising. We now have an agent that may work alone or in combination with other treatments to improve the lives of many," said Dr. Silver. He and his colleagues are seeking to test the ISP drug in preclinical trials.

This work was supported by grants from the NINDS (NS025713), Case Western Reserve University Council to Advance Human Health, Mrs. Suzanne Poon, Unite to Fight Paralysis, The Brumagin Memorial Fund, Spinal Cord Injury Sucks, United Paralysis Foundation and The Kaneko Family Fund.

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http://bit.ly/1IeKaru

Hayabusa 2 probe begins journey to land on an asteroid

Japanese space agency JAXA today successfully launched Hayabusa 2 – an ambitious follow-up to its Hayabusa probe

13:20 03 December 2014 by Paul Marks

We can't get enough of space rocks. Just weeks after Rosetta's comet landing, Japanese space agency JAXA today successfully launched Hayabusa 2 – an ambitious follow-up to its Hayabusa probe, which landed on an asteroid in 2005. Hayabusa 2 will peck at the asteroid's surface to take samples and place four devices on it – including Mascot, a lander based on Philae technology. More spectacularly, it will hurl a 2-kilogram explosive device called a small carry-on impactor at the asteroid to create an artificial crater. Ejected material and the rock layers exposed by the impact can then be analysed. Watch a test firing of the explosive here.

Hayabusa 2 launched from the Tanegashima Space Center in Japan on an H-IIA rocket and will arrive at asteroid 1993 JU3 in 2018. That rock has been chosen because its reflectivity suggests it contains much organic matter and water, hopefully revealing insights into the origins of water, and therefore life, in the solar system.

Little leaping landers

Unlike Rosetta, Hayabusa 2 will sample the surface itself, using a probe mechanism slung beneath the craft to catch surface dust. To aim for a good

sampling spot, the spacecraft will drop a target marker on the asteroid's surface – effectively a beanbag it can home in on. It will also send back to Earth a sample from the artificial crater it creates, and this should arrive in 2020.

Hayabusa 2 is carrying three tiny, hopping rovers that will land on the asteroid – they are upgraded versions of one lost in space on the original Hayabusa mission. Inside the rovers are weights called torquers, and swinging these is what enables them to hop around.

The Mascot lander has been designed by German aerospace lab DLR - where Philae was developed. A simple box-shaped lander with no legs, Mascot's aim is to study the surface with four imaging and magnetic sensing instruments. Like the Minerva rovers, Mascot will also contain a swinging weight, letting it make surface hops.

http://bit.ly/1BqqGOO

Google updates hair-pulling CAPTCHA with tick box

Google's reCAPTCHA is a free anti-abuse service to protect users' websites from spam and abuse.

Dec 04, 2014 by Nancy Owano weblog

The good news is that the CAPTCHA test can be tossed for many users, replaced with a simple one-box tick saying you're human, not a robot. No mangled text; no frustrating fails because you can't tell if it's a g or a q or if that m is supposed to be two letters instead. Easy. A single checkbox next to the statement "I'm not a robot." Gets you where you want to go.

CAPTCHAs seemed like a good idea at one time, intended to protect against spam and abuse. "As spammers have grown more sophisticated," said Google's promotional reCAPTCHA video, "CAPTCHAs have gotten harder and harder to solve." Matthew Humphries, senior editor for Geek.com, added context to this remark, and said, "bots got clever enough to solve them, meaning the CAPTCHA had to get harder through very distorted text to the point where even a human has trouble reading some of them." What is more, while hard to figure out among the innocent, mischief makers were still gaining ground. "Today's Artificial Intelligence technology can solve even the most difficult variant of distorted text at 99.8% accuracy. Thus distorted text, on its own, is no longer a dependable test," blogged Vinay Shet, product manager, reCAPTCHA, on Wednesday. "For years, we've prompted users to confirm they aren't robots by asking them to read distorted text and type it into a box. But, we figured it would be easier to just directly ask our users whether or not they are robots - so, we did! We've begun rolling out a new API that radically simplifies the reCAPTCHA experience. We're calling it the "No CAPTCHA reCAPTCHA"

This No CAPTCHA reCAPTCHA API will attempt to monitor users' interactions with the CAPTCHA to see if they are genuine or a script. Most valid users will be able to simply click a box without seeing any CAPTCHA. What's the technology to make this possible? Google said they are using an Advanced Risk Analysis engine and "adaptive CATCHAS" where humans can be separated out from bots. Vinay Shet, said , "Last year we developed an Advanced Risk Analysis backend for reCAPTCHA that actively considers a user's entire engagement with the CAPTCHA - before, during, and after - to determine whether that user is a human. This enables us to rely less on typing distorted text and, in turn, offer a better experience for users."

Writing in Wired, Andy Greenberg on Wednesday said more about this kind of capability: Every user unwittingly provides the cues that reCAPTCHA needs to do its job. What kinds of cues? IP addresses and cookies provide evidence that the user is the same friendly human Google remembers from elsewhere on the Web, said Greenberg. "And Shet says even the tiny movements a user's mouse makes as it hovers and approaches a checkbox can help reveal an automated bot."

This does not mean that distorted-text CAPTCHAs are going away altogether. They will still be around. "In cases when the risk analysis engine can't confidently predict whether a user is a human or an abusive agent, it will prompt a CAPTCHA to elicit more cues, increasing the number of security checkpoints to confirm the user is valid," said Google's Shet. Humphries in Geek.com explained that in instances where the Advanced Risk Analysis system was, even after monitoring input, not sure of the status as a human, a more typical CAPTCHA test would be a second-stage fallback.

Shet reported that reCAPTCHA early adopters such as Snapchat, WordPress, Humble Bundle, and several others "are already seeing great results with this new API." (For mobile devices, Google will simplify matters via a presentation of image collections, asking the user to prove humanity. Shet's blog called it making reCAPTCHAs mobile-friendly. "This new API also lets us experiment with new types of challenges that are easier for us humans to use, particularly on mobile devices. In the example below, you can see a CAPTCHA based on a classic Computer Vision problem of image labeling. In this version of the CAPTCHA challenge, you're asked to select all of the images that correspond with the clue. It's much easier to tap photos of cats or turkeys than to tediously type a line of distorted text on your phone."

http://www.eurekalert.org/pub_releases/2014-12/ps-lag120414.php

Living African group discovered to be the most populous humans over the last 150,000 years

New genetic research reveals that a small group of hunter-gatherers now living in Southern Africa once was so large that it comprised the majority of living humans during most of the past 150,000 years.

Only during the last 22,000 years have the other African ethnicities, including the ones giving rise to Europeans and Asians, become vastly most numerous. Now the Khoisan (who sometimes call themselves Bushmen) number about 100,000 individuals, while the rest of humanity numbers 7 billion. Their lives and ways have remained unaltered for hundreds of generations, with only recent events endangering their hunter-gatherer lifestyles. The study's findings will be published in the journal *Nature Communications* on 4 December 2014.

By comparing nearly all the genes of these individuals -- their genomes -- with the genomes of 1,462 people from around the world, the researchers discovered that the inflow of new genes into the Khoisan peoples has been quite restricted the past 150,000 years, indicating that this large hunter-gatherer culture was physically isolated for most of its history and that its men typically did not take wives from outside the group.

"Khoisan hunter-gatherers in Southern Africa always have perceived themselves as the oldest people" said Stephan Schuster, a former Penn State University professor, now at Nanyang Technological University in Singapore and a leader of the research team, which includes scientists at Penn State and other research universities in the United States, Brazil, and Singapore. The Nature Communication paper analyzes five study participants from different tribes in Namibia. The study investigated 420,000 genetic variants across 1,462 genomes from 48 ethnic groups in populations worldwide. These analyses reveal that Southern African Khoisans are genetically distinct not only from Europeans and Asians, but also from all other Africans. The paper's first author Hie Lim Kim, formerly at Penn State and now at Nanyang Technological University, said "It is fascinating to unravel the population history of humankind over the last 150,000 years."

By conducting extensive computational analyses, the team demonstrated that two of the sequenced individuals showed no signs of having inherited any genetic material from members of other ethnic groups. Interestingly, these individuals are the oldest members of the Ju/'hoansi tribe, which still live in protected areas of Northwest Namibia. "This and previous studies show that the Khoisan peoples and the rest of modern humanity shared their most recent common ancestor approximately 150,000 years ago, so it was entirely unexpected to find that this group apparently did not intermarry with non-Khoisan neighbors for many thousand years," said Webb Miller, professor of Bioinformatics at Penn State and a member of the research team. "The current Khoisan culture and tradition, where marriage occurs either among Khoisan groups or results in female members leaving their tribes after marrying non-Khoisan men, appears to be long-standing."

The cultural and genetic persistence of the Ju/'hoansi tribe is intriguing, the researchers say, because genetic and genomic analysis of ancient hominid lineages such as the Neanderthals, as well as non-African humans, have shown that intermarrying does occur frequently in these groups and is traceable over the entire time span of 150,000 history during which anatomically modern humans have lived. "We also observed gene flow for some of the other Khoisan groups, as defined by their largely varying language, but a key finding of this study is that, even today, individuals without genes from other communities can be identified within the Ju/'hoansi population and possibly others," Schuster said.

"Having identified non-admixed Khoisan individuals, we could compare the effective population size of the Khoisan with that of other humans over more than 100,000 years," said research-team member Aakrosh Ratan, an assistant professor at the University of Virginia. "In a twist of fate, the major ethnic groups today in Africa, Asia, and Europe increased in size only after overcoming a population decline about 20,000 years ago."

"This research report is the first time that this population decline was investigated based on whole-genome sequencing of the various human ethnicities," Miller said. "This decline did not affect the Khoisan population to the same degree as the reminder of humankind, because they did not share the same habitats and environments." The researchers say this reduction in population size likely occurred between 30,000 and 120,000 years ago -- the period that includes the migration of modern humans out of Africa. "While the exodus out of Africa resulted in a population bottleneck in itself, the population decline in Western Africa likely had environmental causes," Schuster said.

The researchers also investigated the hypothesis that climatic changes resulted in less-favorable living conditions, first in Western Africa and later in all of central sub-Saharan Africa. "Using a paleoclimate model and data, we were able to show that glaciation in the northern hemisphere resulted in drier conditions in Western/Central Africa, while wetter conditions prevailed in Southern Africa," said Alvaro Montenegro, an assistant professor at Ohio State University and the Sao Paulo State University in Brazil. He said that similar conditions have been

recorded periodically throughout the last several 100,000's of years and likely had a major impact on the ecosystems of the world.

"The decline in population was much less pronounced for the ancestral Khoisan populations living in Southern Africa," said George Perry, an assistant professor of anthropology and biology at Penn State. "A hypothesis suggested by our new study is that the wetter climate conditions in the Khoisan-inhabited parts of Southern Africa may have resulted in more-favorable living conditions." The study highlights just how perilous modern human survival has been throughout history, which documents the extinction of many populations of animals during the same period of time. The climate likely was a major factor for the formation of favorable environments that sustained populations of early human hunter/gatherers.

The Khoisan participating in this study had parts of their genomes sequenced in an earlier study by the same team in 2010. The current study generated complete genome sequences at high quality, which enabled analysis of the addition of genetic material and population history. "The availability of these high-quality Southern African genomes will allow further investigation at high resolution of the population history of this largely understudied branch of humankind," Miller said.

The research, which involved six investigators, was led by Penn State University and Nanyang Technological University. Other institutions participating in the study include Ohio State University in the United States and Universidade Estadual Paulista (UNESP, Sao Paulo State University) in Brazil.

http://phys.org/news/2014-12-cancer-prevalent-pets-treatable-veterinarian.html

Cancer prevalent in pets but treatable, says veterinarian

About 50 percent of dogs and 33 percent of cats age 10 years and older will develop cancer. Although it is very prevalent in these animals, a Kansas State University veterinarian says depending upon the type of cancer, it may be very treatable and doesn't have to be a life-limiting disease.

December 3rd, 2014 by Lindsey Elliott in Biology / Plants & Animals

Mary Lynn Higginbotham, assistant professor of oncology in the university's College of Veterinary Medicine, says any breed is at risk of developing cancer. Common types of cancer found in pets are also common in humans: lymphoma, melanoma and osteosarcoma, for example.

"There are certainly some dog breeds that the Veterinary Health Center has noticed have a tendency to develop tumors, but it varies from tumor to tumor," Higginbotham said. "Osteosarcomas are the primary bone tumors we see in the limbs, most commonly in the front legs of large dog breeds like Great Danes, mastiffs, Labrador retrievers and rottweilers."

An overall change in the behavior of your animal could be an indication of cancer. Symptoms to watch for include:

Lumps or bumps that grow or change.
Wounds that won't heal, such as on the skin of the face or the toe.
Lameness that is persistent or recurrent.
Unexplained weight loss.
Lack of appetite.
Difficulty eating or swallowing.
Bleeding from a body opening such as the mouth, nose or rectum.
Offensive odor, particularly from the mouth.
Difficulty breathing or going to the bathroom, such as straining to urinate or to have a bowel movement.
Lethargy or loss of stamina.

Treatment options for dogs and cats are similar to what humans receive. Higginbotham says veterinarians will consider surgery, radiation therapy, chemotherapy or immunotherapy, but that these therapies usually have fewer side effects in the animals than in humans.

"The majority of our drugs used for chemotherapy are the same drugs used in people, but we are very careful about the dose," Higginbotham said. "We use the amount of dose needed to maximize the response, yet limit the dose so we can diminish the potential for side effects as much as possible. Overall, less than 20 percent of our patients actually need supportive therapy because of a side effect from the treatment. The majority of animals we treat with chemotherapy or radiation therapy have very minimal side effects and those are usually short term."

If you notice a change in your pet's behavior, contact a veterinarian.

http://bit.ly/12g5Cvh

Zigzags on a Shell From Java Are the Oldest Human Engravings

The early human Homo erectus also made the oldest known shell tools half a million years ago

By Helen Thompson

On the banks of the Solo River in Java, Indonesia, 19th-century physician Eugene Dubois uncovered an astounding fossil find: the bones of what appeared to be an ancient human, surrounded by animal remains and shells. Excavated in the 1890s, the site gained fame as the home of “Java Man,” better known today as Homo erectus.

Dated to between a million and 700,000 years old, the bones immediately provoked controversy, because Dubois claimed they showed evidence of a transitional species between apes and humans. It turns out he was right - Homo erectus fossils have since been found in Africa and elsewhere in Asia, and it is possible the species is a direct ancestor of our own. But it’s the palm-sized shells

found alongside the Java remains that are raising big questions today. An examination of the shells published in Nature suggests that Homo erectus may have used the shells for tools and decorated some of them with geometric engravings. At around half a million years old, the shells represent the earliest evidence of such decorative marks and also the first known use of shells to make tools.

Dubois collected 11 species of freshwater shells at the site, called Trinil. Most of them belong to the sub-species Pseudodon vondembuschianus trinilensis, a now extinct freshwater mussel he described in 1908. Initially scientists thought the mollusks had naturally clustered at the site, perhaps driven by water currents. Even without a connection to the human fossil, the cache provided a nice census of ancient freshwater shell life, coming from at least 166 Pseudodon individuals.

Scientists found deliberate scratching on a fossil Pseudodon, likely an engraving made by Homo erectus at Trinil in Indonesia. **Wim Lustenhouwer, VU University Amsterdam**

That's what first attracted Josephine Joordens, a marine biologist and archaeologist at Leiden University in the Netherlands. A few years ago, Stephen Munro, an archaeologist at Australian National University and a study co-author, happened to briefly look through the Dubois shell collection and took a few photos. The images showed markings on the shells, at first invisible to the naked eye. "It's strange to see a zigzag pattern on such old fossil shells," recalls Joordens.

Intrigued, the researchers compared the Dubois shells to how living mollusks were arranged and buried in the wild. The patterns didn't match up. Most of the shells also had weird holes corresponding to the where the organism's adductor muscle and ligament, used to open and close the shell, would have been attached. Presumably, someone or something was trying to pry open the shell and remove the gooey mussel. Back then, shellfish eaters such as otters, rats and monkeys also lived on Java. Figuring out what could have poked holes in the shells required some experimentation.

With no modern specimen to draw from, the team selected a living mollusk with the closest characteristics to the ancient Pseudodons, a freshwater mussel called Potamida littoralis. The group tried to open the shells with the most likely pointy object at hand on Java, a shark tooth. Only piercing the muscle popped the shells open without breaking them. That requires a certain degree of dexterity and knowhow, so Homo erectus became the most likely culprit.

null See the hole on the inside of this fossil Pseudodon shell? Homo erectus likely bored into the shell at exactly at the spot where the adductor muscle attaches to pop it open. (Henk Caspers, Naturalis, Leiden, The Netherlands)

"The opening of shellfish by piercing the valve is unusual, and is not seen in either [early] Homo sapiens or Neanderthal middens," which are essentially shellfish trash dumps, says Kat Szabo, an archaeologist at the University of Wollongong. If humans on Java were opening the shells for food, the method suggests they ate the shellfish raw. "As bivalves open easily after cooking, this does suggest that the mollusks at Trinil weren't cooked," says Szabo.

There is another possible reason Homo erectus might have been scraping out mollusk shells. One specimen had been modified and was likely used as a tool. Under a microscope, the shell was visibly sharpened, with hallmark striations from contact with hard material. "The shell tool has a knife-like edge, so we assume that it was used for cutting and/or scraping," says Joordens.

Exactly what the shell was used for is impossible to know. A previous study suggested that cut marks on ancient cow bones found on Java likely came from shell tools, which could have been used to butcher animals, cut plants or clean fish. Neanderthals, which lived about 200,000 to 40,000 years ago, also used shells as tools, though there's evidence that they broke the shells and then sharpened them, notes Enza Spinapolice, an archaeologist at the Max Planck Institute in Germany. The presence of a shell tool might explain the dearth of stone tools at hominin sites across Indonesia. "This has always been a puzzle," says Joordens. "How would they butcher animals without stone tools?" It makes sense that the Java humans would simply use what they had at their disposal, but without further evidence of shell tools, it's hard to be 100 percent sure.

These carvings go deep into the calcium carbonate shell, which is why evidence of the pattern survived over the centuries. But it's possible other shells bore more superficial engravings. When fresh, the white shell would have been covered by a leathery brown outer layer, and a carved pattern on such a dark canvas probably looked striking in its day.

Perhaps even more intriguing is a single shell with what appears to be a geometric pattern - zigzagged grooves carved into the center of the outer shell. Analysis points to the patterns being carved on purpose. Again the team turned to modern mussels; they tried carving similar patterns into Potamida littoralis with a shark tooth and compared that to weathering and natural abrasions. Sure enough, their carvings were the closest matches to the ancient pattern.

"That must have been an appealing thing for Homo erectus," says Joordens. "You can imagine sitting there with a shell in one hand and a tool in the other hand and maybe ready to open the shell for food, but then making a scratch and seeing this white line appear."

The researchers used two dating techniques on preserved sediment in the shells to estimate their age: between 540,000 and 430,000 years old. The team also used x-rays to examine the Homo erectus bones and confirm that they came from the same rock layer as the shells. The results suggest that the Homo erectus fossils on Java aren't quite as old as we thought they were. Still, the geometric engraving predates other examples by around 300,000 years, and the oldest Neanderthal shell tools are also much younger (about 110,000 years old).

Creation of geometric patterns could represent a higher level of creativity in Homo erectus than previously thought, or maybe such patterns aren't the artistic masterpieces we suppose them to be. "This forces us to reassess not only the capacities of Homo erectus, but the criteria we use to gauge the behavioral evolution of our own species," says Szabo.

Given that other Homo erectus populations used stone technology around the same time, the tools and scratches aren't totally inconsistent with hominin abilities, notes Rick Potts, a paleoanthropologist with the Smithsonian's Human Origins Program. Homo erectus continued to live on Java until around 200,000 yeas ago, and for Potts, the possibility that these practices persisted as part of Homo erectus culture is even more interesting. "That [would mean] that this incipient capacity to impose a creative pattern on an object was a characteristic of the later members of this species," says Potts "That's really cool."

http://nyti.ms/1vDqJ6D

'Superbugs' Kill India's Babies and Pose an Overseas Threat

A deadly epidemic that could have global implications is quietly sweeping India, and among its many victims are tens of thousands of newborns dying because once-miraculous cures no longer work.

By GARDINER HARRIS DEC. 3, 2014

AMRAVATI, India - These infants are born with bacterial infections that are resistant to most known antibiotics, and more than 58,000 died last year as a result, a recent study found. While that is still a fraction of the nearly 800,000 newborns who die annually in India, Indian pediatricians say that the rising toll of resistant infections could soon swamp efforts to improve India's abysmal infant death rate. Nearly a third of the world's newborn deaths occur in India.

"Reducing newborn deaths in India is one of the most important public health priorities in the world, and this will require treating an increasing number of neonates who have sepsis and pneumonia," said Dr. Vinod Paul, chief of pediatrics at the All India Institute of Medical Sciences and the leader of the study. "But if resistant infections keep growing, that progress could slow, stop or even reverse itself. And that would be a disaster for not only India but the entire world."

In visits to neonatal intensive care wards in five Indian states, doctors reported being overwhelmed by such cases.

"Five years ago, we almost never saw these kinds of infections," said Dr. Neelam Kler, chairwoman of the department of neonatology at New Delhi's Sir Ganga Ram Hospital, one of India's most prestigious private hospitals. "Now, close to 100 percent of the babies referred to us have multidrug resistant infections. It's scary."

These babies are part of a disquieting outbreak. A growing chorus of researchers say the evidence is now overwhelming that a significant share of the bacteria present in India - in its water, sewage, animals, soil and even its mothers - are immune to nearly all antibiotics.

Newborns are particularly vulnerable because their immune systems are fragile, leaving little time for doctors to find a drug that works. But everyone is at risk. Uppalapu Shrinivas, one of India's most famous musicians, died Sept. 19 at age 45 because of an infection that doctors could not cure. While far from alone in creating antibiotic resistance, India's resistant infections have already begun to migrate elsewhere.

"India's dreadful sanitation, uncontrolled use of antibiotics and overcrowding coupled with a complete lack of monitoring the problem has created a tsunami of antibiotic resistance that is reaching just about every country in the world," said Dr. Timothy R. Walsh, a professor of microbiology at Cardiff University.

Indeed, researchers have already found "superbugs" carrying a genetic code first identified in India - NDM1 (or New Delhi metallo-beta lactamase 1) - around the world, including in France, Japan, Oman and the United States.

Anju Thakur's daughter, born prematurely a year ago, was one of the epidemic's victims in Amravati, a city in central India. Doctors assured Ms. Thakur that her daughter, despite weighing just four pounds, would be fine. Her husband gave sweets to neighbors in celebration.

Three days later, Ms. Thakur knew something was wrong. Her daughter's stomach swelled, her limbs stiffened and her skin thickened - classic signs of a blood infection. As a precaution, doctors had given the baby two powerful antibiotics soon after birth. Doctors switched to other antibiotics and switched again. Nothing worked. Ms. Thakur gave a puja, or prayer, to the goddess Durga, but the baby's condition worsened. She died, just seven days old. "We tried everything we could," said Dr. Swapnil Talvekar, the pediatrician who treated her. Ms. Thakur was inconsolable. "I never thought I'd stop crying," she said.

A test later revealed that the infection was immune to almost every antibiotic. The child's rapid death meant the bacteria probably came from her mother, doctors said.

Health officials have warned for decades that overuse of antibiotics - miracle drugs that changed the course of human health in the 20th century - would eventually lead bacteria to evolve in a way that made the drugs useless. In September, the Obama administration announced measures to tackle this problem, which officials termed a threat to national security.

Some studies have found that developing countries have bacterial rates of resistance to antibiotics that are far higher than those in developed nations, with India the global focal point. Bacteria spread easily in India, experts say, because half of Indians defecate outdoors, and much of the sewage generated by those who do use toilets is untreated. As a result, Indians have among the highest rates of bacterial infections in the world and collectively take more antibiotics, which are sold over the counter here, than any other nationality.

A recent study found that Indian children living in places where people are less likely to use a toilet tend to get diarrhea and be given antibiotics more often than those in places with more toilet use. On Oct. 2, the Indian government began a campaign to clean the country and build toilets, with Prime Minister Narendra Modi publicly sweeping a Delhi neighborhood. But the task is monumental.

"In the absence of better sanitation and hygiene, we are forced to rely heavily on antibiotics to reduce infections," said Ramanan Laxminarayan, vice president for research and policy at the Public Health Foundation of India. "The result is that we are losing these drugs, and our newborns are already facing the consequences of untreatable sepsis," or blood infections.

Some health experts and officials here say that these killer bugs are largely confined to hospitals, where heavy use of antibiotics leads to localized colonies. But India's top neonatologists suspect the large number of resistant infections in newborns in their first days of life demonstrates that these dangerous bacteria are thriving in communities and even pregnant women's bodies. "Our hypothesis is that resistant infections in newborns may be originating from the maternal genital tract and not just the environment," Dr. Paul said in an interview.

In a continuing study in Delhi at several government-run hospitals that has so far included more than 12,000 high-risk newborns, and was made available to The New York Times, about 70 percent of the babies' infections were found to be immune to multiple powerful antibiotics, confirming the results of earlier and smaller studies.

Doctors interviewed in hospitals across India said that a large number of the infections they found in newborns were resistant to many antibiotics. Awareness of the problem has begun to grow, with Indian medical associations calling for efforts to reduce unnecessary antibiotic use. But there is keen sensitivity here to any alert to the dangers. A 2010 discovery of a New Delhi "superbug" caused intense controversy because of fears that publicity would threaten India's profitable medical tourism industry. Government officials have stopped some studies of the problem, Dr. Walsh said.

The effects of antibiotic-resistant bacteria on treating disease in India could be enormous. Tuberculosis is just one example of the challenges doctors face. India has the world's largest number of cases, and recent studies using the latest genetic tests have shown that as many as 10 percent of untreated patients in places as far apart as Mumbai and Sikkim have resistant infections. These patients are catching resistant bugs at home, not hospitals, making the epidemic very difficult to control, Dr. Soumya Swaminathan, director of the National Institute for Research in Tuberculosis, said in an interview.

"It's startling and very worrying," Dr. Swaminathan said. Unless the government makes profound and drastic changes, tuberculosis in India may soon become untreatable, she said.

Although resistant bugs are everywhere here, hospitals have become factories for untreatable "superbugs." A government program that pays women to have babies in hospitals has in 10 years more than doubled the share of hospital-born babies to 82 percent, but the government did little to increase hospital capacity to deal with the crush. Maternity wards often have two and three women in each bed, allowing infections to spread rapidly.

Besides being desperately crowded, many hospitals are unhygienic, allowing the bugs to flourish. A Unicef survey of 94 district hospitals and health centers in Rajasthan last year found that 70 percent had possibly contaminated water and 78 percent had no soap available at hand-washing sinks, while 67 percent of toilets were unsanitary.

Doctors across India have responded to the sanitation crisis in hospitals by giving antibiotics freely. In Haryana, for instance, almost every baby born in hospitals in recent years was injected with antibiotics whether they showed signs of illness or not, Dr. Suresh Dalpat, deputy director of child health in the state of Haryana, said in an interview. "Now, with proper training, we are bringing that down."

All those drugs create resistant bacteria that find their way into hospital sewage, which is mostly dumped untreated into rivers, canals and pits in the surrounding community where pregnant women can become infected.

The most frequent causes of resistant newborn infections in India are bacteria like Klebsiella and Acinetobacter, which are found in untreated human waste. Such bacteria rarely infect newborns in developed nations, said Dr. Paul.

India and other developing nations are by no means alone in threatening the future of antibiotics. Overuse of the drugs in chicken, hog and cattle farms in the United States has led to the rise of resistant strains there, and research has shown that as much as half of antibiotic prescriptions in the United States are unnecessary.

The Centers for Disease Control and Prevention estimated last year that two million people are sickened by resistant bacteria every year in the United States and 23,000 die as a result. But efforts to crack down on inappropriate antibiotic use in the United States and much of Europe have been successful, with prescriptions dropping from 2000 to 2010. That drop was more than offset, however, by growing use in the developing world.

Global sales of antibiotics for human consumption rose 36 percent from 2000 to 2010, with Brazil, Russia, India, China and South Africa accounting for 76 percent of that increase. In India, much of that growth has been driven by private doctors who deliver about 90 percent of care here and are often poorly trained. Much of these doctors' income comes from drug sales.

Just as worrisome has been the rapid growth of India's industrialized animal husbandry, where antibiotics are widespread. Most large chicken farms here use feed laced with antibiotics banned for use in animals in the United States. A New Delhi science group recently found antibiotic residues in 40 percent of chicken samples tested.

But the effects in children are perhaps the most heart-wrenching. After her baby's death a year ago, Ms. Thakur, 21, was soon pregnant again. She gave birth on Sept. 21 to a baby girl. On a visit shortly after the baby's birth, Ms. Thakur was shivering from a severe infection while staying in a home with no toilet or running water. She nursed her tiny infant, Khushi, under a small shrine with pictures of Durga and Krishna.

Nearly two months later, she reported that she and the baby were fine.

http://www.eurekalert.org/pub_releases/2014-12/aha-iob120114.php

Images of brain after mild stroke predict future risk

A CT scan of the brain within 24 hours of a mild, non-disabling stroke can predict when patients will be at the highest risk of another stroke or when symptoms may worsen, according to new research published in the American Heart Association journal Stroke.

Like stroke, a transient ischemic attack (TIA) is caused by restricted blood supply to the brain. Symptoms may last only a few minutes.

"All patients should get a CT scan of their brain after a TIA or non-disabling stroke," said Jeffrey J. Perry, M.D., M.Sc., co-senior author of the study and associate professor of emergency medicine at the University of Ottawa in Canada.

"Images can help healthcare professionals identify patterns of damage associated with different levels of risk for a subsequent stroke or help predict when symptoms may get worse.

Most, but not all, Canadian and U.S. patients with these symptoms undergo CT scanning - an imaging that combines a series of X-ray views to generate cross-sectional images of the brain, he said.

Of 2,028 patients who received CT scans within 24 hours of a TIA or non-disabling stroke, 814 (40.1 percent) had brain damage due to impaired circulation (ischemia).

Compared to patients without ischemia, the probability of another stroke occurring within 90 days of the initial episode was:

2.6 times greater if the CT image revealed newly damaged tissue due to poor circulation (acute ischemia);

5.35 times greater if tissue was previously damaged (chronic ischemia) in addition to acute ischemia;

4.9 times greater if any type of small vessel damage occurred in the brain, such as narrowing of the small vessels (microangiopathy), in addition to acute ischemia;

8.04 times greater if acute and chronic ischemia occurred in addition to microangiopathy.

While 3.4 percent of the people in the study group had a subsequent stroke within 90 days, 25 percent of patients with CT scans showing all three types of damage to their brain had strokes.

"During the 90-day period, and also within the first two days after the initial attack, patients did much worse in terms of experiencing a subsequent stroke if they had additional areas of damage along with acute ischemia," said Perry, who is also a senior scientist at the Ottawa Hospital Research Institute.

"These findings should prompt physicians to be more aggressive in managing patients with TIA or non-disabling stroke who are diagnosed with acute ischemia, especially if there is additional chronic ischemia and/or microangiopathy."

Measures to avert a new stroke might include cardiac monitoring or medications to lower blood pressure, treat high cholesterol or prevent blood clots.

The researchers are assessing how to incorporate the study's findings into stroke risk scores that rely on symptoms along with patient factors such as age and the presence of high blood pressure or diabetes.

Co-authors are Jason K. Wasserman, M.D., Ph.D.; Marco L.A. Sivilotti, M.D., M.Sc.; Jane Sutherland, M.Ed.; Andrew Worster, M.D., M.Sc.; Marcel Émond, M.D., M.Sc.; Albert Y. Jim, M.D.; Wieslaw J. Oczkowski, M.D.; Demetrios J. Sahlas, M.D.; Heather Murray, M.D.; Ariane MacKey, M.D.; Steven Verreault, M.D.; George A. Wells, Ph.D.; Dar Dowlatshashi, M.D., Ph.D.; Grant Stotts, M.D.; Ian G. Stiell, M.D., M.Sc.; and Mukul Sharma, M.D., M.Sc., co-senior author. Author disclosures are on the manuscript.

http://www.eurekalert.org/pub_releases/2014-12/muhc-oms120414.php

Obesity may shorten life expectancy up to eight years

Canadian researchers put numbers on health risk

Montreal - 'Tis the season to indulge. However, restraint may be best according to a new study led by investigators at the Research Institute of the McGill University Health Centre (RI-MUHC) and McGill University. The researchers examined the relationship between body weight and life expectancy. Their findings show that overweight and obese individuals have the potential to decrease life expectancy by up to 8 years. The study, published in the current issue of The Lancet Diabetes and Endocrinology, further demonstrates that when one considers that these individuals may also develop diabetes or cardiovascular disease earlier in life, this excess weight can rob them of nearly two decades of healthy life.

"In collaboration with researchers from the University of Calgary and the University of British Columbia our team has developed a computer model to help doctors and their patients better understand how excess body weight contributes to reduced life expectancy and premature development of heart disease and diabetes," says lead author Dr. Steven Grover, a Clinical Epidemiologist at the RI-MUHC and a Professor of Medicine at McGill University.

Diabetes and Cardiovascular Disease: The Predictors of Health

Dr. Grover and his colleagues used data from the National Health and Nutrition Examination Survey (from years 2003 to 2010) to develop a model that estimates the annual risk of diabetes and cardiovascular disease in adults with different body weights. This data from almost 4,000 individuals was also used to analyze the contribution of excess body weight to years of life lost and healthy years of life lost.

Their findings estimated that individuals who were very obese could lose up to 8 years of life, obese individuals could lose up to 6 years, and those who were overweight could lose up to three years. In addition, healthy life-years lost were two to four times higher for overweight and obese individuals compared to those who had a healthy weight, defined as 18.5-25 body mass index (BMI). The age at which the excess weight accumulated was an important factor and the worst outcomes were in those who gained their weight at earlier ages.

"The pattern is clear - the more an individual weighs and the younger their age, the greater the effect on their health," Dr. Grover adds. "In terms of life-expectancy, we feel being overweight is as bad as cigarette smoking."

The next steps are to personalize this information in order to make it more relevant and compelling for patients. "What may be interesting for patients are the 'what if?' questions. What if they lose 10 to 15 pounds? Or, what if they are more active? How will this change the numbers?" says Dr. Grover. The research team is now conducting a three year study in community pharmacies across the country to see if engaging patients with this information and then offering them a web-based e-health program will help them adopt healthier lifestyles, including healthier diets and regular physical activity.

"These clinically meaningful models are useful for patients, and their healthcare professionals, to better appreciate the issues and the benefits of a healthier lifestyle, which we know is difficult for many of us to adopt and maintain, Dr. Grover adds.

http://www.thelancet.com/journals/landia/article/PIIS2213-8587(14)70229-3/abstract

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The paper Years of life lost and healthy life-years lost from diabetes and cardiovascular disease in overweight and obese people: a modelling study was co-authored by Steven A Grover (Division of Clinical Epidemiology, RI-MUHC and Faculty of Medicine, Department of Medicine, McGill University, QC, Canada); Mohammed Kaouache and Philip Rempel (Division of Clinical Epidemiology, RI-MUHC, QC, Canada); Lawrence Joseph (Faculty of Medicine, Department of Medicine and Department of Epidemiology, Biostatistics and Occupational Health, McGill University, QC, Canada), Martin Dawes (Department of Family Practice, University of British Columbia, BC, Canada); David C W Lau(Diabetes and Endocrine Research Group, University of Calgary, Calgary, AB, Canada); and Ilka Lowensteyn (Division of Clinical Epidemiology, RI-MUHC, QC, Canada).

Related Links

Cited Lancet study: http://www.thelancet.com/journals/landia/onlinefirst

http://www.medscape.com/viewarticle/835631

Enterovirus D68: The Other 'E' Virus Causing Illness Now

Infectious diseases have been rightfully hogging much of the news and landscape lately, primarily because of Ebola.

Paul G. Auwaerter, MD

But I want to chat briefly about a different "E" virus, one that was first noted in August this year in Kansas City.[1,2] More than 1100 cases have been reported to date on both US coasts and in the Midwest. This virus has principally afflicted children and caused many hospitalizations and a rather severe respiratory illness, particularly in those with a background of asthma or wheezing problems.

This virus was first identified in 1962 in California but really has not made much of a mark in the United States. For more than 5 years, it has rapidly spread in many other parts of the world, including Japan, the Philippines, and The Netherlands.[3,4] Perhaps it is not unexpected that it arrived in the United States during the characteristic time when this type of virus causes trouble—summer and into late fall.

This "E" virus, specifically enterovirus D68, seems to have driven this respiratory illness. But I believe the story is not so much about this particular virus. Not

surprising, perhaps, but not so many years ago, physicians probably would have thrown up their hands and just said, "A virus is going around, and some kids are getting sick with this," and let it pass. But the power of molecular technologies has allowed for near real-time identification of a whole host of respiratory viruses that, once identified, can be sequenced and determined to be a specific type of enterovirus.

That is the story that we will see more and more: the recognition that these viruses could be introduced into a probably virgin population and then spread.

A Fascinating "Broad-Spectrum" Pathogen

Enteroviruses are fascinating because they cause relatively mundane ailments, such as hand, foot, and mouth disease, and they can also target the gastrointestinal tract, the central nervous system, and cardiac and respiratory systems. The spectrum is diverse. Indeed, poliovirus is an enterovirus. There is no clear treatment for enterovirus; therefore, you might say, what does the recognition achieve?

Recognition is important because children who have preexisting conditions warrant extra attention to their coughs and hand hygiene. In addition, respiratory precautions are no doubt prudent, not only in hospitals but in home environments. Getting a handle on this will be important.

We do not yet know the real morbidity or mortality caused by the virus, which seems to have been much more prevalent this year than in any of the past 40-plus years. Without a doubt, this is a story that will continue. The molecular diagnostics have been responsible for helping detect the spread and recognition of enterovirus D68, as well as H1N1, Middle East respiratory syndrome coronavirus (MERS-CoV), severe acute respiratory syndrome (SARS), and so on.

Although not quite as severe as the other "E" virus, the Ebola virus, this story is also important and highlights the changes in the 21st century that will help patients and physicians better understand human illness. Thanks for listening.

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Deadlier Flu Season Is Possible, C.D.C. Says

This year's flu season may be deadlier than usual, and this year's flu vaccine is a relatively poor match to a new virus that is now circulating, federal health officials warned on Thursday.

By DONALD G. McNEIL Jr.DEC. 4, 2014

"Flu is unpredictable, but what we've seen thus far is concerning," said Dr. Thomas R. Frieden, the director of the Centers for Disease Control and Prevention.

The C.D.C. has alerted doctors to the problem and has urged them to prescribe antiviral drugs like Tamiflu to vulnerable patients with flu symptoms without waiting for a positive flu test.

The season has only just begun, but 91 percent of the approximately 1,200 samples tested thus far are of the H3N2 subtype of influenza A, Dr. Frieden said. Almost all the rest were influenza B. There were almost no samples of the H1 subtype, a descendant of the 2009 swine flu strain.

Years in which H3 subtypes are more common than H1 subtypes tend to lead to more hospitalizations and deaths, he added.

Moreover, about half of those H3 subtypes - or about 45 percent of all the samples tested so far - are of a new H3 subtype that this season's flu vaccine does not protect well against.

The new subtype first appeared overseas in March, Dr. Frieden said. Because it was not found in many samples in the United States until September, it is too late to change the vaccine, he said.

Most of the flu vaccine sold in the United States is grown in chicken eggs, which takes about six months. Other methods, like growing it in cell broths, can speed up the process, but still take about four months.

The C.D.C. still recommends that all Americans get flu shots because they are as protective as usual against the older H3 strain, influenza B and the small numbers of H1. And they may provide at least a weak defense against the newer H3.

But because of the increased danger from the H3 strain - and because B influenza strains can also cause serious illness - the C.D.C. recommends that patients with asthma, diabetes or lung or heart problems see a doctor at the first sign of a possible flu, and that doctors quickly prescribe antivirals like Tamiflu or Relenza.

Those medications are "not miracle drugs," Dr. Frieden said. The earlier they are given in the illness, the better they work, and all they usually do is shorten the illness by one day - but in a vulnerable patient, that may mean the difference between death and survival.

Five children are known to have died from flu-related illnesses this season, Dr. Frieden said.

http://www.eurekalert.org/pub_releases/2014-12/ucdl-tii120414.php

The intestinal immune system controls the body weight

Surprising interaction with intestinal bacteria

A group of UCL researchers (Louvain Drug Research Institute) identified an unsuspected mechanism impacting the development of obesity and diabetes type 2 after following a diet with a high dose of fat nutrition. The team of Professor Patrice D. Cani - in direct collaboration with two French teams, a Swedish expert as well as other UCL-researchers (LDRI and Ludwig Institute) - made an important discovery related to the essential role of the intestinal immune system regarding the control of the energy metabolism.

Today, the work of Doctor Amandine Everard (in charge of FNRS-research) and of Professor Patrice D. Cani (qualified FNRS-researcher and WELBIO-researcher) highlights a new therapeutic target for treatment of obesity and diabetes type 2. Indeed, they were able to demonstrate for the very first time that as a result of fat nutrition, the inactivation of a part of the intestine immune system (a protein called MyD88) allows these persons to lose weight and to reduce the diabetes type 2, linked to the obesity.

More specifically, the team shows that when modifying the response of the immune system by disabling this protein MyD88 only in those cells covering the intestine, this allows to slow down de development of diabetes induced by a diet of fat nutrition, to limit the development of adipose tissue, to reduce the harmful inflammation present because of the obesity and to strengthen the barrier function assured by our intestine and limiting as such the inappropriate transit of bacterial elements of our intestines in our body.

Even more important, the researchers managed to demonstrate that because of this modification within the immunity system, it is experimentally demonstrated possible to lose weight and thus to have a therapeutic effect, even when the animals used for the experiments are already obese and diabetic.

Among the various revealed mechanisms, the UCL-team identified that in addition to the partial protection against inflammation and diabetes type 2, the mice that do not have this protein MyD88 in their intestines, are as well protected against obesity because they consume more energy than other obese mice. In addition, they have different intestinal macrobiotics. Surprisingly, the teams have shown that it is possible to provide a partial protection against obesity and diabetes by transferring (grafting) the intestinal bacteria of these mice to other mice that are axenic (without flora).

All the research work put together leads thus to the recommendation that during consumption of fat nutrition, the intestine immunity system plays an important role in the fat storage regulation in the body and is literally capable to modify the composition of intestinal bacteria (including some which are still unidentified).

The discovery of the UCL-researchers, published in the scientific journal Nature Communications, confirms the involvement of intestinal bacteria in the development of obesity, but even more important, it provides new therapeutic possibilities, being a protein of the intestine immunity system for treatment of obesity and diabetes type 2.

Everard A et al. Intestinal epithelial MyD88 is a sensor switching host metabolism towards obesity according to nutritional status. Nature Communications. 5:5648, DOI: 10.1038/ncomms6648.

http://www.eurekalert.org/pub_releases/2014-12/f-sf-tac120514.php

The antioxidant capacity of orange juice is multiplied tenfold

The antioxidant activity of citrus juices and other foods is undervalued.

A new technique developed by researchers from the University of Granada for measuring this property generates values that are ten times higher than those indicated by current analysis methods. The results suggest that tables on the antioxidant capacities of food products that dieticians and health authorities use must be revised.

Orange juice and juices from other citrus fruits are considered healthy due to their high content of antioxidants, which help to reduce harmful free radicals in our body, but a new investigation shows that their benefits are greater than previously thought.

In order to study these compounds in the laboratory, techniques that simulate the digestion of food in the digestive tract are used, which analyse only the antioxidant capacities of those substances that can potentially be absorbed in the small intestine: the liquid fraction of what we eat.

"The problem is that the antioxidant activity of the solid fraction (the fibre) isn't measured, as it's assumed that it isn't beneficial. However, this insoluble fraction arrives at the large intestine and the intestinal microbiota can also ferment it and extract even more antioxidant substances, which we can assess with our new methodology," José Ángel Rufián Henares, professor at the University of Granada, explains to SINC.

His team has developed a technique called 'global antioxidant response' (GAR), which includes an in vitro simulation of the gastrointestinal digestion that occurs in our body, whilst taking into account the 'forgotten' antioxidant capacity of the solid fraction.

The method, the details of which are published in the journal 'Food Chemistry', includes assessments of various physical and chemical parameters, such as colour,

fluorescence and the relationship between the concentrations analysed and compounds indicators such as furfural.

Upon applying the technique to commercial and natural orange, mandarin, lemon and grapefruit juices, it has been proved that their values greatly increase. For example, in the case of orange juice, the value ranges from 2.3 mmol Trolox/L (units for the antioxidant capacity) registered with a traditional technique to 23 mmol Trolox/L with the new GAR method.

"The antioxidant activity is, on average, ten times higher than that which everyone thought up until now, and not just in juices, but also in any other kind of food analysed with this methodology," highlights Rufián Henares, who notes its possible application: "This technique and the results derived from it could allow dieticians and health authorities to better establish the values of the antioxidant capacity of foods."

With the help of this method, scientists have also created a mathematical model in order to classify juices according to their natural and storage conditions, which ensures that the correct raw materials and sterilisation and pasteurisation processes are used.

J. Álvarez, S. Pastoriza, R. Alonso-Olalla, C. Delgado-Andrade, J.A. Rufián-Henares. "Nutritional and physicochemical characteristic of commercial Spanish citrus juices". Food **Chemistry 164: 396-405, 2014.**

http://www.eurekalert.org/pub_releases/2014-12/afps-ef120514.php

Evidence for 'bilingual advantage' may be less conclusive than previously thought

Results challenging the idea that bilingual speakers have a cognitive advantage less likely to be published than those supporting the bilingual-advantage theory

Study results that challenge the idea that bilingual speakers have a cognitive advantage are less likely to be published than those that support the bilingual-advantage theory, according to new research published in Psychological Science, a journal of the Association for Psychological Science. This research suggests that a publication bias in favor of positive results may skew the overall literature on bilingualism and cognitive function.

"Publishing only 'successful' studies means that we do not have access to many valuable studies that could increase our understanding of the actual effects of bilingualism," says lead researcher Angela de Bruin of Edinburgh University. "The 'bilingual advantage' has received much attention and is now often considered to be common wisdom. Especially because of its societal relevance, it is important to realize that our interpretation of these advantages may be biased by the type of studies published."

Many published studies have shown that bilingual speakers perform better on cognitive tasks related to executive function abilities -- such as those involved with attention and the ability to ignore distractions and switch between tasks -- when compared to people who are fluent in only one language.

But in informal discussions with colleagues, de Bruin and her co-authors confirmed that study results that fail to support the bilingual advantage often don't make it to publication. Thus, they never become part of the established scientific literature -- a phenomenon known as the "file drawer effect."

To see if they could find concrete evidence for a publication bias, the researchers decided to compare studies presented at conferences with those that are eventually published. They identified 104 conference abstracts describing studies on bilingualism and executive control in any age group, presented between 1999 and 2012. They then looked to see which of those studies were accepted for publication in an international scientific journal on or before February 2014.

Of the 104 abstracts, 38% described studies that supported a bilingual advantage, 13% found mixed results that tended to support the advantage, 32% found mixed results that challenged the advantage, and 16% failed to find an advantage.

While 52 of the studies reported in the abstracts were accepted for publication, analyses indicated that some studies were much more likely to make it to publication than others.

The researchers found that the majority (63%) of the studies that supported the bilingual advantage, either partly or completely, were published; however, only 36% of the studies that mainly or fully failed to support the advantage were published. The difference in publication rates couldn't be explained by the specific tasks or the sample sizes used in the studies.

De Bruin and colleagues note that the different rates of publication could result from bias at various points in the publication process. Researchers may choose to submit only those studies that show a positive result, leaving studies with null findings to languish in the file cabinet. It's also possible that journal reviewers and editors are more likely to accept positive findings and reject null findings in deciding what to publish. Ultimately, the findings suggest that the commonly accepted view that bilingualism confers a cognitive advantage may not accurately reflect the full body of existing scientific evidence.

According to de Bruin, these findings underscore how essential it is to review the published scientific literature with a critical eye, and how important it is that researchers share all of their findings on a given topic, regardless of the outcome. "All data, not just selected data that supports a particular theory, should be shared, and this is especially true when it comes to data regarding issues that have

enormous societal relevance and implications, such as bilingualism," de Bruin and colleagues conclude.

Study co-authors include Barbara Treccani of the University of Sassari in Italy and Sergio Della Sala of the University of Edinburgh.

http://www.eurekalert.org/pub_releases/2014-12/asfc-rtg_1112514.php

Rescuing the Golgi puts brakes on Alzheimer's progression

New findings say attending to the Golgi slows AD protein accumulation significantly.

Alzheimer's disease (AD) progresses inside the brain in a rising storm of cellular chaos as deposits of the toxic protein, amyloid-beta (Aβ), overwhelm neurons. An apparent side effect of accumulating Aβ in neurons is the fragmentation of the Golgi apparatus, the part of the cell involved in packaging and sorting protein cargo including the precursor of Aβ. But is the destruction the Golgi a kind of collateral damage from the Aβ storm or is the loss of Golgi function itself part of the driving force behind Alzheimer's? This was the question for Yanzhuang Wang, Gunjan Joshi, and colleagues at the University of Michigan, Ann Arbor, as they set out to uncover the mechanism damaging the Golgi, using a transgenic mouse and tissue culture models of AD to look at what was going on.

The unsurprising part of the answer was that rising levels of Aβ do lead directly to Golgi fragmentation by activating a cell cycle kinase, cdk5. The surprising part of the answer was that Golgi function can be rescued by blocking cdk5 or shielding its downstream target protein in the Golgi, GRASP65. The even more surprising answer was that rescuing the Golgi reduced Aβ accumulation significantly, apparently by re-opening a normal protein degradation pathway for the amyloid precursor protein (APP). To Wang et al, this suggested an entirely new line of attack for drugs hoping to slow AD progression.

Speaking at the ASCB/IFCB Meeting in Philadelphia, the researchers now say that Golgi fragmentation is in itself a major--and until now an unrecognized--mechanism through which Aβ extends its toxic effects. They believe that as Aβ accumulation rises, damage to the Golgi increases, which in turn accelerates APP trafficking, which in turn increases Aβ production. This is a classic "deleterious feedback circuit," they say. By blocking cdk5 or its downstream target, that circuit can be broken or greatly slowed. "Our study provides a molecular mechanism for Golgi fragmentation and its effects on APP trafficking and processing in AD, suggesting Golgi as a potential drug target for AD treatment," the Michigan researchers report.

Golgi defects in Alzheimer's disease G. Joshi1, Y. Chi1, Z. Huang1, Y. Wang1; 1Dept. of Molecular, Cellular and Developmental Biology, University of Michigan, Ann Arbor, MI

http://phys.org/news/2014-12-smallest-star.html

What is the Smallest Star?

Space and astronomy is always flaunting its size issues.

December 5th, 2014 by Fraser Cain in Astronomy & Space / Astronomy

Biggest star, hugest nebula, prettiest most talented massive galaxy, most infinite universe, and which comet came out on top in the bikini category. Blah blah blah. In an effort to balance the scales a little we're going look at the other end of the spectrum. Today we're talking small stars. First, I'm going to get the Gary Coleman and Emmanuel Lewis joke out of the way, so we can start talking about adorable little teeny tiny fusion factories.

We get big stars when we've got many times the mass of the Sun's worth of hydrogen in one spot. Unsurprisingly, to get smaller stars we'll need less hydrogen, but there's a line we can't cross where there's so little, that it won't generate the temperature and pressure at its core to ignite solar fusion. Then it's a blob, it's a mess. It's clean-up in aisle Andromeda. It's who didn't put the lid back on the jar marked H.

So how small can stars get? And what's the smallest star we know about? In the traditional sense, a star is an object that has enough mass and pressure in its core that it can ignite fusion, crushing atoms of hydrogen into helium.

Fusion is exothermic, releasing energy. It's this energy that counteracts the force of gravity pulling everything inward. That gives you the size of the star and keeps it from collapsing in on itself.

By some random coincidence and fluke of nature our Sun is exactly 1 solar mass. Actually, that's not true at all, our shame is that we use our Sun as the measuring stick for other stars. This might be the root of this size business. We're in an endless star measuring contest, with whose is the most massive and whose has the largest circumference?

We've talked about the biggest stars, but what about the smallest stars? What's the smallest star you can see with your own eyes, and how small can they get? So, as it turns out, you can still have fusion reactions within a star if you get all the way down to 7.5% of a solar mass. This is the version you know as a red dwarf. We haven't had a chance to measure many red dwarf stars, but the nearest star, Proxima Centauri, has about 12.3% the mass of the Sun and measures only 200,000 kilometers across. In other words, the smallest possible red dwarf would only be about 50% larger than Jupiter.

There is an important distinction, this red dwarf star would have about EIGHTY times the mass of Jupiter. I know that sounds crazy, but when you pile on more hydrogen, it doesn't make the star that much bigger. It only makes it denser as the gravity pulls the star together more and more.

At the time I'm recording this video, this is smallest known star at 9% the mass of the Sun, just a smidge over the smallest theoretical size.
Proxima Centauri is about 12% of a solar mass, and the closest star to Earth, after the Sun. But it's much too dim to be seen without a telescope. In fact, no red dwarfs are visible with the unaided eye. The smallest star you can see is 61 Cygni, a binary pair with one star getting only 66% the size of the Sun. It's only 11.4 light years away, and you can just barely see it in dark skies. After that it's Spock's home, Epsilon Eridani, with 74% the size of the Sun, then Alpha Centauri B with 87%, and then the Sun. So, here's your new nerd party fact. The Sun is the 4th smallest star you can see with your own eyes. All the other stars you can see are much bigger than the Sun. They're all gigantic terrifying monsters.
And in the end, our Sun is absolutely huge compared to the smallest stars out there. We here like to think of our Sun as perfectly adequate for our needs, it's ours and all life on Earth is there because of it. It's exactly the right size for us. So don't you worry for one second about all those other big stars out there.

http://www.eurekalert.org/pub_releases/2014-12/dci-sct120514.php

Stem cell transplant without radiation or chemotherapy pre-treatment shows promise

Trial reports transplant success in dyskeratosis congenita, a rare bone marrow failure syndrome, following conditioning with immunosuppressive drugs alone

SAN FRANCISCO - Researchers at Dana-Farber/Boston Children's Cancer and Blood Disorders Center report promising outcomes from a clinical trial with patients with a rare form of bone marrow failure who received a hematopoietic stem cell transplant (HSCT) after pre-treatment with immunosuppressive drugs only.
This is the first trial reporting successful transplant in dyskeratosis congenita (DC) patients without the use of any radiation or conventional cytotoxic chemotherapy beforehand.
The trial's data were presented by study authors Leslie Lehmann, MD, and Suneet Agarwal, MD, PhD, of Dana-Farber/Boston Children's, at the 56th annual meeting of the American Society of Hematology (abstract #2941).
The data suggest that this immunosuppression-only approach could benefit patients with DC--and, perhaps, other bone marrow failure syndromes--who are at high risk of poor transplant outcomes because they cannot tolerate the toxicity of conventional or even reduced-intensity conditioning.
All four participants in the study are alive and well between 10 and 27 months after transplant. None remain dependent on transfusions to maintain blood counts, nor did any experience significant unexpected toxicities or infections during or after transplantation. Were it not for this new regimen, one patient would have been ineligible for transplant due to severe DC-related lung disease.
Conventional transplant conditioning employs radiation and/or high-dose cytotoxic drugs (also known as alkylators) to destroy the bone marrow and blood and immune cells; it also causes widespread cellular damage throughout the body. The process prepares the patient's body to accept the donated stem cells, reducing the risk of rejection and providing a hospitable environment for the new cells to engraft, thrive and produce new blood and immune cells.
In DC and other bone marrow failure syndromes, however, the disease itself already weakens or destroys the patient's bone marrow, raising the question of whether a less toxic approach could effectively condition patients for transplant.
"These data show that it is possible to achieve engraftment within the context of DC using immunosuppression-only conditioning.
This experience begs the question of whether we can think more broadly about this approach's applicability for other conditions, something I think is worth considering," Agarwal said.
"Bone marrow failure syndromes are problems of blood and immune cell production," he added. "In theory, then, in some of these conditions it should be possible for healthy donated stem cells to outcompete native cells, without exposing patients to the toxic effects of radiation or alkylating agents."
Eighty percent of patients with DC develop bone marrow failure before reaching age 30. The genetic defects underlying the disease prevent cells from maintaining their telomeres, the caps at the ends of chromosomes that gradually shorten as cells divide and a person ages.
As a result, DC patients' hematopoietic stem cells age prematurely and do not divide well. While an HSCT can cure the resulting bone marrow failure, outcomes are often poor, likely because of the toxicity associated with conventional conditioning.
The cellular defects in DC created an opportunity for Agarwal and his collaborators to attempt immunosuppression-only pre-transplant conditioning. Tamping down a patient's immune system, they theorized, would give donor stem cells and their progeny a chance to outcompete the patient's existing cells with a minimal risk of rejection.
At the same time, avoiding radiation and alkylators--which cause widespread cellular damage throughout the body--should reduce the risk of long-term HSCT-related complications, such as organ failure and cancer.
The research was funded by Boston Children's Hospital's Translational Research Program.

http://www.eurekalert.org/pub_releases/2014-12/uons-iwf120514.php

In world first -- UNSW researchers convert sunlight to electricity with over 40 percent efficiency

UNSW Australia's solar researchers have converted over 40% of the sunlight hitting a solar system into electricity, the highest efficiency ever reported.

The record efficiency was achieved in outdoor tests in Sydney, before being independently confirmed by the National Renewable Energy Laboratory (NREL) at their outdoor test facility in the United States. The work was funded by the Australian Renewable Energy Agency (ARENA) and supported by the Australia-US Institute for Advanced Photovoltaics (AUSIAPV).

"This is the highest efficiency ever reported for sunlight conversion into electricity," UNSW Scientia Professor and Director of the Advanced Centre for Advanced Photovoltaics (ACAP) Professor Martin Green said.

"We used commercial solar cells, but in a new way, so these efficiency improvements are readily accessible to the solar industry," added Dr Mark Keevers, the UNSW solar scientist who managed the project.

The 40% efficiency milestone is the latest in a long line of achievements by UNSW solar researchers spanning four decades. These include the first photovoltaic system to convert sunlight to electricity with over 20% efficiency in 1989, with the new result doubling this performance. "The new results are based on the use of focused sunlight, and are particularly relevant to photovoltaic power towers being developed in Australia," Professor Green said.

Power towers are being developed by Australian company, RayGen Resources, which provided design and technical support for the high efficiency prototype. Another partner in the research was Spectrolab, a US-based company that provided some of the cells used in the project.

A key part of the prototype's design is the use of a custom optical bandpass filter to capture sunlight that is normally wasted by commercial solar cells on towers and convert it to electricity at a higher efficiency than the solar cells themselves ever could. Such filters reflect particular wavelengths of light while transmitting others.

ARENA CEO Ivor Frischknecht said the achievement is another world first for Australian research and development and further demonstrates the value of investing in Australia's renewable energy ingenuity. "We hope to see this home grown innovation take the next steps from prototyping to pilot scale demonstrations. Ultimately, more efficient commercial solar plants will make renewable energy cheaper, increasing its competitiveness."

The 40% efficiency achievement is outlined in a paper expected to be published soon by the Progress in Photovoltaics journal. It will also be presented at the Australian PV Institute's Asia-Pacific Solar Research Conference, which begins at UNSW today (Monday 8 December).