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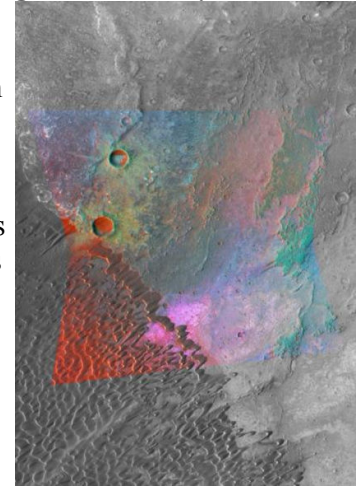
Evidence found for granite on Mars

Researchers now have stronger evidence of granite on Mars and a new theory for how the granite – an igneous rock common on Earth – could have formed there, according to a new study.

The findings suggest a much more geologically complex Mars than previously believed.

Large amounts of a mineral found in granite, known as feldspar, were found in an ancient Martian volcano. Further, minerals that are common in basalts that are rich in iron and magnesium, ubiquitous on Mars, are nearly completely absent at this location. The location of the feldspar also provides an explanation for how granite could have formed on Mars. Granite, or its eruptive equivalent, rhyolite, is often found on Earth in tectonically active regions such as subduction zones. This is unlikely on Mars, but the research team concluded that prolonged magmatic activity on Mars can also produce these compositions on large scales.

"We're providing the most compelling evidence to date that Mars has granitic rocks," said James Wray, an assistant professor in the School of Earth and Atmospheric Sciences at the Georgia Institute of Technology and the study's lead author.



NASA's Mars Reconnaissance Orbiter is providing new spectral "windows" into the diversity of Martian surface materials. Here in a volcanic caldera, bright magenta outcrops have a distinctive feldspar-rich composition.

NASA/JPL/JHUAPL/MSSS

The research was published November 17 in the Advance Online Publication of the journal *Nature Geoscience*. The work was supported by the NASA Mars Data Analysis Program.

For years Mars was considered geologically simplistic, consisting mostly of one kind of rock, in contrast to the diverse geology of Earth. The rocks that cover most of Mars's surface are dark-colored volcanic rocks, called basalt, a type of rock also found throughout Hawaii for instance. But earlier this year, the Mars Curiosity rover surprised scientists by discovering soils with a composition similar to granite, a light-colored, common igneous rock. No one knew what to make of the discovery because it was limited to one site on Mars.

The new study bolsters the evidence for granite on Mars by using remote sensing techniques with infrared spectroscopy to survey a large volcano on Mars that was active for billions of years. The volcano is dust-free, making it ideal for the study. Most volcanoes on Mars are blanketed with dust, but this volcano is being sand-blasted by some of the fastest-moving sand dunes on Mars, sweeping away any dust that might fall on the volcano. Inside, the research team found rich deposits of feldspar, which came as a surprise.

"Using the kind of infrared spectroscopic technique we were using, you shouldn't really be able to detect feldspar minerals, unless there's really, really a lot of feldspar and very little of the dark minerals that you get in basalt," Wray said.

The location of the feldspar and absence of dark minerals inside the ancient volcano provides an explanation for how granite could form on Mars. While the magma slowly cools in the subsurface, low density melt separates from dense crystals in a process called fractionation. The cycle is repeated over and over for millennia until granite is formed. This process could happen inside of a volcano that is active over a long period of time, according to the computer simulations run in collaboration with Josef Dufek, who is also an associate professor in the School of Earth and Atmospheric Sciences at Georgia Tech.

"We think some of the volcanoes on Mars were sporadically active for billions of years," Wray said. "It seems plausible that in a volcano you could get enough iterations of that reprocessing that you could form something like granite."

This process is sometimes referred to as igneous distillation. In this case the distillation progressively enriches the melt in silica, which makes the melt, and eventual rock, lower density and gives it the physical properties of granite. "These compositions are roughly similar to those comprising the plutons at Yosemite or erupting magmas at Mount St. Helens, and are dramatically different than the basalts that dominate the rest of the planet," Dufek said.

Another study published in the same edition of *Nature Geoscience* by a different research team offers another interpretation for the feldspar-rich signature on Mars. That team, from the European Southern Observatory and the University of Paris, found a similar signature elsewhere on Mars, but likens the rocks to anorthosite, which is common on the moon. Wray believes the context of the feldspar minerals inside of the volcano makes a stronger argument for granite. Mars hasn't been known to contain much of either anorthosite or granite, so either way, the findings suggest the Red Planet is more geologically interesting than before.

"We talk about water on Mars all the time, but the history of volcanism on Mars is another thing that we'd like to try to understand," Wray said. "What kinds of rocks have been forming over the planet's history? We thought that it was a pretty easy answer, but we're now joining the emerging chorus saying things may be a little bit more diverse on Mars, as they are on Earth."

This research is supported by the NASA Mars Data Analysis Program under award NNX13AH80G. Any conclusions or opinions are those of the authors and do not necessarily represent the official views of the sponsoring agencies.

CITATION: J Wray, et al. "Prolonged magmatic activity on Mars inferred from the detection of felsic rocks." (Nature Geoscience, 2013) <http://dx.doi.org/DOI.10.1038/NGEO1994>.

http://www.eurekalert.org/pub_releases/2013-11/uo-111813.php

Amber provides new insights into the evolution of the Earth's atmosphere

One of the few organic materials that may preserve reliable data of the Earth's geological history over millions of years

Scientists encounter big challenges when reconstructing atmospheric compositions in the Earth's geological past because of the lack of useable sample material. One of the few organic materials that may preserve reliable data of the Earth's geological history over millions of years are fossil resins (e.g. amber). "Compared to other organic matter, amber has the advantage that it remains chemically and isotopically almost unchanged over long periods of geological time," explains Ralf Tappert from the Institute of Mineralogy and Petrography at the University of Innsbruck.



This is a selection of amber samples from the Eocene from Bitterfeld, Saxony-Anhalt, approximately 35 million years old. Ralf Tappert

The mineralogist and his colleagues from the University of Alberta in Canada and universities in the USA and Spain have produced a comprehensive study of the chemical composition of the Earth's atmosphere since the Triassic period. The study has been published in the journal *Geochimica et Cosmochimica Acta*.

The interdisciplinary team, consisting of mineralogists, paleontologists and geochemists, use the preserving properties of plant resins, caused by polymerization, for their study. "During photosynthesis plants bind atmospheric carbon, whose isotopic composition is preserved in resins over millions of years, and from this, we can infer atmospheric oxygen concentrations," explains Ralf Tappert. The information about oxygen concentration comes from the isotopic composition of carbon or rather from the ratio between the stable carbon isotopes ^{12}C and ^{13}C .

Atmospheric oxygen between 10 and 15 percent

The research team analyzed a total of 538 amber samples from from well-known amber deposits worldwide, with the oldest samples being approximately 220 million years old and recovered from the Dolomites in Italy. The team also compared fossil amber with modern resins to test the validity of the data. The results of this comprehensive study suggest that atmospheric oxygen during most of the past 220 million years was considerably lower than today's 21 percent. "We suggest numbers between 10 and 15 percent," says Tappert. These oxygen concentrations are not only lower than today but also considerably lower than the majority of previous investigations propose for the same time period. For the Cretaceous period (65 - 145 million years ago), for example, up to 30 percent atmospheric oxygen has been suggested previously.

Effects on climate and environment

The researchers also relate this low atmospheric oxygen to climatic developments in the Earth's history. "We found that particularly low oxygen levels coincided with intervals of elevated global temperatures and high carbon dioxide concentrations," explains Tappert. The mineralogist suggests that oxygen may influence carbon dioxide levels and, under certain circumstances, might even accelerate the influx of carbon dioxide into the atmosphere. "Basically, we are dealing here with simple oxidation reactions that are amplified particularly during intervals of high temperatures such as during the Cretaceous period."

The researchers, thus, conclude that an increase in carbon dioxide levels caused by extremely strong volcanism was accompanied by a decrease of atmospheric oxygen. This becomes particularly apparent when looking at the last 50 million years of geological history. Following the results of this study, the comparably low temperatures of the more recent past (i.e. the Ice Ages) may be attributed to the absence of large scale volcanism events and an increase in atmospheric oxygen.

Oxygen may not be the cause of gigantism

According to the results of the study, oxygen may indirectly influence the climate. This in turn may also affect the evolution of life on Earth. A well-known example are dinosaurs: Many theories about animal gigantism offer high levels of atmospheric oxygen as an explanation. Tappert now suggests to reconsider these theories:

"We do not want to negate the influence of oxygen for the evolution of life in general with our study, but the gigantism of dinosaurs cannot be explained by those theories." The research team highly recommends conducting further studies and intends to analyze even older plant resins.

http://www.eurekalert.org/pub_releases/2013-11/mali-cpv111813.php

Calcium plus vitamin D supplementation does not reduce risk of hip fracture or colorectal cancer

New results are in from the Women's Health Initiative (WHI) Calcium plus Vitamin D Supplementation Trial.

New Rochelle, NY - These findings assess the effects on hip fracture and colorectal cancer incidence among 30,000 postmenopausal women nearly five years after the seven-year period of calcium plus vitamin D supplementation ended. The results are presented in Journal of Women's Health, a peer-reviewed publication from Mary Ann Liebert, Inc., publishers. The article is available free on the Journal of Women's Health website at <http://www.liebertpub.com/jwh>.

Jane Cauley, DrPH and a large team of researchers from around the country report that after an average of 11 years, including seven years of supplementation with 1,000 mg of calcium and 400 IU of vitamin D3, neither hip fracture nor colorectal cancer incidence were reduced compared to women who did not receive supplementation. The authors report a small risk reduction for vertebral fractures and in situ breast cancers across the study period for women who received supplementation. They discuss the implications of these findings in the article "Calcium Plus Vitamin D Supplementation and Health Outcomes 5 Years After Active Intervention Ended: The Women's Health Initiative."

"This post-intervention study from the WHI contributes new data on the long-term effects of calcium plus vitamin D supplementation on health outcomes," says Susan G. Kornstein, MD, Editor-in-Chief of Journal of Women's Health, Executive Director of the Virginia Commonwealth University Institute for Women's Health, Richmond, VA, and President of the Academy of Women's Health.

http://www.eurekalert.org/pub_releases/2013-11/slu-bme111813.php

Bitter melon extract may have potential to fight head and neck cancer

Extract taken from an Asian vegetable may have therapeutic qualities to treat head and neck cancer, a Saint Louis University researcher has found.

ST. LOUIS –Preliminary findings of the research were published in the Public Library of Science One Journal by Ratna Ray, Ph.D. associate professor of pathology at Saint Louis University. Ray found that bitter melon extract, a vegetable commonly used in Indian and Chinese diets, reduces the head and neck cancer cell growth in the animal model.

"We wanted to see the effect of the bitter melon extract treatment on different types of cancer using different model systems," said Ray, who first tested the extract in breast and prostate cancer cells. "In this study, the bitter melon extract treatment suppressed the head and neck cancer cell growth in the mouse model, reducing the growth of the tumor."

In a controlled lab setting, Ray found that bitter melon extract regulated several pathways that helped reduce the head and neck cancer cell growth in the animal model. After a period of four weeks, Ray found that the growth and volume of the tumor had reduced.

Bitter melon is a tropical vegetable that is commonly used in Indian and Chinese cooking. Ray, who is originally from India, often uses bitter melon in her meals. People in Asia use this vegetable in stir fries, salads, and also drink its juice as part of a healthy diet. Although more research is needed, Ray believes the bitter melon extract may enhance the current treatment option.

"It's difficult to measure the exact impact of bitter melon extract treatment on the cell growth, but a combination of things – existing drug therapy along with bitter melon – may help the efficacy of the overall cancer treatment," Ray said.

Head and neck cancers, which account for 6 percent of all cancer cases, start in the mouth, nose, sinuses, voicebox and throat. They frequently are aggressive, and often spread from one part of the head or neck to another.

Before moving to phase I clinical trial with head and neck cancer patients, Ray said she and her team would need to validate their results with other preclinical models. Ray's initial research found that treatment with this natural substance halted the breast and prostate cancer cell growth, eventually stopping them from spreading.

This research was funded by grant from the Lottie Caroline Hardy Charitable Trust. Established by Lottie Caroline Hardy at the time of her death from brain cancer in 1979, the Lottie Caroline Hardy Charitable Trust provides funding for the benefit and research into the cause and cure of cancer, heart disease, arthritis and emphysema. The trust's award to Ray is the fourth given to a SLU researcher.

http://www.eurekalert.org/pub_releases/2013-11/uoitbm111813.php

The big male nose

University of Iowa study explains why men's noses are bigger than women's

Human noses come in all shapes and sizes. But one feature seems to hold true: Men's noses are bigger than women's.

A new study from the University of Iowa concludes that men's noses are about 10 percent larger than female noses, on average, in populations of European descent. The size difference, the researchers believe, comes from the sexes' different builds and energy demands: Males in general have more lean muscle mass, which requires more oxygen for muscle tissue growth and maintenance. Larger noses mean more oxygen can be breathed in and transported in the blood to supply the muscle.

The researchers also note that males and females begin to show differences in nose size at around age 11, generally, when puberty starts. Physiologically speaking, males begin to grow more lean muscle mass from that time, while females grow more fat mass. Prior research has shown that, during puberty, approximately 95 percent of body weight gain in males comes from fat-free mass, compared to 85 percent in females.

"This relationship has been discussed in the literature, but this is the first study to examine how the size of the nose relates to body size in males and females in a longitudinal study," says Nathan Holton, assistant professor in the UI College of Dentistry and lead author of the paper, published in the *American Journal of Physical Anthropology*. "We have shown that as body size increases in males and females during growth, males exhibit a disproportionate increase in nasal size. This follows the same pattern as energetic variables such as oxygenate consumption, basal metabolic rate and daily energy requirements during growth."

It also explains why our noses are smaller than those of our ancestors, such as the Neanderthals. The reason, the researchers believe, is because our distant lineages had more muscle mass, and so needed larger noses to maintain that muscle. Modern humans have less lean muscle mass, meaning we can get away with smaller noses. "So, in humans, the nose can become small, because our bodies have smaller oxygen requirements than we see in archaic humans," Holton says, noting also that the rib cages and lungs are smaller in modern humans, reinforcing the idea that we don't need as much oxygen to feed our frames as our ancestors. "This all tells us physiologically how modern humans have changed from their ancestors."

Holton and his team tracked nose size and growth of 38 individuals of European descent enrolled in the Iowa Facial Growth Study from three years of age until the mid-twenties, taking external and internal measurements at regular intervals for each individual. The researchers found that boys and girls have the same nose size, generally speaking, from birth until puberty percolated, around age 11. From that point onward, the size difference grew more pronounced, the measurements showed.

"Even if the body size is the same," Holton says, "males have larger noses, because more of the body is made up of that expensive tissue. And, it's at puberty that these differences really take off."

Holton says the findings should hold true for other populations, as differences in male and female physiology cut across cultures and races, although further studies would need to confirm that.

Prior research appears to support Holton's findings. In a 1999 study published in the *European Journal of Nutrition*, researchers documented that males' energy needs doubles that of females post-puberty, "indicating a disproportional increase in energy expenditure in males during this developmental period," Holton and his colleagues write.

Another interesting aspect of the research is what it all means for how we think of the nose. It's not just a centrally located adornment on our face; it's more a valuable extension of our lungs. "So, in that sense, we can think of it as being independent of the skull, and more closely tied with non-cranial aspects of anatomy," Holton says.

Thomas Southard, professor and chair of orthodontics in the UI College of Dentistry, is a contributing author on the paper. Other authors are Todd Yokley, from Metropolitan State University in Denver, and Andrew Froehle, from Wright State University, in Dayton, Ohio. The Department of Orthodontics in the UI College of Dentistry funded the research.

http://www.eurekalert.org/pub_releases/2013-11/drnl-cpi111813.php

Chaotic physics in ferroelectrics hints at brain-like computing

Unexpected behavior in ferroelectric materials explored by researchers at the Department of Energy's Oak Ridge National Laboratory supports a new approach to information storage and processing.

OAK RIDGE, Tenn. - Ferroelectric materials are known for their ability to spontaneously switch polarization when an electric field is applied. Using a scanning probe microscope, the ORNL-led team took advantage of this property to draw areas of switched polarization called domains on the surface of a ferroelectric material. To the

researchers' surprise, when written in dense arrays, the domains began forming complex and unpredictable patterns on the material's surface.

"When we reduced the distance between domains, we started to see things that should have been completely impossible," said ORNL's Anton Ievlev, the first author on the paper published in Nature Physics. "All of a sudden, when we tried to draw a domain, it wouldn't form, or it would form in an alternating pattern like a checkerboard. At first glance, it didn't make any sense. We thought that when a domain forms, it forms. It shouldn't be dependent on surrounding domains."

After studying patterns of domain formation under varying conditions, the researchers realized the complex behavior could be explained through chaos theory. One domain would suppress the creation of a second domain nearby but facilitate the formation of one farther away -- a precondition of chaotic behavior, says ORNL's Sergei Kalinin, who led the study.

"Chaotic behavior is generally realized in time, not in space," he said. "An example is a dripping faucet: sometimes the droplets fall in a regular pattern, sometimes not, but it is a time-dependent process. To see chaotic behavior realized in space, as in our experiment, is highly unusual."

Collaborator Yuriy Pershin of the University of South Carolina explains that the team's system possesses key characteristics needed for memcomputing, an emergent computing paradigm in which information storage and processing occur on the same physical platform.

"Memcomputing is basically how the human brain operates: Neurons and their connections--synapses--can store and process information in the same location," Pershin said. "This experiment with ferroelectric domains demonstrates the possibility of memcomputing."

Encoding information in the domain radius could allow researchers to create logic operations on a surface of ferroelectric material, thereby combining the locations of information storage and processing. The researchers note that although the system in principle has a universal computing ability, much more work is required to design a commercially attractive all-electronic computing device based on the domain interaction effect.

"These studies also make us rethink the role of surface and electrochemical phenomena in ferroelectric materials, since the domain interactions are directly traced to the behavior of surface screening charges liberated during electrochemical reaction coupled to the switching process," Kalinin said.

The study is published as "Intermittency, quasiperiodicity, and chaos during scanning probe microscopy tip-induced ferroelectric domain switching," and is available online here:

<http://www.nature.com/nphys/journal/vaop/ncurrent/full/nphys2796.html>. Coauthors are ORNL's Stephen Jesse, Evgheni Strelcov, Sergei Kalinin and Amit Kumar; the National Academy of Sciences of Ukraine's Anna Morozovska and Eugene Eliseev; the University of South Carolina's Yuriy Pershin; and Ural Federal University's Vladimir Shur. Ievlev, formerly of Ural Federal University, has joined ORNL as a postdoctoral fellow.

<http://phys.org/news/2013-11-breadfruit-ability-repel-insects.html>

Studies confirm breadfruit's ability to repel insects

ARS scientists and their collaborators have identified three compounds in tropical breadfruit trees--capric, undecanoic and lauric acids--that can repel mosquitoes significantly better than DEET.

Breadfruit, used as a folk remedy in Pacific regions to control insects, is an effective mosquito repellent, U.S. Department of Agriculture (USDA) scientists have found.

Agricultural Research Service (ARS) scientists and their collaborators at the University of British Columbia in Okanagan, Canada, identified three breadfruit compounds—capric, undecanoic and lauric acids—that act as insect repellents. ARS is the chief intramural scientific research agency of USDA.

In the study, chemist Charles Cantrell and his colleagues at the ARS Natural Products Utilization Research Unit (NPURU) in Oxford, Miss., and the University of British Columbia scientists collected smoke extracts by burning sun-dried clusters of flowers in the traditional method used by people in Pacific regions.

Capric, undecanoic and lauric acids, which are saturated fatty acids, were found to be significantly more effective at repelling mosquitoes than DEET, the primary insect repellent used against biting insects. For the first time, breadfruit was shown to actually work as a repellent, confirming it as a valid folk remedy, according to Cantrell.

These same compounds found in breadfruit and other folk remedies were shown to be highly active and the most repelling in a different study that examined a variety of saturated and unsaturated fatty acids. Cantrell teamed with Uli Bernier, a chemist in the Mosquito and Fly Research Unit at the ARS Center for Medical, Agricultural and Veterinary Entomology in Gainesville, Fla., and scientists at the University of Mississippi to evaluate the compounds. The test involved cloth treated with different concentrations of compounds and worn by volunteers. Again, these compounds were shown to provide effective protection against mosquitoes.

More information: Read more about this research in the November/December 2013 issue of Agricultural Research magazine.

<http://www.sciencedaily.com/releases/2013/11/131118080918.htm>

Human Error Most Common Cause of Birth Asphyxia: Poor Fetal Monitoring in 50% of Cases, Norwegian Study Shows

Findings indicate human error is the most common cause of infant asphyxiation at birth

Findings from a 15-year study published in *Acta Obstetrica et Gynecologica Scandinavica*, a journal of the Nordic Federation of Societies of Obstetrics and Gynecology, indicate that human error is the most common cause of infant asphyxiation at birth. Inadequate fetal monitoring, lack of clinical skills, and failure to obtain senior medical staff assistance are most often cited in Norwegian compensation claims following birth asphyxia. In Norway there are roughly 60,000 births each year, with The Norwegian System of Compensation to Patients (NPE) receiving 65 claims for obstetric injury to the child. A previous study by the current research team found that asphyxia was the most common cause for compensation -- between 20 and 25 cases annually. Prior research estimate that lifelong compensation for injury caused by birth asphyxia averages about €430,000 (\$574,000) in Norway, with costs more than 10 times higher in the U.S.

"While fetal brain injury or death is uncommon during childbirth, when it occurs the effects are devastating," explains Dr. Stine Andreassen with the Department of Obstetrics and Gynecology at Nordlandssykehuset (Nordland Hospital) in Bodø, Norway. "Our study investigates claims made to the NPE for neurological injury or death following birth asphyxia."

For the present study, researchers examined 315 claims made to the NPE between 1994 and 2008 that were associated with alleged birth asphyxia. The team looked at hospital records, assessments by experts, along with NPE and courts of law decisions. Of the claims made, there were 161 cases that were awarded compensation. Results show that in the compensated cases there were 107 infants who survived, with 96 having neurological injury, and 54 children who died. Human error was the most common cause of birth asphyxia with 50% attributed to inadequate fetal monitoring, 14% lack of clinical knowledge, 11% non-compliance to clinical guidelines, 10% failure to ask for senior medical assistance, and 4% were errors in drug administration. In cases of substandard care, the obstetrician and midwife were documented as the responsible staff at 49% and 46%, respectively.

"In most compensated cases, poor fetal monitoring led to an inadequate supply of oxygen to the infant," concludes Dr. Andreassen. "Training for midwives and obstetricians, along with high-quality audits, could help to reduce claims for compensation after birth asphyxia."

<http://www.sciencedaily.com/releases/2013/11/131118081045.htm>

Would an 'Anti-Ketamine' Also Treat Depression?

A new study reports that enhancing, instead of blocking, that same target -- the NMDA glutamate receptor -- also causes antidepressant-like effects

Thirteen years ago, an article in this journal first reported that the anesthetic medication, ketamine, showed evidence of producing rapid antidepressant effects in depressed patients who had not responded to prior treatments. Ketamine works by blocking one of the targets for the neurotransmitter glutamate in the brain, the N-methyl-D-aspartate (NMDA) glutamate receptor.

Now, a new study in *Biological Psychiatry* reports that enhancing, instead of blocking, that same target -- the NMDA glutamate receptor -- also causes antidepressant-like effects.

Scientists theorize that NMDA receptor activity plays an important role in the pathophysiology of depression, and that normalizing its functioning can, potentially, restore mood to normal levels.

Prior studies have already shown that the underlying biology is quite complex, indicating that both hyperfunction and hypofunction of the NMDA receptor is somehow involved. But, most studies have focused on antagonizing, or blocking, the receptor, and until now, studies investigating NMDA enhancement have been in the early phases.

Sarcosine is one such compound that acts by enhancing NMDA function. Collaborators from China Medical University Hospital in Taiwan and the University of California in Los Angeles studied sarcosine in an animal model of depression and, separately, in a clinical trial of depressed patients.

"We found that enhancing NMDA function can improve depression-like behaviors in rodent models and in human depression," said Dr. Hsien-Yuan Lane, the corresponding author on the article.

In the clinical portion of the study, they conducted a 6-week trial where 40 depressed patients were randomly assigned to receive sarcosine or citalopram (Celexa), an antidepressant already on the market that was used as a comparison drug. Neither the patients nor their doctors knew which one they were receiving.

Compared to citalopram, patients receiving sarcosine reported significantly improved mood scores, were more likely to experience relief of their depression symptoms, and were more likely to continue in the study. There

were no major side effects in either group, but patients receiving citalopram reported more relatively minor side effects than the patients being treated with sarcosine.

"It will be important to understand how sarcosine, which enhances NMDA receptor function, produces the interesting effects reported in this study. There are ways that its effects, paradoxically, might converge with those of ketamine, a drug that blocks NMDA receptors," commented Dr. John Krystal, Editor of Biological Psychiatry. "For example, both compounds may enhance neuroplasticity, the capacity to remodel brain networks through experience. Also, both potentially attenuate signaling through NMDA receptors, ketamine with single doses and sarcosine, with long-term administration, by evoking an adaptive down regulation of NMDA receptors."

Better understanding the reported findings may help to advance the development of medication treatments for patients who do not respond to available treatments. This is an important goal, with estimates indicating that as many as half of all patients do not experience complete relief of their depression.

Chih-Chia Huang, I-Hua Wei, Chieh-Liang Huang, Kuang-Ti Chen, Mang-Hung Tsai, Priscilla Tsai, Rene Tun, Kuo-Hao Huang, Yue-Cune Chang, Hsien-Yuan Lane, Guochuan Emil Tsai. Inhibition of Glycine Transporter-1 as a Novel Mechanism for the Treatment of Depression. Biological Psychiatry, 2013; 74 (10): 734 DOI: 10.1016/j.biopsych.2013.02.020

<http://www.livescience.com/41277-health-benefits-illegal-drugs.html>

6 Party Drugs That May Have Health Benefits

The use of illegal drugs for medicinal reasons is a controversial topic, even as more states and jurisdictions allow the use of medical marijuana and other substances every year.

By Marc Lallanilla, Assistant Editor

And self-medicating — using drugs without the assistance of a doctor or other medical professional — can be dangerous. "Potential risks of self-medication practices include incorrect self-diagnosis, delays in seeking medical advice ... incorrect dosage, incorrect choice of therapy, masking of a severe disease, and risk of dependence and abuse," wrote the authors of a 2010 article published in the journal Current Drug Safety. Because of these risks, doctors strongly advise against the unregulated use of illicit drugs, which can do more harm than good. Nonetheless, medical researchers continue to find a surprising number of health benefits in drugs widely used for recreational purposes. [[Image Gallery: 7 Potent Medicinal Plants](#)]

Magic Mushrooms: [Mushrooms containing psilocybin](#) produce colorful hallucinations, even when consumed in small quantities. There's also some evidence that small amounts of psilocybin can relieve the symptoms of cluster headaches, obsessive-compulsive disorder and depression.

Research published in the British Journal of Psychiatry in 2012 found that volunteers taking psilocybin had enhanced recall, making the substance an effective adjunct to psychotherapy. Another 2012 study, published in the Proceedings of the National Academy of Sciences, found that the drug slowed activity in the centers of the brain that are hyperactive in people with depression.

"We're not saying go out there and eat magic mushrooms," Robin Carhart Harris, lead author of both studies, told [Reuters](#). "But ... this drug has such a fundamental impact on the brain that it's got to be meaningful. It's got to be telling us something about how the brain works. So we should be studying it and optimizing it if there's a therapeutic benefit."

Ecstasy: Also known as [MDMA](#), ecstasy is a synthetic compound that produces hallucinations, feelings of emotional warmth and high levels of energy. The same psychoactive properties that make ecstasy so popular with partygoers may also make it useful in treating post-traumatic stress disorder, or PTSD.

Other research has found that ecstasy has robust anticancer properties, particularly for leukemia, lymphoma and myeloma. In 2011, researchers from the University of Birmingham found that a slightly modified form of ecstasy was 100 times more potent at destroying cancer cells than the original form of MDMA. "Further work is required, but this research is a significant step forward in developing a potential new cancer drug," the researchers said in a statement.

Cocaine: Leaves of the coca plant (*Erythroxylum coca*) have been used as a stimulant in South America for thousands of years. The drug derived from coca, [cocaine](#) — popularly known as coke, blow or Bolivian marching powder — has been credited with a range of health benefits.

Cocaine can be used as a topical anesthetic for surgical procedures due to its rapid-acting numbing properties. When combined with other compounds into a preparation called TAC, cocaine can also treat minor skin lacerations, since the drug is an effective vasoconstrictor (narrows blood vessels).

Dr. Andrew Weil, founder and director of the Arizona Center for Integrative Medicine, has studied coca's gastrointestinal effects among South American communities. "If you look carefully at the coca leaf's molecular array, you find 14 bioactive alkaloids ... while cocaine acts as a gut stimulant, other coca alkaloids can have precisely the opposite action. They inhibit gut activity," Weil wrote in the [Huffington Post](#).

"During my time in Andean Indian communities, I collected many reports about whole coca's paradoxical, normalizing effect on bowel function, and experienced it firsthand, as well," he wrote.

LSD: Lysergic acid diethylamide, usually known as [LSD or acid](#), is a hallucinogen that's been widely used for decades, but recent research finds it has some potential for treating alcoholism. A study from Norway, published in 2012 in the Journal of Psychopharmacology, suggests that LSD prevented alcoholics from relapsing during treatment.

"LSD worked in an entirely different way than any current psychiatric drugs," said study author Teri Krebs of the Norwegian University of Science and Technology. "Many patients said they had gained a new appreciation for their alcohol problem and new motivation to address it." [[Slideshow: Scientists Analyze Drawings by an Acid-Tripping Artist](#)]

Ketamine: Also called "Special K," this animal tranquilizer is sometimes used as a recreational drug by attendees at dance raves and other events. The drug may also effectively combat the symptoms of depression. A 2012 study from the journal Science found that [ketamine](#) may help stimulate the growth of synapses in the brain, and beneficial effects of the drug on people with chronic depression can occur within hours. "The rapid therapeutic response of ketamine in treatment-resistant patients is the biggest breakthrough in depression research in a half century," Ronald Duman, professor of psychiatry and neurobiology at Yale University, said in a statement.

Marijuana: Pot, in addition to being the most widely used illicit drug in the United States, has a raft of medical benefits. According to NORML (a marijuana advocacy group), 21 states and the District of Columbia allow some use of [medical marijuana](#).

The drug has been shown through years of scientific research to relieve chronic pain, prevent PTSD, stimulate appetite for people with AIDS wasting syndrome, control nausea, relieve intra-ocular pressure associated with glaucoma, treat opioid dependence and improve the symptoms of Crohn's disease.

<http://bit.ly/1byEhC3>

Deformed, Pointy Skull from Dark Ages Unearthed

The skeleton of an ancient aristocratic woman whose head was warped into a deformed, pointy shape has been unearthed in a necropolis in France.

Nov 18, 2013 11:30 AM ET // by Tia Ghose, LiveScience

The necropolis, found in the Alsace region of France, contains 38 tombs that span more than 4,000 years, from the Stone Age to the Dark Ages.

The Obernai region where the remains were found contains a river and rich, fertile soil, which has attracted people for thousands of years. Philippe Lefranc, an archaeologist who excavated the Stone Age burials, wrote in an email.

Archaeologists first found the tombs in 2011 while doing a preliminary excavation of the area prior to the start of a big industrial building project. This year, Lefranc and his colleagues went back to do a more in-depth excavation.



A woman's deformed skull was found in one of the tombs, which dates to around 1,650 years ago. Denis Gliksman, Inrap

They found that the tombs were well preserved by the limestone rock in which they were buried. One of the burials contained 20 tombs of men, women and children.

"The corpses are lying on their backs, with outstretched legs and heads turned westwards," Lefranc said.

The tombs, which date to between 4900 B.C. and 4750 B.C., also contained a few stone vases and tools, along with ornaments such as mother-of-pearl elbow bracelets and collars. The small group may have been a family from a Neolithic farming and animal-herding culture that lived in long houses and buried their dead in cemeteries, Lefranc said.

Eastern transplants

In the second burial, which was in a separate area, they found 18 tombs from either the late Roman period or the early Dark Ages, about 1,650 years ago. One of the tombs held a woman, likely an aristocrat, who had a deformed, flattened forehead.

"The deformation of the skull with the help of bandages (narrow strips of cloth) and small boards is a practice coming from central Asia," Lefranc said in an email. "It was popularized by the Huns and adopted by many German people." In those times, the deformed, alienlike skull was a privilege reserved for the aristocracy.

"In France, Germany and eastern Europe, these deformed skulls appear in tombs rich in objects," Lefranc said.

The wealthy lady's tomb also contained gold pins, belts known as chatelaines, pearls, a comb made of a stag antler, and a bronze mirror that likely came from the Caucasus region or central Asia, he said.

The team speculates that the 1,650-year-old graves held mercenary soldiers from the East and their families, who were employed by the Roman Army during the waning days of the Roman empire.

<http://nyti.ms/HVpvgM>

New Plan for a Disabled Kepler

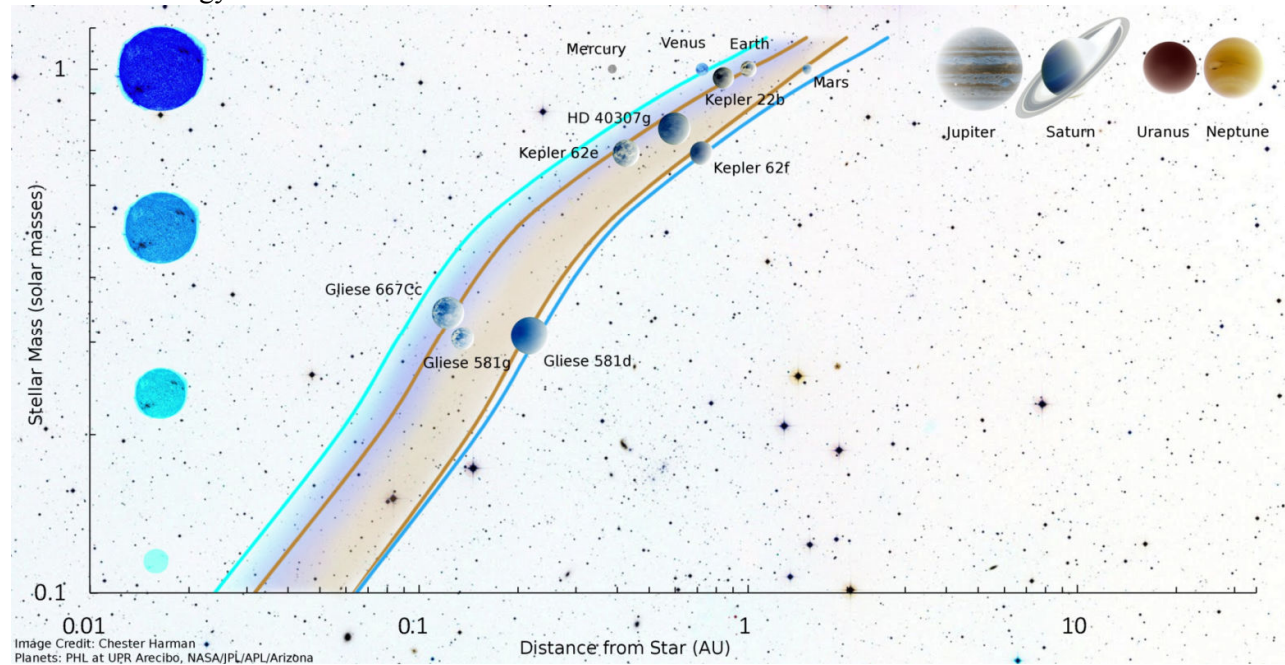
The little spacecraft that could may still have some life left in it.

By Dennis Overbye

Mountain View, Calif. - Hearts were broken around the lonely cosmos in the spring when a critical wheel on NASA's Kepler spacecraft got stuck, leaving its telescope unable to point precisely enough to continue prospecting for Earthlike planets in a starry patch of the Milky Way. But Kepler's managers say they have a plan that could keep it hunting for these exoplanets for three or four more years.

"K2: The story begins," Steve Howell, Kepler's project scientist, told a recent gathering of astronomers here at NASA's Ames Research Center, borrowing the name of the world's second-highest mountain to herald the proposed mission.

In its four years of monitoring the brightness of each of 160,000 stars in one patch of sky, Kepler identified 3,500 possible exoplanets by seeing stars dim when planets crossed in front of them. It also enabled the first rough estimate of the abundance of habitable planets in the Milky Way: about one in five sunlike stars have potentially habitable Earth-size planets, meaning billions of chances for the existence of E.T. Not to mention how it revolutionized the understanding of the internal structures of the stars themselves through the practice of "asteroseismology."



But the little spacecraft was only beginning to zero in on planets with orbits analogous to our own, Earth-size worlds that take a year to orbit suns similar to our own, candidates for Earth 2.0, in the vernacular. K2 would no longer train Kepler on only one set of stars. Instead, it would skip around the sky, monitoring the stars in one spot continuously for up to 80 days.

Over such an interval, Kepler could not detect any planets with orbital periods more than a few weeks. But it could detect planets with habitable orbits around the smaller, dimmer stars known as red dwarfs. For such stars, the temperate orbital regions, or Goldilocks zones — where the surface temperatures on a planet are mild enough for liquid water — are closer and thus have shorter orbital periods.

"There are niches where we can deliver small planets," said Dr. Howell, noting that K2 would cover five to 10 times as much of the sky as the original Kepler survey and could discover hundreds of planets around the red dwarfs.

Kepler was launched in March 2009 after a decades-long battle by its originator and prime scientist, William Borucki of NASA's Ames Research Center, to show that planets could be detected this way.

Its original field of view, 160,000 stars on the border of the constellations Cygnus and Lyra in the thick of the Milky Way, was chosen to provide as large a sample as possible of sunlike stars for a cosmic census of

exoplanets. To do this, Kepler had to be able to point precisely and stably enough to keep all these stars on the same pixels of its camera for four years.

The loss of a second reaction wheel — Kepler was launched with four — left the spacecraft prone to rolling about its telescope's line of sight, especially when its solar panels, which wrap halfway around the telescope like a cape, are unevenly illuminated by sunlight.

That, unfortunately, is the case when Kepler points at Cygnus. Light exerts pressure, which is why comets have tails. "The sun, unfortunately, continues to shine," said Charles Sobeck, deputy project manager of Kepler, and the uneven solar illumination makes the spacecraft roll and unable to keep stars on the right pixels. Through all of this, the telescope and detector remained unscathed, making it a valuable astronomical resource already in space. In response to a call for ideas about how to make use of Kepler, astronomers submitted 42 white papers. The solution was a neat bit of rocket science. Tests have shown sunlight can be used to stabilize Kepler. The key is to keep it pointed in directions that leave its solar panels evenly illuminated. "When it's stable, it's really stable," Mr. Sobeck said. As a result, Kepler's planet hunting will now be limited to fields of stars that lie along a circle known as the ecliptic — the path traversed by the sun through the zodiac.

Mr. Sobeck said giving up the original field of view was a big hurdle. "After four years that was emotionally difficult."

The reward will be variety, as well as a new lease on life. Part of the sun's path goes right across the center of the galaxy, in the constellation Sagittarius, and other parts, away from the Milky Way, cross outside galaxies, where Kepler could record the rise and fall of supernova explosions that have proved critical to understanding cosmic history. Other fields of opportunity include stormy regions strewn with clouds of gas and dust where new stars and presumably new planets are being born, so Kepler, if the plan goes through, will be able to study stars and planets in a variety of environments.

For now, however, K2 is only a proposal, still being tested. The idea has to pass muster with NASA's astrophysics division and then survive a review at NASA, in a sort of bake-off with other needy projects.

The final decision on Kepler's fate will come next spring. Regardless of the answer, the Kepler team will go on. The scientists have three more years of work to analyze the data that has already been obtained, including the whole last year of the spacecraft's observations, which Mr. Borucki characterized in a news conference as "the most valuable data we have."

Mr. Sobeck is hopeful for more. "Nobody wants to turn off a spacecraft in orbit," he said.

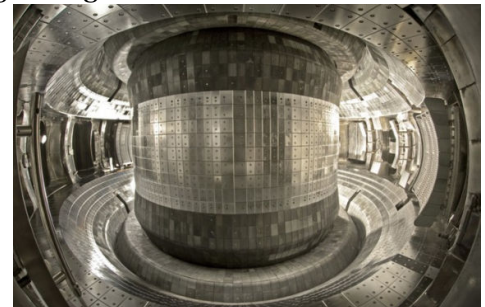
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Fusion reactor achieves tenfold increase in plasma confinement time

Experimental design improved heat dissipation, reducing damage to reactor walls.

by [Matthew Francis](#) - Nov 19 2013, 4:30am TST

The promise of fusion is immense. Its fuel is hydrogen plasma, made from the most abundant atom in the Universe, and the major byproduct is helium, an inert gas. In this era with the threat of climate change, clean alternative sources of energy are more necessary than ever. However, even after decades of research and enormous investments of money, scientists haven't succeeded in producing a working nuclear fusion plant. Nevertheless, many feel the potential payoff is worth continued investment.



The interior of the donut-shaped Experimental Advanced Superconducting Tokamak (EAST). Hydrogen plasma is confined in this chamber by strong magnetic fields, where it fuses into heavier nuclei. Institute of Plasma Physics, Chinese Institute of Science

Practical fusion

For that reason, work is proceeding apace on the next generation of fusion reactors. Researchers at the Experimental Advanced Superconducting Tokamak (EAST) in Hefei, China, achieved a significant improvement in its confinement time and the density of the plasma it held. This step is necessary to maintain the appropriate conditions for fusion as well as to reduce the damage the hot plasma causes to the reactor walls. As described by J. Li and colleagues, the latest run at EAST achieved a plasma pulse lasting over 30 seconds, a record achievement that simultaneously demonstrated improvements in heat dispersal.

Nuclear fusion requires overcoming the electric repulsion between positively charged nuclei until the strong nuclear force exerts itself. In practice, that requires very high temperatures, which ensure that the nuclei are moving fast enough to collide rather than repel each other. While fusion is relatively easy on a small scale, researchers have yet to produce a reliable chain reaction that safely yields more energy than is required to sustain it.

Hydrogen is the simplest atom, consisting of one proton and one electron. In practice, D-T fusion reactors are common, and they use the deuterium (D) and tritium (T) isotopes of hydrogen (with one and two neutrons, respectively). The presence of those neutrons lowers the energy bar to fusion. Ramping the temperature up beyond the minimum required for fusion, by increasing the number of nuclei moving fast enough to overcome electric repulsion, also helps.

Ultimately the problem is one of plasma confinement: holding the nuclei within a limited space at sufficiently high temperature. (Plasma is a gas consisting of free electrons and nuclei; at cooler temperatures, these particles recombine to make neutral atoms, another reason to keep things hot.) Hot gas expands rapidly, so energy is required to force the plasma back together.

Fusion requires temperatures greater than 15 million degrees Celsius; many reactors top 100 million degrees. That's hot enough to melt anything solid, so confinement requires something other than a wall. Stars have a natural plasma confinement system in the form of gravity: their large mass ensures high pressure and temperature in the core. But that's obviously impractical for Earth-bound scientists.

Magnetic confinement is one possible solution, and the one used by the donut-shaped reactors known as tokamaks. ([Other types of reactors and confinement exist as well.](#)) Electrically charged particles like deuterium nuclei can be steered by magnetic fields, so sufficiently strong fields can both heat and contain plasma. As its name suggests, EAST utilizes superconducting magnets to increase the force it can exert, a method also practiced to contain the protons that circulate at the Large Hadron Collider (LHC).

When plasma is magnetically confined and heated beyond a certain limit, it transitions to a high-confinement mode, or H-mode. In this mode, the plasma itself spontaneously generates an "edge" that partly prevents particles from escaping, and it throttles turbulence in the hot material. This more than doubles the time plasma can be confined. The present study achieved more than 30 seconds of a sustained H-mode pulse, an improvement of 10 to 20 times beyond anything achieved at other reactors. Thirty seconds may not sound like much until you realize this is plasma at more than 100 million degrees, more than five times the core temperature of the Sun.

Additionally, the authors described enhancements to the walls of the EAST reactor. When energetic particles collide with the atoms in the reactor chamber, they can create unwanted byproducts, which in turn may interfere with the operation of the equipment. For that reason, the improvements to EAST were designed to dissipate the heat efficiently and to remove the helium "ash" produced by the fusion reactions.

EAST can be thought of as a pathfinder for the larger International Thermonuclear Experimental Reactor (ITER), slated to begin operation in 2020 with full fusion power tests in 2028. However, thanks largely to budgetary cuts across science, the United States has withdrawn its financial contribution to ITER, which could delay the start further.

Nevertheless, these results are necessary but incremental steps toward reliable nuclear fusion power. A tenfold increase in plasma confinement time is a significant accomplishment, and it came with an improvement in heat dissipation. The slow state of progress may or may not yield ultimate results, but the promise of clean abundant power could be a bit closer to reality.

Nature Physics, 2013. DOI: [10.1038/nphys2795](https://doi.org/10.1038/nphys2795)

http://www.eurekalert.org/pub_releases/2013-11/afps-lal111813.php

Liberals aren't like the rest, or so they think

Liberals tend to underestimate the amount of actual agreement among those who share their ideology, while conservatives tend to overestimate intra-group agreement, according to new research published in *Psychological Science*, a journal of the Association for Psychological Science.

These findings may help to explain differences in how political groups and movements, like the Tea Party and Occupy Wall Street, gain traction on the national stage:

"The Tea Party movement developed a succinct set of goals in its incipient stages and effectively mobilized its members toward large-scale social change quite quickly," says psychological scientist Chadly Stern of New York University. "In contrast, despite its popularity, the liberal Occupy Wall Street movement struggled to reach agreement on their collective mission and ultimately failed to enact large-scale social change."

Stern, with co-authors Tessa West and Peter Schmitt, recruited almost 300 hundred participants to complete an online survey. The participants read political statements (e.g., "In general, I support labor unions,") and non-political statements (e.g., "I enjoy coffee") and were asked to indicate whether they agreed or disagreed with each statement. They were also asked to indicate how much others of the same political persuasion would support their own attitudes – a measure of perceived in-group consensus.

Liberals showed what the researchers call "truly false uniqueness," perceiving their beliefs as more divergent from the beliefs of other liberals than they actually were. Moderates and conservatives, on the other hand,

showed evidence of "truly false consensus," perceiving their beliefs to be more similar to those of other members of their political group than they actually were.

Data from a second study suggest that the relationship is driven by participants' desire to feel unique: Liberals reported a stronger desire for uniqueness than did moderates or conservatives.

Surprisingly, these trends even emerged among nonpolitical judgments, such as preference for coffee: Liberals believed their preferences were more different from those of other liberals than they actually were, while conservatives believed their preferences were more similar to those of other conservatives than they actually were.

Given that perceptions of in-group consensus can be an important motivator for social change, these new findings may help to explain why liberal and conservative movements develop different political trajectories: "Liberal social movements might struggle to develop solidarity and formulate shared goals within their ranks, both because liberals want to maintain unique beliefs and because they underestimate the amount of agreement among their members," Stern explains.

"Conservative social movements might initially capitalize on perceiving agreement to galvanize their ranks, but their inaccurate perceptions could impair group progress when actual agreement is necessary."

This research was supported by a National Science Foundation Graduate Research Fellowship awarded to C. Stern and by funding from New York University awarded to T. V. West.

http://www.eurekalert.org/pub_releases/2013-11/aha-msc111213.php

Many sudden cardiac arrests preceded by warning signs

Sudden cardiac arrest isn't always so sudden, according to research presented at the American Heart Association's Scientific Sessions 2013.

Abstract: 18987: Hall F, Core 4, Poster Board: 4051

In a study of middle-age men in Portland, Oregon, more than half had possible warning signs up to a month before their hearts stopped abruptly.

Cardiac arrest occurs when the heart stops due to a failure in its electrical system. Patients can sometimes survive if they receive CPR immediately and a defibrillator is used quickly to shock the heart into a normal rhythm.

About 360,000 out-of-hospital cardiac arrests are reported each year in the United States, according to the American Heart Association. Only 9.5 percent of people who suffer a cardiac arrest outside the hospital survive. "By the time rescuers get there, it's much too late," said Eloi Marijon, M.D., study lead author and a visiting scientist at Cedars-Sinai Heart Institute in Los Angeles.

The new research is part of the 11-year-old Oregon Sudden Unexpected Death Study, which involves 1 million people in the Portland metro area. Researchers gathered information about the symptoms and health history of men 35 to 65 years old who had out-of-hospital cardiac arrests in 2002-12.

Among 567 men who had out-of-hospital cardiac arrests, 53 percent had symptoms prior to the cardiac arrest. Of those with symptoms, 56 percent had chest pain, 13 percent had shortness of breath and 4 percent had dizziness, fainting or palpitations. Almost 80 percent of the symptoms occurred between four weeks and one hour before the sudden cardiac arrest, he said.

Most men had coronary artery disease, but only about half had been tested for it before their cardiac arrest. Researchers are conducting similar work in women.

"The lesson is, if you have these kinds of symptoms, please don't blow them off," said Sumeet Chugh, M.D., senior author and associate director for genomic cardiology at the Cedars-Sinai Heart Institute. "Go see your healthcare provider. Don't waste time."

Co-authors are Kyndaron Reinier, Ph.D., M.P.H.; Audrey Evanado, M.D.; Carmen Teodorescu, M.D., Ph.D.; Kumar Narayanan, M.D.; Adriana Huertas Vazquez, Ph.D.; Harpriya Chugh, B.E.; Katherine Jerger, B.S.; Ronald Mariani, E.M.T.P.; Eric Stecker, M.D., M.P.H.; Karen Gunson, M.D.; and Jonathan Jui, M.D., M.P.H. Author disclosures are on the abstract. The Centers for Disease Control and Prevention, the American Heart Association and the Doris Duke Charitable Foundation funded the study. Learn more about cardiac arrest and CPR.

http://www.eurekalert.org/pub_releases/2013-11/ace-iwf111213.php

Individuals who flush after drinking are at higher risk of alcohol-related hypertension
Excessive drinking is a known risk factor for hypertension. Drinking that results in facial flushing indicates high sensitivity or even intolerance to alcohol.

A new study has found that drinking-related hypertension has a higher risk in flushers than in non-flushers, and the risk of hypertension was significantly increased when flushers consumed more than four drinks per week. Excessive drinking is a known risk factor for hypertension. Drinking that results in facial flushing indicates high sensitivity or even intolerance to alcohol. A study of the relationship between drinking and these two

conditions has found that drinking-related hypertension has a lower threshold value and higher risk in flushers than in non-flushers.

Results will be published in the April 2014 online-only issue of *Alcoholism: Clinical & Experimental Research* and are currently available at Early View.

"Facial flushing after drinking is always considered as a symptom of high alcohol sensitivity or even intolerance to alcohol, unless a patient is taking special medicine," said Jong Sung Kim, head of the department of family medicine at Chungnam National University School of Medicine. "The facial flushing response to drinking usually occurs in a person who cannot genetically break down acetaldehyde, the first metabolite of alcohol."

"Facial flushing after alcohol drinking differs across gender, age, and ethnic groups," added Kyung Hwan Cho, president of the Korean Academy of Family Medicine. "In general, it is more common in women, the elderly, and East Asians versus Westerners."

Cho noted that it is well known that excessive alcohol consumption is associated with elevated blood pressure and the likely development of hypertension. "This association persists regardless of beverage type and shows a dose-response relationship, which means excess drinking for weeks or months can increase blood pressure," he said. "However, the relationship may vary by gender, race/ethnicity, or presence of other risk factors for cardiovascular disease. Conversely, many studies have reported that meaningful blood pressure reductions occur after reductions in alcohol drinking."

"To my knowledge," noted Kim, "there has been no detailed research that has analyzed the relationship between drinking and hypertension while considering individual responses to alcohol." Kim and his colleagues collected data from the medical records of 1,763 men (288 non-drinkers, 527 flushing drinkers, 948 non-flushing drinkers) who had received a health check-up. The risk of hypertension related to the weekly drinking amount by non-flushers and flushers was analyzed and compared with the risk of hypertension among non-drinkers. "Our results indicate that hypertension associated with drinking has a lower threshold value and higher risk in flushers than in non-flushers," said Kim. "After adjusting for age, body mass index, exercise status, and smoking status, the risk of hypertension was significantly increased when flushers consumed more than four drinks per week. In contrast, in non-flushers, the risk increased with consuming more than eight drinks per week".

Kim added that these results indicate that facial flushing after drinking may potentially serve as a marker of risk for hypertension associated with drinking. "Our research findings suggest that clinicians and researchers should, respectively, consider evaluating their patients' flushing response to alcohol as well as drinking amount in a daily routine care, and researching hazard by drinking."

"Thus, if you or your patient have facial flushing, the risk of hypertension can increase even if you drink less than those who do not have facial flushing," said Cho. "[Under these circumstances, I would] recommend limiting your or their drinking amount even more to prevent the development of hypertension."

Alcoholism: Clinical & Experimental Research (ACER) is the official journal of the Research Society on Alcoholism and the International Society for Biomedical Research on Alcoholism. Co-authors of the ACER paper, "Hypertension Associated with Alcohol Consumption Based on the Facial Flushing Reaction to Drinking," were: Jong-Sung Kim, Jin-Gyu Jung, Young-Seok Kim, and Seok-Joon Yoon from the Department of Family Medicine, Research Institute for Medical Sciences in the School of Medicine at Chungnam National University; and Mi-Kyeong Oh of the Department of Family Medicine in the College of Medicine at the University of Ulsan, Gangneung Asan Hospital, both in Korea. This release is supported by the Addiction Technology Transfer Center Network at <http://www.ATTCnetwork.org>.

http://www.eurekalert.org/pub_releases/2013-11/lm-oos111913.php

Origin of species: Protein imbalances doom hybrids

Why do crosses between closely related species fail to produce fertile hybrids?

A new study led by Professor Axel Imhof of Ludwig-Maximilians-Universitaet (LMU) in Munich shows that differences in the levels - not necessarily the sequences - of certain key proteins are crucial in mediating reproductive isolation.

Two individuals are defined as belonging to the same biological species, if matings between them give rise to viable and fertile offspring. Crosses between closely related, but already distinct, species produce hybrid offspring that are either inviable or sterile, and thus cannot give rise to a self-propagating hybrid lineage. In the early 20th century, geneticists and evolutionary biologists developed a theoretical model to explain why distinct species that share the same common ancestor soon diverge to such an extent that their hybrids are unable to reproduce. This model postulates that certain genes evolve more rapidly than others – and in a manner which ensures that they function well within each of the diverging populations, but interfere with one another when brought together in hybrid genomes.

Such genes are referred to as Dobzhansky-Muller gene pairs, or hybrid-incompatibility genes. "Although several Dobzhansky-Muller gene pairs have been isolated in the last five years, their function remained essentially unclear prior to our study," says Professor Axel Imhof of LMU's Adolf Butenandt Institute. In their new study, he and his team have now characterized the functions of the genes Lmr (Lethal male rescue) and Hmr (Hybrid male rescue), which form a Dobzhansky-Muller gene pair in hybrid matings between fruitflies belonging to the closely related *Drosophila* species *D. melanogaster* and *D. simulans*. Hybrid males produced by crosses between these two species are inviable, while the female hybrids are viable but sterile. Imhof's group has now shown that the proteins encoded by the genes Hmr and Lmr form a molecular complex, which binds to the centromeric regions of chromosomes, i.e., at the site of the typical constriction found in paired sister chromosomes prior to cell division, and play an important role in chromosome segregation later in cell division. The problem for the hybrids lies in the fact that, although both *D. melanogaster* and *D. simulans* synthesize HMR and LHR proteins, they make these gene products in very different amounts.

Thus *D. melanogaster* makes far more HMR than *D. simulans*, while the latter produces LHR in much higher concentrations than *D. melanogaster*. Nevertheless, the HMR and LHR proteins retain the ability to interact with each other, irrespective of their origin. As a result, in hybrid cells, HMR-LHR complexes are formed in much larger amounts than in the cells of the parental species. Moreover, this increase cannot be accommodated by the number of centromeric binding sites available in the hybrid. The resulting discrepancy between the amounts of complex and centromeric binding sites leads to binding of the complex all over the genome. It is this abnormal distribution of HMR-LHR complexes that is responsible for hybrid lethality.

These results show that it is the relative level of the proteins concerned, and not any differences in their amino acid sequences, that plays the crucial role here. It also encourages the LMU researchers to search further for species-specific differences in protein levels with the aid of quantitative proteomics. "In addition to the proteins HMR and LHR that we have focused on, other factors have been identified which are involved in mediating reproductive isolation between species. "In future experiments, we intend to look at these proteins in more detail, and will analyze their functions in true species and their hybrids," says Imhof.

<http://www.medscape.com/viewarticle/814640?src=rss>

Plasma Apolipoprotein E Linked to Dementia Risk

Plasma levels of apolipoprotein E (APOE) are associated with the risk for Alzheimer's disease (AD) and dementia, independent of APOE genotype, a new study shows.

Susan Jeffrey

DALLAS, Texas - Using 2 large general population cohorts, Danish researchers found that low plasma levels of APOE were associated with significantly higher risks of AD and of all dementia, but not with cerebrovascular disease, regardless of the presence or absence of the APOE $\epsilon 4$ genotype that is already associated with increased AD risk. "These things suggest that plasma levels of APOE may be a new preclinical plasma biomarker for dementia, and again, this is the first plasma biomarker for predicting future dementia," said Ruth Frikke-Schmidt, from Rigshospitalet, Copenhagen University Hospital in Copenhagen, Denmark. She speculated that low levels of plasma APOE reflect APOE activity in the brain. "So, low APOE in plasma mirrors low APOE production in the brain, which probably is not good, because less β -amyloid is cleared," she concluded. Dr. Frikke-Schmidt reported their findings here at the American Heart Association (AHA) Scientific Sessions 2013.

Established Risk

APOE plays a major role in lipid transport and in neuronal repair, the authors note. In the circulation, it's associated with... and serves as a ligand for receptors in the liver, clearing triglyceride-rich lipoproteins. "But in the brain, it's another situation," Dr. Frikke-Schmidt said. Astrocytes produce APOE, and there it's responsible for the clearance of β -amyloid, the "sticky" protein associated with the senile plaques seen in AD and other forms of dementia.

The strong association between an APOE genetic variant, $\epsilon 4$, and dementia, particularly AD, was established in 1993 and "has been validated globally," she said. Later, APOE $\epsilon 4$ was also linked to a moderate increased risk for cerebrovascular disease. In this study, they set out to test whether plasma levels of APOE are similarly related to risk for AD, dementia or cerebrovascular disease, independent of APOE genotype. "This is important because we do not have any biomarkers for dementia, and only a few for cerebrovascular disease," she said. The population studied included 76,386 participants in the Copenhagen General Population Study (CGPS) and the Copenhagen City Heart Study (CCHS). They measured plasma APOE levels and calculated the risk for disease according to age- and sex-adjusted percentile groups of plasma APOE concentrations, creating the following tertiles: 0% to 33%, 34% to 66%, and 67% to 100%.

They also genotyped participants for rs429358 and rs7412, which combine into 6 common APOE genotypes: ϵ 22, ϵ 32, ϵ 42, ϵ 33, ϵ 43, and ϵ 44. The latter is the highest-risk allele for AD.

In the combined studies, they found that participants in the lowest tertile for plasma APOE had a higher cumulative incidence of dementia compared with those in the intermediate and highest tertiles (log-rank trend, $P = 4.4 \times 10^{-12}$). "If you look at the age, at approximately the age of 86, there was a cumulative incidence of 8% in those with the lowest levels compared to 3% in those with the highest levels of APOE," Dr. Frikke-Schmidt noted.

In the individuals with the lowest levels vs the highest levels, the risk for dementia was 3-fold higher in the group with the lowest APOE levels. "This remained significant even after adjustment for the very strong ϵ 4 APOE genotype," she noted.

Most people carry the ϵ 33 genotype, and using these carriers as the control, the researchers found that carriers of the ϵ 44 genotype had a 10-fold increased risk for dementia. "In all populations, it's 10-fold," she noted, "a 1000% increase, and 3% of us carry this." This risk remained unchanged after adjustment for APOE levels. They then plotted APOE levels by APOE genotype in each population separately and found in both the CGPS and the CCHS populations almost identical proportions, with the ϵ 22 carriers having the highest levels, declining steadily down the groups to the ϵ 44 carriers, a highly significant trend.

"This association with the ϵ 22 carriers is well known, way back in biology, because these individuals are receptor defective, and they do not bind to LDL [low-density lipoprotein] receptors in the liver, so there are high levels of APOE in plasma," Dr. Frikke-Schmidt noted.

Dissecting the Risk

APOE genotype explains 26% of the variation in APOE, Dr. Frikke-Schmidt said, "so when there is this strong association between genotype and plasma levels, how do we dissect the risk of dementia conferred by plasma APOE levels from the risk conferred by the strong APOE genotype?" To look at this, they stratified APOE levels into tertiles within just the low-risk carriers (ϵ 32 and ϵ 33) and just the high-risk carriers (ϵ 43 and ϵ 44), and saw similar results (P for trends = .001 and 3.1×10^{-4} , respectively).

"I think this is the strongest evidence that APOE levels, the effect of that on dementia is independent of genotype," she said. This is further substantiated by the fact there was no evidence of interaction between APOE levels and APOE genotype in predicting dementia, she added.

There was no association between plasma APOE and cerebrovascular disease, but there was an association between APOE genotype and cardiovascular disease. There was a slight increased risk of all cardiovascular disease for ϵ 44 carriers that was most pronounced for hemorrhagic stroke, she noted, and the associations remained significant after adjustment for other lipids and proteins, including APOE.

Dr. Frikke-Schmidt pointed to a recent paper in *Nature* showing in a mouse model that the ϵ 44 allele and a lack of APOE was associated with an inflammatory response in the pericytes of the neurovascular unit, leading to a defect in the blood-brain barrier and access of neurotoxic substances into the brain tissue, starting the process of AD. *The authors have disclosed no relevant financial relationships.*

<http://www.nature.com/news/mystery-humans-spiced-up-ancients-sex-lives-1.14196>

Mystery humans spiced up ancients' sex lives

Genome analysis suggests there was interbreeding between modern humans, Neanderthals, Denisovans and an unknown archaic population.

Ewen Callaway

Updated genome sequences from two extinct relatives of modern humans suggest that these 'archaic' groups bred with humans and with each other more extensively than was previously known.

The ancient genomes, one from a Neanderthal and one from a member of an archaic human group called the Denisovans, were presented on 18 November at a meeting on ancient DNA at the Royal Society in London. The results suggest that interbreeding went on between the members of several ancient human-like groups in Europe and Asia more than 30,000 years ago, including an as-yet-unknown human ancestor from Asia.

"What it begins to suggest is that we're looking at a Lord of the Rings-type world - that there were many hominid populations," says Mark Thomas, an evolutionary geneticist at University College London who was at the meeting but was not involved in the work.

The first published Neanderthal¹ and Denisovan² genome sequences revolutionized the study of ancient human history, not least because they showed that these groups bred with anatomically modern humans, contributing to the genetic diversity of many people alive today.

Mixed heritage

All modern humans whose ancestry originates outside of Africa owe about 2% of their genome to Neanderthals. Certain populations living in Oceania, such as Papua New Guineans and Australian Aboriginals, share about

4% of their DNA with Denisovans, members of a group named after a cave in the Altai Mountains in Siberia, Russia, where they were discovered. The cave contains remains deposited between 30,000 and 50,000 years ago.

At the meeting, however, David Reich, an evolutionary geneticist at Harvard Medical School in Boston, Massachusetts, who worked on those studies, said that the conclusions were based on low-quality genome sequences, riddled with errors and full of gaps. His team, along with collaborator Svante Pääbo at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, has now produced much more complete versions of the Denisovan and Neanderthal genomes — matching the quality of contemporary human genomes. These high-quality Denisovan and Neanderthal sequences are both based on bones from the Denisova Cave. The Denisovan genome indicates that the population got around: Reich said at the meeting that as well as interbreeding with the ancestors of Oceanians, they also bred with Neanderthals and the ancestors of modern humans in China and other parts of East Asia. Most surprisingly, Reich said, the genomes indicate that Denisovans interbred with yet another extinct population of archaic humans that lived in Asia more than 30,000 years ago — one that is neither human nor Neanderthal.

The meeting was abuzz with conjecture about the identity of this unknown population of humans. “We don’t have the faintest idea,” says Chris Stringer, a paleoanthropologist at the Natural History Museum in London, who was not involved in the work. He speculates that the population could be related to *Homo heidelbergensis*, a species that left Africa around half a million years ago and later gave rise to Neanderthals in Europe. “Perhaps it lived on in Asia as well,” says Stringer.

Nature doi:10.1038/nature.2013.14196

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http://www.eurekalert.org/pub_releases/2013-11/wcmc-dob111913.php

Discovery of brain activity in severely brain injured patients who 'wake up' with sleep drug

Pattern of brain activity points to possible neural circuit switched on by drug and may identify other patients who could respond

NEW YORK - George Melendez has been called a medical miracle. After a near drowning deprived his brain of oxygen, Melendez remained in a fitful, minimally conscious state until his mother, in 2002, decided to give him the sleep aid drug Ambien to quiet his moaning and writhing. The next thing she knew, her son was quietly looking at her and trying to talk. He has been using the drug ever since to maintain awareness, but no one could understand why Ambien led to such an awakening.

Now, a team of scientists led by Weill Cornell Medical College has discovered a signature of brain activity in Melendez and two other similarly "awakened" patients they say explain why he and others regain some consciousness after using Ambien or other drugs or treatments. The pattern of activity, reported Nov. 19 in the journal *eLife*, was identified by analyzing the common electroencephalography (EEG) test, which tracks brain waves.

"We found a surprisingly consistent picture of electrical activity in all three patients before they receive the drug. Most interesting is that their specific pattern of activity suggests a particular process occurring in the brain cells of the cerebral cortex and also supports the role of a crucial brain circuit," says the study's senior investigator, Dr. Nicholas Schiff, the Jerold B. Katz Professor of Neurology and Neuroscience and professor of public health at Weill Cornell. "These findings may help predict other patients who might similarly harbor reserve capacity, whether they are able to respond to Ambien or other approaches." Dr. Schiff is also on the faculty of the Feil Family Brain and Mind Research Institute at Weill Cornell and is a neurologist at NewYork-Presbyterian Hospital/Weill Cornell Medical Center.

"We are focused on finding ways to identify patients who have a functional reserve of cognitive capacities that can be rescued and how to achieve this result," Dr. Schiff adds. "These findings give us a very important lead to follow, and we will now rigorously test their implications in other patients."

Although it is not precisely known how many Americans are diagnosed as severely brain injured with disorders of consciousness, by one estimate there are nearly 300,000 patients trapped in a minimally conscious state who may retain some awareness, according to Dr. Schiff.

Riding a Wave of Excitation

The three patients in the study suffered brain damage in different ways. One fell and the other had a brain aneurysm that led to multiple strokes. Melendez was in a car accident that led to his nearly drowning. All three patients -- two men and a woman -- become aware when Ambien was used, a rare response that has been documented in fewer than 15 brain-injured patients. The research team, which included scientists from

Memorial Sloan-Kettering Cancer Center, Boston University School of Medicine, and the University Hospital of Liège in Belgium, used EEG to measure electrical activity in the patients' brains before and after they were given the drug.

Although each patient's brain was damaged in different ways, all showed the same unique features of low frequency waves in their EEG readings. These low frequency oscillations are most prominent over the frontal cortex, a region strongly dependent for its activity on other brain structures, particularly the central thalamus and the striatum, which together support short-term memory, reward, motivation, attention, alertness and sleep, among other functions.

In this setting of an idling brain, the investigators propose that Ambien works like any anesthesia drug, in that it briefly triggers a fast wave of excitation in brain cells before producing sleep -- a phenomenon known as paradoxical excitation. Instead of going on to produce sedation and sleep, as it does in healthy people who use the drug, zolpidem further activates the brain after it's affected the idling cells, allowing the patients to become more awake than at baseline. "What we think is happening in these patients is that the initial excitation produced by Ambien turns on a specific circuit. The drug creates the opportunity for the brain to effectively catch a ride on this initial wave of excitation, and turn itself back on," Dr. Schiff says.

This proposed "mesocircuit" links the cortical regions of the brain to the central thalamus and striatum. Neurons in the central thalamus are highly connected to other parts of the brain, "so damage in one part of the brain or another will affect the thalamus, which is key to consciousness," Dr. Schiff says. Neurons in the striatum "will only fire if there is a lot of electrical input coming to them quickly," he says. "We believe the switch that Ambien turns on is at the level of the joint connections between these three brain structures," Dr. Schiff says. The pattern of brain activity seen in the EEG on Ambien was also the same in all the patients in the study. But the circuit turns off again when the effects of the drug diminish. Using the drug regularly at mealtimes, Melendez can speak fluently, and read and write simple phrases. His tremors and spasticity are significantly reduced on Ambien and he can use objects, such as a spoon, and is alert and can communicate.

The first patient in the study can reliably move from minimally conscious to "the mid-range of what is called a confusional state -- a more alert status, but not full consciousness," Dr. Schiff says. "Use of Ambien offers a step in the right direction, but certainly not a cure."

Different Ways to Kick-Start the Brain

The resting EEG pattern the researchers saw in the patients indicates they have a "recruitable reserve" of function in these critical brain areas that Ambien can harness to turn the brain on, even if only temporarily. "The idea is that hopefully we can screen other patients with EEG to find out if they also have such a reserve," Dr. Schiff says.

And while some of these patients may not respond to Ambien -- as the drug works at a very specific brain receptor and individuals can vary considerably in having enough of it in the key components of the proposed circuit -- other drugs may target the same structures and potentially produce similar effects, he says.

For example, two drugs (amantadine and L-Dopa) that provide extra dopamine, a brain chemical that fuels the part of the brain damaged in the study's patients, have been shown to have similar effects on restoring function in patients with severe brain injuries, as has electrical brain stimulation of the central thalamus.

"Now that we have uncovered important insight into fundamental mechanisms underlying the dramatic and rare response of some severely brain-injured patients to Ambien, we hope to systematically explore ways to achieve such kick-starts in other patients -- that is our goal," Dr. Schiff says.

The study was funded by grants from the James S. McDonnell Foundation, the National Institutes of Health and the Eunice Kennedy Shriver National Institute of Child Health and Human Development, the Belgian National Science Foundation and the Jerold B. Katz Foundation.

Working with Dr. Schiff on the study were Dr. Shawniqua T. Williams, Dr. Mary M. Conte, Dr. Andrew M. Goldfine, Jennifer Hersh, and Dr. Jonathan Victor, from Weill Cornell Medical College; Dr. Quentin Noirhomme, Dr. Olivia Gosseries, Dr. Marie Thonnard and Dr. Steven Laureys from the Coma Science Group from the Research Centre and Neurology Department, University and University Hospital of Liège, Belgium; Bradley Beattie from Memorial Sloan Kettering Cancer Center; and Dr. Douglas Katz from Boston University School of Medicine.

<http://www.sciencedaily.com/releases/2013/11/131119152816.htm>

Evidence of Ancient Human History Encoded in Music's Complex Patterns

In the same way that fragments of ancient pottery and bones offer valuable information about human history, music can also reveal previously hidden clues about the past, according to new research from an international team led by McMaster University psychologist Steven Brown.

The team has established for the first time that the history of human populations is embedded in music, where complex combinations of rhythm, pitch and arrangement form a code that scientists can read in a manner that can be compared to the way they read changes in human DNA and language.

"Music is an untapped migrational marker that can be used to help people understand the history of human populations," says Brown, an associate professor of Psychology, Neuroscience & Behaviour. "It adds to the whole story of human history. We need more evidence, and this is a new kind of evidence that we can add to the pot."

Brown's research team used a comparison between the mitochondrial DNA and the folk music of nine indigenous populations of Taiwan to show that each tells a similar story about the ways those populations have changed and converged over the last 6,000 years. Mitochondrial DNA changes at a predictable rate, acting as an evolutionary clock that makes it ideal for such comparisons.

The group included researchers from Tokyo University of the Arts, the Max Planck Institute for Evolutionary Anthropology in Germany and China Medical University and Mackay Memorial Hospital, both in Taiwan. Their results are published in Proceedings of the Royal Society B, one of the society's biological journals. The researchers analyzed the structures of 220 Taiwanese choral songs recorded since the 1940s. They compared the results with DNA samples taken from 1,050 subjects from different parts of the island and found that the musical results shared significant similarities to the genetic results when it came to tracking changes over thousands of years.

The findings prove that music can be a repository of scientific information about the people who make it, says Brown, who is director of the NeuroArts Lab in McMaster's Department of Psychology.

"Languages and genes change slowly over time, but music can change much more quickly," Brown says. "I think people thought that music was too transient to carry evidence of what happened thousands of years ago. Our results support the idea that music actually has elements in it that are ancient. In addition to being able to evolve quickly, it can also retain traces of ancient population movements."

Brown's lab is devoted to understanding of the neural, cognitive and evolutionary foundations of the arts, including: music, dance, drama and the visual arts, and is associated with McMaster's Institute for Music and the Mind. Research on the project was funded by the Social Sciences and Humanities Research Council of Canada.

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<http://bit.ly/1hVLC7i>

Universe's Largest Structure is a Cosmic Conundrum

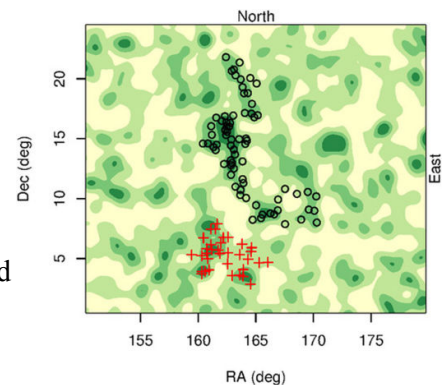
Astronomers have found a mind-bogglingly large structure -- so big it takes light 10 billion years to traverse -- in a distant part of the universe.

Nov 19, 2013 06:50 PM ET // by Irene Klotz

The discovery poses a conundrum to a fundamental tenet of modern cosmology, which posits that matter should appear to be distributed uniformly if viewed at a large enough scale.

The newly found structure is more than double the size of the previous record-holder, a cluster of 73 quasars referred to as the Huge-LQG, or Large Quasar Group, which spans 4 billion light-years. It is six times larger than the 1.4-billion-light year diameter Sloan Great Wall. Light travels at about 671 million miles per hour, or about 6 trillion miles per year. Scientists found the new structure by mapping the locations of gamma ray bursts. These fleeting, but high-energy outbursts are believed to be caused by exploding massive stars.

The colored background indicates the peaks and troughs in the occurrence of quasars at the distance of the LQG. Darker colours indicate more quasars, lighter colors indicate fewer quasars. The LQG is clearly seen as a long chain of peaks indicated by black circles. (The red crosses mark the positions of quasars in a different and smaller LQG). The horizontal and vertical axes represent right ascension and declination, the celestial equivalent of longitude and latitude. The map covers around 29.4 by 24 degrees on the sky, indicating the huge scale of the newly discovered structure. R. G. Clowes / UCLan



"It's a great tracer of where something was," astronomer Jon Hakkila, with the College of Charleston in South Carolina, told Discovery News. Because bigger stars form in areas with more material in general, gamma ray

bursts can give astronomers a rough estimate of how much matter a particular region contains. "We're treating each (gamma ray burst) source as if it's a pin in the map and it's sticking to something," Hakkila said.

After accounting for potential survey biases -- such as NASA's Swift telescope and other gamma ray trackers looking more often in one part of the sky or another -- scientists found a region roughly 10 billion light-years away in the direction of the constellations Hercules and Corona Borealis that had a disproportionate number of gamma ray bursts. Extrapolating from the locations of the bursts, scientists estimate the structure from which they came spans approximately 10 billion light-years in diameter.

"This is probably a large concentration of galaxy clusters and other normal matter," co-investigator Istvan Horvath, with the National University of Public Service in Budapest, Hungary, wrote in an email to Discovery News. Additional monitoring of gamma ray bursts should provide more evidence for the structure's existence. For now, Horvath says he has "no idea" how something that big could have evolved.

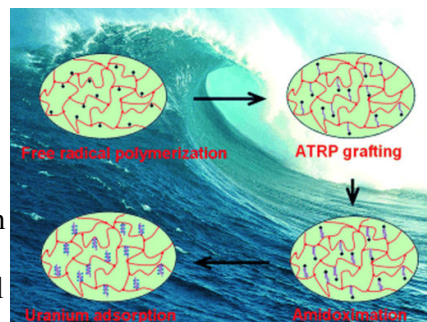
The research appears in the online archive arXiv.org (arXiv:1311.1104 [astro-ph.CO]).

<http://phys.org/news/2013-11-sorbents-efficiently-uranium-seawater.html>

New sorbents efficiently extract uranium from seawater

Producing adsorption agents to isolate uranium from seawater

Phys.org - Uranium mining for the nuclear industry causes immense environmental damage, which becomes more severe as reserves are depleted. The isolation of uranium from seawater would be a much more environmentally friendly alternative. In the journal *Angewandte Chemie*, American researchers have now introduced a process by which they can produce tailored, highly effective adsorption agents to do this job. Because the concentration of uranyl ions in seawater is very low, adsorption agents used for this process must be particularly efficient. By carefully controlling the surface and pore structures, a team from Oak Ridge National Laboratory and the University of Tennessee has now been able to significantly increase both the rate and capacity of adsorption of a new polymer adsorbent.



From the sea to the reactor: Nanoporous template-free initiators for atom-transfer radical polymerization (ATRP) were synthesized with surface and framework initiator sites and tailorable pore structures. Polyacrylonitrile grown on one initiator was converted into polyamidoxime to generate an uranium sorbent for seawater extraction with a high uptake rate and capacity relative to those of nonwoven irradiation-grafted polyethylene-fiber composites.

Their success stems from a special polymerization technique. Sheng Dai's team begins by producing a porous polymer framework based on the monomer vinylbenzyl chloride (VBC) with divinylbenzene (DVB) as a cross-linking agent. It is possible to vary the surface properties and pore volume of the product by changing the ratio of VBC to DVB. The interiors of the resulting frameworks contain many accessible chloride species that then serve as starting points for the next polymerization step, which is known as atom-transfer radical polymerization (ATRP). This reaction allows the researchers to grow polyacrylonitrile chains within the framework. The advantage of ATRP is that the length of the chains is highly controllable and uniform. In the final step, the polyacrylonitrile is converted to polyamidoxime because amidoxime groups bind well to uranyl ions.

Tests with simulated seawater resulted in distinctly higher and significantly faster uranium adsorption than with conventional, polyethylene-based adsorbents. Experiments showed that the adsorption capacity of the new adsorbent is strongly dependent on the density of amidoxime groups—a parameter that can be tailored by means of the pore size and the number of accessible chloride species in the original nanoporous framework.

"These frameworks are the first example of ATRP initiators in which the initiator species is located within the nanoporous support network," reports Dai. "This new process puts materials with tailored adsorption and surface properties within reach. The method can be used to produce a wide variety of polymer nanocomposites for applications including the removal of heavy-metal ions from solutions or novel catalysts."

*More information: "Seawater Uranium Sorbents: Preparation from a Mesoporous Copolymer Initiator by Atom-Transfer Radical Polymerization," Sheng Dai. *Angewandte Chemie International Edition*: dx.doi.org/10.1002/anie.201307825*

<http://nyti.ms/1au2cFM>

24,000-Year-Old Body Shows Kinship to Europeans and American Indians

The genome of a young boy buried at Mal'ta near Lake Baikal in eastern Siberia some 24,000 years ago has turned out to hold two surprises for anthropologists.

By NICHOLAS WADE

The first is that the boy's DNA matches that of Western Europeans, showing that during the last Ice Age people from Europe had reached farther east across Eurasia than previously supposed. Though none of the Mal'ta boy's skin or hair survives, his genes suggest he would have had brown hair, brown eyes and freckled skin. The second surprise is that his DNA also matches a large proportion — about 25 percent — of the DNA of living Native Americans. The first people to arrive in the Americas have long been assumed to have descended from Siberian populations related to East Asians. It now seems that they may be a mixture between the Western Europeans who had reached Siberia and an East Asian population.

The Mal'ta boy was 3 to 4 years old and was buried under a stone slab wearing an ivory diadem, a bead necklace and a bird-shaped pendant. Elsewhere at the same site about 30 Venus figurines were found of the kind produced by the Upper Paleolithic cultures of Europe. The remains were excavated by Russian archaeologists over a 20-year period ending in 1958 and stored in museums in St. Petersburg.

There they lay for some 50 years until they were examined by a team led by Eske Willerslev of the University of Copenhagen. Dr. Willerslev, an expert in analyzing ancient DNA, was seeking to understand the peopling of the Americas by searching for possible source populations in Siberia. He extracted DNA from bone taken from the child's upper arm, hoping to find ancestry in the East Asian peoples from whom Native Americans are known to be descended.

But the first results were disappointing. The boy's mitochondrial DNA belonged to the lineage known as U, which is commonly found among the modern humans who first entered Europe about 44,000 years ago.



The Mal'ta boy was buried with a variety of artefacts, including a Venus figurine

The lineages found among Native Americans are those designated A, B, C, D and X, so the U lineage pointed to contamination of the bone by the archaeologists or museum curators who had handled it, a common problem with ancient DNA projects. "The study was put on low speed for about a year because I thought it was all contamination," Dr.

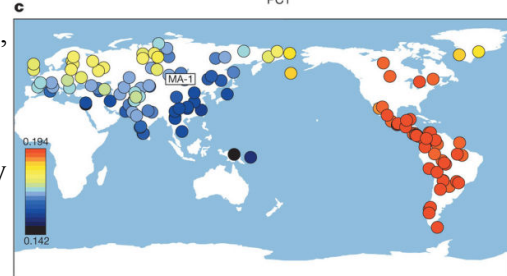
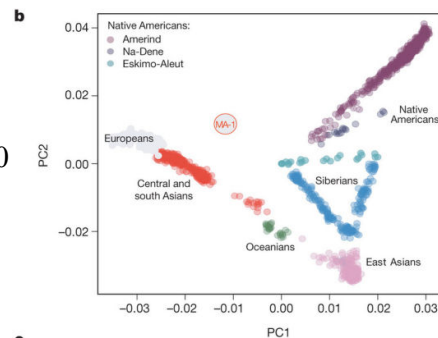
Willerslev said.

His team proceeded anyway to analyze the nuclear genome, which contains the major part of human inheritance. They were amazed when the nuclear genome also turned out to have partly European ancestry.

Examining the genome from a second Siberian grave site, that of an adult who died 17,000 years ago, they found the same markers of European origin. Together, the two genomes indicate that descendants of the modern humans who entered Europe had spread much farther east across Eurasia than had previously been assumed and occupied Siberia during an extremely cold period starting 20,000 years ago that is known as the Last Glacial Maximum.

The other surprise from the Mal'ta boy's genome was that it matched to both Europeans and Native Americans but not to East Asians. Dr. Willerslev's interpretation was that the ancestors of Native Americans had already separated from the East Asian population when they interbred with the people of the Mal'ta culture, and that this admixed population then crossed over the Beringian land bridge that then lay between Siberia and Alaska to become a founding population of Native Americans.

"We estimate that 14 to 38 percent of Native American ancestry may originate through gene flow from this ancient population," he and colleagues wrote in an article published Wednesday in the journal Nature.



a, Geographical locations of Mal'ta and Afontova Gora-2 in south-central Siberia. For reference, Palaeolithic sites with individuals belonging to mtDNA haplogroup U are shown (red and black triangles): 1, Oberkassel; 2, Hohle Fels; 3, Dolni Vestonice; 4, Kostenki-14. A Palaeolithic site with an individual belonging to mtDNA haplogroup B is represented by the square: 5, Tianyuan Cave. Notable Palaeolithic sites with Venus figurines are marked by brown circles: 6, Laussel; 7, Lespugue; 8, Grimaldi; 9, Willendorf; 10, Gargarino. Other notable Palaeolithic sites are shown by grey circles: 11,

Sungir; 12, Yana RHS. **b**, PCA (PC1 versus PC2) of MA-1 and worldwide human populations for which genomic tracts from recent European admixture in American and Siberian populations have been excluded¹⁹. **c**, Heat map of the statistic f_3 (Yoruba; MA-1, X) where X is one of 147 worldwide non-African populations (standard errors shown in [Supplementary Fig. 21](#)). The graded heat key represents the magnitude of the computed f_3 statistics.

A European contribution to Native American ancestry could explain two longstanding puzzles about the people's origins. One is that many ancient Native American skulls, including that of the well-known Kennewick man, look very different from those of the present day population. Another is that one of the five mitochondrial DNA lineages found in Native Americans, the lineage known as X, also occurs in Europeans. One explanation is that Europeans managed to cross the Atlantic in small boats some 20,000 years ago and joined the Native Americans from Siberia.

Dr. Willerslev thinks it more likely that European bearers of the X lineage had migrated across Siberia with the ancestors of the Mal'ta culture and joined them in their trek across the Beringian land bridge.

He said his finding does not solve the much-disputed question of when the Americas were first settled.

Archaeologists long believed the people of the Clovis culture, dated from 13,000 years ago, were the first Americans, but several recent finds point to an earlier date. "We need the sequencing of more ancient genomes to address this question," Dr. Willerslev said.

The Mal'ta people built houses that were partly underground, with bone walls and roofs made of reindeer antlers. Their culture is distinguished by its many art objects and its survival in an unforgiving climate.

Dr. Willerslev presented his team's findings last month at a conference in Santa Fe on Native American origins. "There was a lot of surprise and some skepticism, as is often the case in science toward new findings," said Dennis H. O'Rourke, an anthropologist at the University of Utah who works on ancient DNA and the North American Arctic.

Dr. O'Rourke said the result would prompt a search for more ancient DNA from Siberia in order to provide a better context for Dr. Willerslev's reconstruction of early American origins. "I think it's a very important and really interesting result, but it is from a single individual," he said.

Theodore G. Schurr, an anthropologist at the University of Pennsylvania, said Dr. Willerslev had provided an interesting new perspective on Native American origins that helped explain the presence of the mitochondrial X lineage in North America and enlarged the understanding of population history in Siberia. But the time and place of the East-West population mixing adduced by Dr. Willerslev is not yet clear, he said.

An unexplained feature of the mixing is that the Mal'ta people did not pass on their mitochondrial DNA since the U lineage is unknown among Native Americans. Since mitochondrial DNA is passed down only through the female line, the population ancestral to Native Americans could have been formed by men of the Mal'ta culture who acquired East Asian wives.

Dr. Willerslev sees this as one possibility, another being that mitochondrial DNA lineages are easily lost through genetic drift, the random change in DNA patterns through the generations. "One has to be careful setting up detailed geographical scenarios at this stage," Dr. Willerslev said.

<http://www.wired.com/wiredscience/2013/11/end-abx/>

When We Lose Antibiotics, Here's Everything Else We'll Lose Too

"Post-antibiotic era" is a phrase that gets tossed around a lot these days, most of the time without people stopping to consider what it might really mean.

By Maryn McKenna

This week, health authorities in New Zealand announced that the tightly quarantined island nation — the only place I've ever been where you get x-rayed on the way into the country as well as leaving it — has experienced its first case, and first death, from a strain of totally drug-resistant bacteria. From the New Zealand Herald:

In January, while he was teaching English in Vietnam, (Brian) Pool suffered a brain hemorrhage and was operated on in a Vietnamese hospital.

He was flown to Wellington Hospital where tests found he was carrying the strain of bacterium known as KPC-Oxa 48 — an organism that rejects every kind of antibiotic.

Wellington Hospital clinical microbiologist Mark Jones (said): "Nothing would touch it. Absolutely nothing. It's the first one that we've ever seen that is resistant to every single antibiotic known."

Pool's death is an appalling tragedy. But it is also a lesson, twice over: It illustrates that antibiotic resistance can spread anywhere, no matter the defenses we put up — and it demonstrates that we are on the verge of entering a new era in history. Jones, the doctor who treated Pool, says in the story linked above: "This man was in the post-antibiotic era."

"Post-antibiotic era" is a phrase that gets tossed around a lot these days, most of the time without people stopping to consider what it might really mean. A year ago, I started wondering what life would be like, if we

really didn't have antibiotics any more. I was commissioned and edited by got research support from (editing to make clear that they didn't give me a grant; they don't do that) the fantastic Food and Environment Reporting Network, and today Medium publishes our 4,000-word report, "Imagining a Post-Antibiotics Future" — a view from the far side of the antibiotic miracle. If we really lost antibiotics to advancing drug resistance - and trust me, we're not far off - here's what we would lose. Not just the ability to treat infectious disease; that's obvious. But also: The ability to treat cancer, and to transplant organs, because doing those successfully relies on suppressing the immune system and willingly making ourselves vulnerable to infection. Any treatment that relies on a permanent port into the bloodstream - for instance, kidney dialysis. Any major open-cavity surgery, on the heart, the lungs, the abdomen. Any surgery on a part of the body that already harbors a population of bacteria: the guts, the bladder, the genitals. Implantable devices: new hips, new knees, new heart valves. Cosmetic plastic surgery. Liposuction. Tattoos.

We'd lose the ability to treat people after traumatic accidents, as major as crashing your car and as minor as your kid falling out of a tree. We'd lose the safety of modern childbirth: Before the antibiotic era, 5 women died out of every 1,000 who gave birth. One out of every nine skin infections killed. Three out of every 10 people who got pneumonia died from it.

And we'd lose, as well, a good portion of our cheap modern food supply. Most of the meat we eat in the industrialized world is raised with the routine use of antibiotics, to fatten livestock and protect them from the conditions in which the animals are raised. Without the drugs that keep livestock healthy in concentrated agriculture, we'd lose the ability to raise them that way. Either animals would sicken, or farmers would have to change their raising practices, spending more money when their margins are thin. Either way, meat — and fish and seafood, also raised with abundant antibiotics in the fish farms of Asia — would become much more expensive.

And it wouldn't be just meat. Antibiotics are used in plant agriculture as well, especially on fruit. Right now, a drug-resistant version of the bacterial disease fire blight is attacking American apple crops. There's currently one drug left to fight it. And when major crops are lost, the local farm economy goes too.

If you've been reading here a while, you'll know that I write about antibiotic resistance, in human medicine and in agriculture, all the time (and wrote a book about it). But something personal propelled me into this story. By random chance, I received a copy of the obit of my great-uncle, my grandfather's younger brother Joe.

I'd heard about Joe as I was growing up, because everyone said my father resembled him. All I knew was that he was good-looking, and died young, and there was something about his death that was tragic. He was a New York City fireman, and I always assumed he'd died in a fire. I was wrong. He died of an infection, 5 years before penicillin came on the scene.

Joe's death was protracted, and terrible, and it changed my family forever. Seventy-five years later, we would like to think that deaths like his are impossible. But they aren't; as the story from New Zealand shows, they are happening again. We have a few chances left to turn back the tide of resistance — but only a few, and not much room for mistakes. I hope we take them.

http://www.eurekalert.org/pub_releases/2013-11/fsu-rus111913.php

Research uncovers secrets of Mars' birth from unique meteorite

As NASA prepares to launch a new Martian probe, a Florida State University scientist has uncovered what may be the first recognized example of ancient Martian crust.

TALLAHASSEE, Fla. - The work of Munir Humayun — a professor in FSU's Department of Earth, Ocean and Atmospheric Science and a researcher at the National High Magnetic Field Laboratory (MagLab) - is based on an analysis of a 4.4 billion-year-old Martian meteorite that was unearthed by Bedouin tribesmen in the Sahara desert. The rock (NWA 7533) may be the first recognized sample of ancient Martian crust and holds a wealth of information about the origin and age of the Red Planet's crust. Humayun's groundbreaking discoveries about the crust and what it reveals about the Red Planet's origins will be published in the journal *Nature*.

In order to detect minute amounts of chemicals in this meteorite, Humayun and his collaborators performed complex analysis on the meteorite using an array of highly sophisticated mass spectrometers in the MagLab's geochemistry department. High concentrations of trace metals such as iridium, an element that indicates meteoritic bombardment, showed that this meteorite came from the elusive cratered area of Mars' southern highlands.

"This cratered terrain has been long thought to hold the keys to Mars' birth and early childhood," Humayun said. While craters cover more than half of Mars, this is the first meteoric sample to come from this area and the first time researchers are able to understand Mars' early crustal growth.

Using the chemical information found in pieces of soil contained in the meteorite, the researchers were able to calculate the thickness of Mars' crust. Their calculation aligned with estimates from independent spacecraft measurements and confirms that Mars did not experience a giant impact that melted the entire planet in its early history. Using a powerful microprobe at Curtin University in Perth, Australia, the team dated special crystals within the meteorite - called zircons - at an astounding 4.4 billion years old.

"This date is about 100 million years after the first dust condensed in the solar system," Humayun said. "We now know that Mars had a crust within the first 100 million years of the start of planet building, and that Mars' crust formed concurrently with the oldest crusts on Earth and the Moon."

Humayun and his collaborators hypothesize that these trailblazing discoveries are just the tip of the iceberg of what continued research on this unique meteorite will uncover. Further studies may reveal more clues about the impact history of Mars, the nature of Martian zircons and the makeup of the earliest sediments on the Red Planet.

Humayun's international team of collaborators include curator of meteorites Brigitte Zanda with the National Museum of Natural History (the Muséum National d'Histoire Naturelle) in Paris; A. Nemchin, M. Grange and A. Kennedy with Curtin University's Department of Applied Geology in Perth, Australia; and scientists R.H. Hewins, J.P. Lorand, C. Göpel, C. Fieni, S. Pont and D. Deldicque.

<http://news.discovery.com/space/astronomy/comet-ison-an-observers-guide-131120.htm>

Comet ISON: An Observer's Guide

Since its discovery in September 2012, Comet C/2012 S1 - commonly known as Comet ISON - has been keeping astronomers guessing. Will it become the 'Comet of the Century' or would it be a flop, second only to the infamous Comet Kohoutek of the early 1970's?

Nov 20, 2013 01:04 PM ET // by Mark Thompson

Even now, as the comet barrels toward the sun passing the orbit of Mercury, we still don't know how it will ultimately perform, but it is looking less likely to be the stuff of legend.

Fear not though, as ISON continues its relentless march toward the sun at over 220,000 kilometers (137,000 miles) per hour, it is blasting out some teasing little outbursts that, as astronomers watch with bated breath, bring it ever closer to becoming a stunning sight in our skies during early December.

But there's a catch! Before it graces our skies and becomes 'that comet' it first has to survive a close approach to the sun, an approach that may very well prove to be its downfall. On Nov. 28, ISON will pass within 1.8 million kilometers (1.1 million miles) of the sun at perihelion -- less than one solar diameter.

As it gets closer to the powerhouse of our solar system, the increasing levels of heat and energy will cause more cometary outbursts, possibly fracturing the comet, breaking it apart.

Should that happen, then these next few nights may be the last chance we get to see it. If it does survive then there will be a very good chance of a spectacular sight in the northern sky in December after ISON has completed its hellish swing around the sun.

At time of writing, ISON is a magnitude 5 object, moving through the constellation Virgo on its way to Libra and Scorpius before changing direction and heading northwards toward Ophiuchus, Hercules and up through Draco.

The magnitude estimates for comets can be a little misleading, so a little caution is recommended. The estimates are based on the overall brightness of the comet, but because the light from a comet is spread over the fuzzy coma it will seem fainter than forecast.

A magnitude 5 star would be a fairly easy to see naked eye target, but in reality, the comet is only just becoming visible at a very dark site owed to its fuzziness. Current estimates suggest it might reach the brightness of Venus, but again, this will be spread over the fuzzy blob, so it will still be fainter.

Whether ISON survives its trip close by the sun or not, in the next few days we still have a pretty impressive comet to look out for.

If you want to try and spot ISON for yourself before perihelion over the next few days, you will need to look low in the east before sunrise. Find the bright star Spica in the constellation Virgo and to its lower left is ISON that will appear as a faint fuzzy blob.

At the moment, binoculars or wide field telescopes (even bird watching telescopes) can be used to spot it, but as we head toward its closest approach it will become easier to spot with the naked eye, although this will be counteracted by the increasing brightness of the sun, drowning out the faint light of ISON.

For anyone wishing to try and capture this beauty on camera then try using a long focal length telephoto lens, anything above 200mm should work. Set your camera to its highest ISO setting, widest aperture and try exposures of about 10 seconds or so. Exposures longer than 10 seconds will cause the stars to trail so you will

need to keep them short at longer focal lengths. You will need to have a bit of an experiment with the settings but that should help you capture it. Once ISON has rounded the sun, and if it has survived, then we should be treated to a real beauty as it climbs higher in the sky through December.

But for now, we must be content with sitting and waiting until the fate of one of nature's most beautiful and enigmatic objects is decided in 8 days time.

<http://tbo.com/eating-nuts-is-tied-to-lower-risk-of-death-20131120/>

Eating nuts is tied to lower risk of death

Study subjects who ate nuts roughly every day were 20 percent less likely to die during the study period than those who never ate nuts.

DALLAS — Help yourself to some nuts this holiday season: Regular nut eaters were less likely to die of cancer or heart disease — in fact, were less likely to die of any cause — during a 30-year Harvard study. Nuts have long been called heart-healthy, and the study is the largest ever done on whether eating them affects mortality. Researchers tracked 119,000 men and women and found that those who ate nuts roughly every day were 20 percent less likely to die during the study period than those who never ate nuts. Eating nuts less often also appeared to lower the death risk, in direct proportion to consumption.

The risk of dying of heart disease dropped 29 percent and the risk of dying of cancer fell 11 percent among those who had nuts seven or more times a week compared with people who never ate them.

The benefits were seen from peanuts as well as from pistachios, almonds, walnuts and other tree nuts. The researchers did not look at how the nuts were prepared — oiled or salted, raw or roasted. A bonus: Nut eaters stayed slimmer.

“There’s a general perception that if you eat more nuts you’re going to get fat. Our results show the opposite,” said Dr. Ying Bao of Harvard-affiliated Brigham and Women’s Hospital in Boston.

She led the study, published in Thursday’s New England Journal of Medicine. The National Institutes of Health and the International Tree Nut Council Nutrition Research & Education Foundation sponsored the study, but the nut group had no role in designing it or reporting the results.

Researchers don’t know why nuts may boost health. It could be that their unsaturated fatty acids, minerals and other nutrients lower cholesterol and inflammation and reduce other problems, as earlier studies seemed to show.

Observational studies like this one can’t prove cause and effect, only suggest a connection. Research on diets is especially tough, because it can be difficult to single out the effects of any one food. People who eat more nuts may eat them on salads, for example, and some of the benefit may come from the leafy greens, said Dr. Robert Eckel, a University of Colorado cardiologist and former president of the American Heart Association.

Dr. Ralph Sacco, a University of Miami neurologist who also is a former heart association president, agreed.

“Sometimes when you eat nuts you eat less of something else like potato chips,” so the benefit may come from avoiding an unhealthy food, Sacco said.

The Harvard group has long been known for solid science on diets. Its findings build on a major study earlier this year — a rigorous experiment that found a Mediterranean-style diet supplemented with nuts cuts the chance of heart-related problems, especially strokes, in older people at high risk of them. Many previous studies tie nut consumption to lower risks of heart disease, diabetes, colon cancer and other maladies.

In 2003, the Food and Drug Administration said a fistful of nuts a day as part of a low-fat diet may reduce the risk of heart disease. The heart association recommends four servings of unsalted, unoiled nuts a week and warns against eating too many, since they are dense in calories.

The new research combines two studies that started in the 1980s on 76,464 female nurses and 42,498 male health professionals. They filled out surveys on food and lifestyle habits every two to four years, including how often they ate a serving (1 ounce) of nuts.

Study participants who often ate nuts were healthier — they weighed less, exercised more and were less likely to smoke, among other things. After taking these and other things into account, researchers still saw a strong benefit from nuts. Compared with people who never ate nuts, those who had them less than once a week reduced their risk of death 7 percent; once a week, 11 percent; two to four times a week, 13 percent; and seven or more times a week, 20 percent.

“I’m very confident” the observations reflect a true benefit, Bao said. “We did so many analyses, very sophisticated ones,” to eliminate other possible explanations. For example, they did separate analyses on smokers and non-smokers, heavy and light exercisers, and people with and without diabetes, and saw a consistent benefit from nuts.

At a heart association conference in Dallas this week, Penny Kris-Etherton, a Pennsylvania State University nutrition scientist, reviewed previous studies on this topic. "We're seeing benefits of nut consumption on cardiovascular disease as well as body weight and diabetes," said Kris-Etherton, who has consulted for nut makers and also served on many scientific panels on dietary guidelines.

"We don't know exactly what it is" about nuts that boosts health or which ones are best, she said. "I tell people to eat mixed nuts."

http://www.eurekalert.org/pub_releases/2013-11/ded-idf111813.php

IceCube detects first high-energy neutrinos from the cosmos

World's largest particle detector opens up a new branch of astronomy

Within the eternal ice of Antarctica, scientists have observed the first solid evidence for high-energy neutrinos coming from cosmic accelerators beyond our own solar system. Between May 2010 and May 2012 the IceCube detector at the South Pole captured a total of 28 neutrinos with energies greater than 30 teraelectronvolts (TeV). Two of the neutrinos had an energy of more than 1,000 TeV - that's more than the kinetic energy of a fly in flight - compressed into a single elementary particle. The international IceCube collaboration, in which DESY is the second-largest partner after the University of Wisconsin-Madison, now presents these observations in the scientific journal *Science*.

"This is the first indication of very high-energy neutrinos coming from outside our solar system," says Francis Halzen, principal investigator of IceCube and the Hildale and Gregory Breit Distinguished Professor of Physics at the University of Wisconsin-Madison. Neutrinos are elementary particles that have almost no mass and interact extremely seldom with other particles. They are unique messengers of the highest-energy events in the universe, because in contrast to light they can easily escape from extremely dense environments - such as the core of a supernova explosion or the interior of cosmic particle accelerators.

For example, neutrinos from the famous supernova 1987A reached the Earth approximately three hours before the flash of light, which first had to make its way out of the supernova. "However, the neutrinos that have now been detected by IceCube have energies that are millions of times higher than those coming from supernova 1987A," emphasizes the head of the neutrino astronomy group at DESY in Zeuthen near Berlin, Dr. Markus Ackermann.

The advantage of the neutrinos as cosmic messengers is also a disadvantage. That's because they fly through matter so easily that countless neutrinos penetrate the earth every second without leaving any trace. Very seldom does a neutrino collide with another particle. Gigantic detectors are needed in order to enable researchers to occasionally observe such a neutrino event. IceCube, the largest particle detector in the world, encompasses a whole cubic kilometre of the eternal ice of the Antarctic. Inside IceCube, a total of 5,160 sensitive detectors hang from 86 steel cables. These detectors, which are known as optical modules, are sensitive to the weak flashes of light that are generated by a neutrino collision. After a construction period of seven years, the gigantic detector was fully operational at the end of 2010.

The first hints of extra-terrestrial high-energy neutrinos came with the unexpected discovery in April 2012 of two detector events above 1000 TeV. The IceCube scientists nicknamed these two rare events "Ernie" and "Bert". An analysis of those events was reported in the scientific journal *Physical Review Letters*. An intensified search, the results of which are presented now, turned up 26 additional events beyond 30 teraelectronvolts, exceeding the results expected for neutrinos produced in the earth's atmosphere.

"Perhaps, we are currently experiencing the birth of neutrino astronomy," says Ackermann. The analysis did not find any statistically significant clustering of the 28 events either in time or space - the number of events is too small. "We are now working hard on improving the significance of our observation, and on understanding what this signal means and where it comes from", says collaboration spokesperson Professor Olga Botner of Uppsala University (Sweden). With an increase in the number of events the scientists hope to identify sources of high energy neutrinos in the cosmos.

The international IceCube team consists of 260 scientists from eleven countries. "The success of IceCube builds on the efforts of hundreds of people around the world," emphasizes Botner. In Germany, apart from DESY eight universities participate in the collaboration: the Technical University of Aachen, the Humboldt University Berlin, the University of Bochum, the University of Bonn, the Technical University of Dortmund, the University of Erlangen-Nürnberg, the University of Mainz, the Technical University of Munich and the University of Wuppertal. Apart from a quarter of the optical modules, the German participants contributed a significant part of the receiver electronics on the ice surface. The German share of about 20 million Euro was funded by the Federal Ministry of Education and Research, the Helmholtz Association, the German Research Foundation, and by the budgets of the participating universities.

Deutsches Elektronen-Synchrotron DESY is the leading German accelerator centre and one of the leading in the world. DESY is a member of the Helmholtz Association and receives its funding from the German Federal Ministry of Education and Research (BMBF) (90 percent) and the German federal states of Hamburg and Brandenburg (10 percent). At its locations in Hamburg and Zeuthen near Berlin, DESY develops, builds and operates large particle accelerators, and uses them to investigate the structure of matter. DESY's combination of photon science and particle physics is unique in Europe.

Reference: Evidence for High-Energy Extraterrestrial Neutrinos at the IceCube Detector; The IceCube Collaboration; Science (2013); DOI: 10.1126/science.1242856

http://www.eurekalert.org/pub_releases/2013-11/uoia-rmb112113.php

Researchers map brain areas vital to understanding language

Neuroscience professor Aron Barbey and his colleagues used brain injury data from Vietnam War veterans to map the ability of humans to understand written or spoken language

CHAMPAIGN, Ill. - When reading text or listening to someone speak, we construct rich mental models that allow us to draw conclusions about other people, objects, actions, events, mental states and contexts. This ability to understand written or spoken language, called "discourse comprehension," is a hallmark of the human mind and central to everyday social life. In a new study, researchers uncovered the brain mechanisms that underlie discourse comprehension. The study appears in *Brain: A Journal of Neurology*.

With his team, study leader Aron Barbey, a professor of neuroscience, of psychology, and of speech and hearing science at the University of Illinois, previously had mapped general intelligence, emotional intelligence and a host of other high-level cognitive functions. Barbey is the director of the Decision Neuroscience Laboratory at the Beckman Institute for Advanced Science and Technology at Illinois.

To investigate the brain regions that underlie discourse comprehension, the researchers studied a group of 145 American male Vietnam War veterans who sustained penetrating head injuries during combat. Barbey said these shrapnel-induced injuries typically produced focal brain damage, unlike injuries caused by stroke or other neurological disorders that affect multiple regions. These focal injuries allowed the researchers to pinpoint the structures that are critically important to discourse comprehension.

"Neuropsychological patients with focal brain lesions provide a valuable opportunity to study how different brain structures contribute to discourse comprehension," Barbey said.

A technique called voxel-based lesion-symptom mapping allowed the team to pool data from the veterans' CT scans to create a collective, three-dimensional map of the cerebral cortex. They divided this composite brain into units called voxels (the three-dimensional counterparts of two-dimensional pixels). This allowed them to compare the discourse comprehension abilities of patients with damage to a particular voxel or cluster of voxels with those of patients without injuries to those brain regions. The researchers identified a network of brain areas in the frontal and parietal cortex that are essential to discourse comprehension.

"Rather than engaging brain regions that are classically involved in language processing, our results indicate that discourse comprehension depends on an executive control network that helps integrate incoming language with prior knowledge and experience," Barbey said. Executive control, also known as executive function, refers to the ability to plan, organize and regulate one's behavior.

"The findings help us understand the neural foundations of discourse comprehension, and suggest that core elements of discourse processing emerge from a network of brain regions that support language processing and executive functions. The findings offer new insights into basic questions about the nature of discourse comprehension," Barbey said, "and could offer new targets for clinical interventions to help patients with cognitive-communication disorders. "Discourse comprehension is a hallmark of human social behavior," Barbey said. "By studying the mechanisms that underlie these abilities, we're able to advance our understanding of the remarkable cognitive and neural architecture from which language comprehension emerges."

http://www.eurekalert.org/pub_releases/2013-11/uomm-rst111913.php

Research shows that anti-fungal medicine may increase vulnerability to influenza and other viruses

First line anti-viral protein rendered ineffective by Amphotericin B

WORCESTER, MA – Scientists at the University of Massachusetts Medical School (UMMS) and the Wellcome Trust Sanger Institute have discovered evidence that a widely used anti-fungal medicine increases susceptibility to flu infection in mice and cell cultures. Published online in *Cell Reports*, the study shows that Amphotericin B, commonly given to cancer and bone marrow transplant patients to fight invasive fungal infections, neutralizes an important anti-viral protein, making it easier for viruses to infect cells.

These findings suggest that patients taking the antifungal therapy may be functionally immunocompromised and vulnerable to influenza and potentially other viruses.

"While these studies don't confirm that such an interaction may translate into clinical relevance for patients, it does suggest that some vigilance is warranted, especially for patients who are undergoing treatment for cancer and may already have suppressed immune systems," said Abraham Brass, MD, PhD, assistant professor of microbiology & physiological systems and senior author of the study.

Paul Kellam, PhD, professor from the Wellcome Trust Sanger Institute and co-author of the study said, "This is an important discovery and the consequences for patients on certain anti-fungal treatments should now be investigated. Preventative flu vaccinations, rapid antiviral therapy or alternative anti-fungal treatment could be offered to these patients when at risk of flu infection."

Found in nearly all human cells, IFITM3 works to alter the cell membrane, making it more difficult for viruses, such as the influenza virus, to penetrate the cell's outer layer. When IFITM3 is inactive, influenza viruses can more readily infiltrate and infect the cell.

Previous studies by Drs. Kellam and Brass and their colleagues have also shown that people who have a genetic variant in the IFITM3 gene are more susceptible to influenza.

Brass and his lab were working to understand how IFITM3 protects cells from viral infection when they discovered the link between Amphotericin B and influenza. "Several cell cultures in the lab became contaminated with a fungus," said Brass. "We treated them with Amphotericin B, not knowing it would have an effect on IFITM3 activity. Surprisingly, when we tested for influenza infection we found no IFITM3 activity in the normal, wild type, cells. At that point, we began to suspect that Amphotericin B was having an effect on IFITM3."

This unexpected revelation opened up a new line of inquiry that revealed that Amphotericin B was preventing IFITM3 from fending off the influenza virus. "When we treated lung cancer cells with the anti-fungal drug, we saw the anti-viral protection normally provided by IFITM3 disappear," said Christopher R. Chin, research associate in the Brass lab and co-first author of the study.

To better appreciate the effects Amphotericin B has on IFITM3, Brass teamed up with Kellam to treat mice with the anti-fungal drug. The pair found that once the mice contracted influenza, they displayed the same, more severe flu symptoms as mice completely lacking the protective IFITM3 gene. In the absence of the influenza virus, the mice treated with the Amphotericin B showed no signs of illness.

This research indicates that patients undergoing Amphotericin B anti-fungal treatments could potentially lose the protective effects of IFITM3, increasing the risk of flu infections in patients with already compromised immune systems.

"Sometimes a very useful drug can also have unforeseen effects," said Brass. "We now see that a major part of the body's natural defenses to influenza virus is rendered inactive by Amphotericin B in cells and mice. It's our hope that reporting the consequences of this interaction may stimulate further translational studies and potentially guide patient care."

Both Kellam and Brass agree that further work is now needed to evaluate if this effect has any clinical significance for patients receiving Amphotericin B-based treatments.

This research was part of an ongoing collaboration between institutes in the United States (UMass Medical School) and the United Kingdom (Wellcome Trust Sanger Institute).

http://www.eurekalert.org/pub_releases/2013-11/dnal-w2t112113.php

Will 2-D tin be the next super material?

Theorists predict new single-layer material could go beyond graphene, conducting electricity with 100 percent efficiency at room temperature

A single layer of tin atoms could be the world's first material to conduct electricity with 100 percent efficiency at the temperatures that computer chips operate, according to a team of theoretical physicists led by researchers from the U.S. Department of Energy's (DOE) SLAC National Accelerator Laboratory and Stanford University. Researchers call the new material "stanene," combining the Latin name for tin (stannum) with the suffix used in graphene, another single-layer material whose novel electrical properties hold promise for a wide range of applications.

"Stanene could increase the speed and lower the power needs of future generations of computer chips, if our prediction is confirmed by experiments that are underway in several laboratories around the world," said the team leader, Shoucheng Zhang, a physics professor at Stanford and the Stanford Institute for Materials and Energy Sciences (SIMES), a joint institute with SLAC. The team's work was published recently in Physical Review Letters.

The Path to Stanene

For the past decade, Zhang and colleagues have been calculating and predicting the electronic properties of a special class of materials known as topological insulators, which conduct electricity only on their outside edges or surfaces and not through their interiors. When topological insulators are just one atom thick, their edges conduct electricity with 100 percent efficiency. These unusual properties result from complex interactions between the electrons and nuclei of heavy atoms in the materials.

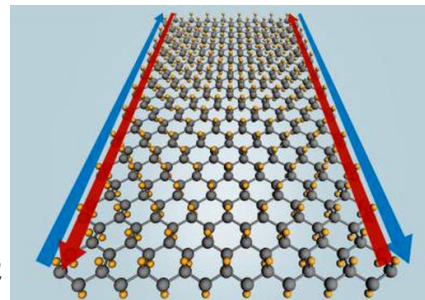
"The magic of topological insulators is that by their very nature, they force electrons to move in defined lanes without any speed limit, like the German autobahn," Zhang said. "As long as they're on the freeway – the edges or surfaces – the electrons will travel without resistance."

In 2006 and 2009, Zhang's group predicted that mercury telluride and several combinations of bismuth, antimony, selenium and tellurium should be topological insulators, and they were soon proven right in experiments performed by others. But none of those materials is a perfect conductor of electricity at room temperature, limiting their potential for commercial applications.

Earlier this year, visiting scientist Yong Xu, who is now at Tsinghua University in Beijing, collaborated with Zhang's group to consider the properties of a single layer of pure tin.

"We knew we should be looking at elements in the lower-right portion of the periodic table," Xu said. "All previous topological insulators have involved the heavy and electron-rich elements located there."

Their calculations indicated that a single layer of tin would be a topological insulator at and above room temperature, and that adding fluorine atoms to the tin would extend its operating range to at least 100 degrees Celsius (212 degrees Fahrenheit).



Adding fluorine atoms (yellow) to a single layer of tin atoms (gray) should allow a predicted new material, stanene, to conduct electricity perfectly along its edges (blue and red arrows) at temperatures up to 100 degrees Celsius. The first application for this stanene-fluorine combination could be in wiring that connects the many sections of a microprocessor, allowing electrons to flow as easily as cars on a freeway. Yong Xu/Tsinghua University; Greg Stewart/SLAC

Ultimately a Substitute for Silicon?

Zhang said the first application for this stanene-fluorine combination could be in wiring that connects the many sections of a microprocessor, allowing electrons to flow as freely as cars on a highway. Traffic congestion would still occur at on- and off-ramps made of conventional conductors, he said. But stanene wiring should significantly reduce the power consumption and heat production of microprocessors.

Manufacturing challenges include ensuring that only a single layer of tin is deposited and keeping that single layer intact during high-temperature chip-making processes. "Eventually, we can imagine stanene being used for many more circuit structures, including replacing silicon in the hearts of transistors," Zhang said. "Someday we might even call this area Tin Valley rather than Silicon Valley."

Additional contributors included researchers from Tsinghua University in Beijing and the Max Planck Institute for Chemical Physics of Solids in Dresden, Germany. The research was supported by the Mesodynamic Architectures program of the Defense Advanced Research Projects Agency.

SLAC is a multi-program laboratory exploring frontier questions in photon science, astrophysics, particle physics and accelerator research. Located in Menlo Park, California, SLAC is operated by Stanford University for the U.S. Department of Energy Office of Science. To learn more, please visit <http://www.slac.stanford.edu>.

The Stanford Institute for Materials and Energy Sciences (SIMES) is a joint institute of SLAC National Accelerator Laboratory and Stanford University. SIMES studies the nature, properties and synthesis of complex and novel materials in the effort to create clean, renewable energy technologies. For more information, please visit simes.slac.stanford.edu.

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Citation: Yong Xu et al., Physical Review Letters, 27 Sept 2013 (10.1103/PhysRevLett.111.136804)

<http://www.sciencedaily.com/releases/2013/11/131121184216.htm>

Dreading Pain Can Be Worse Than Pain Itself

Faced with inevitable pain, most people would choose to get it out of the way as soon as possible, according to a new study.

Researchers from the Institute of Global Health Innovation (IGHI) at Imperial College London and the Wellcome Trust Centre for Neuroimaging at UCL asked 35 volunteers to choose between electric shocks of different intensity occurring at different times.

They found that most people chose to hasten the pain, and would even accept more severe pain to avoid having to wait for it. A smaller proportion preferred to put it off into the future. They found similar results when they asked the volunteers to choose between imagined dental appointments involving different levels of pain. The study, which was funded by the Wellcome Trust, is published in PLOS Computational Biology.

The anticipation of pain is a major source of misery. People who suffer from longstanding painful conditions report that the dread of their pain getting worse can be more disabling than the pain itself.

The research team sought to better understand the fundamental processes by which people anticipate pain, with the hope of providing new insight into these conditions. In 71 per cent of tests, the participants chose to have the pain earlier, even though in half of the tests that meant a more painful stimulus.

Dr Giles Story, from the IGHl at Imperial, said: "When people are offered a reward, they prefer to have it as soon as possible, which could be interpreted to mean that we rate future experiences as less important when we're making decisions. This reasoning would suggest that you would put off unpleasant things to the future as well. "We found that this isn't the case for most people. If pain can't be avoided, most people choose to get it out of the way sooner, even if that means the pain is worse. "This might make sense if anticipating pain stops you from doing things well or enjoying yourself. We're planning to investigate this in our next studies."

Giles W. Story, Iyaylo Vlaev, Ben Seymour, Joel S. Winston, Ara Darzi, Raymond J. Dolan. Dread and the Disvalue of Future Pain. PLoS Computational Biology, 2013; 9 (11): e1003335 DOI: 10.1371/journal.pcbi.1003335

<http://nyti.ms/I4CDOW>

Wine Cellar, Well Aged, Is Revealed in Israel

Digging this summer at the ruins of a 1700 B.C. Canaanite palace in northern Israel, archaeologists struck wine.

By JOHN NOBLE WILFORD

Near the banquet hall where rulers of a Middle Bronze Age city-state and their guests feasted, a team of American and Israeli researchers broke through to a storage room holding the remains of 40 large ceramic jars. The vessels were broken, their liquid contents long since vanished — but not without a trace.

A chemical analysis of residues left in the three-foot-tall jars detected organic traces of acids that are common components of all wine, as well as ingredients popular in ancient winemaking. These included honey, mint, cinnamon bark, juniper berries and resins used as a preservative. The recipe was similar to medicinal wines used for 2,000 years in ancient Egypt and probably tasted something like retsina or other resinous Greek wines today.



A storage room unearthed from the ruins of a 1700 B.C. Canaanite palace in northern Israel held the remains of 40 ceramic jars. Eric H. Cline/George Washington University

So the archaeologists who have been exploring the Canaanite site, known as Tel Kabri, announced on Friday that they had found one of civilization's oldest and largest wine cellars. The storage room held the equivalent of about 3,000 bottles of red and white wines, they said — and they suspected that this was not the palace's only wine cellar.

"This is a hugely significant discovery," said Eric H. Cline, a co-director of the Tel Kabri excavations, in a statement issued by George Washington University, where he is chairman of the department of classical and Near Eastern languages and civilizations. "It's a wine cellar that, to our knowledge, is largely unmatched in its age and size."

Dr. Cline and the other co-director, Assaf Yasur-Landau of the University of Haifa in Israel, described their findings Friday in Baltimore at the annual meeting of the American Schools of Oriental Research. Another member of the team, Andrew Koh of Brandeis University, reported the results of the organic residue analysis, emphasizing the quantity of the samples and thoroughness of the testing. The researchers had to work fast to examine the residues before they became contaminated on exposure outside the storage room.

The archaeologists said that much of the palace, including the banquet hall and the wine storage room, was destroyed 3,600 years ago in some violent event, perhaps an earthquake. The wine cellar was covered with thick debris of mud bricks and plaster. That and the fact that no subsequent buildings were erected on top of the site have made Tel Kabri an inviting place for archaeological studies.

Team members said some older discoveries had been made before in tombs, but nothing on the scale of Tel Kabri. Patrick McGovern of the Museum of Archaeology and Anthropology at the University of Pennsylvania said he had "reservations about a finding for which a detailed scientific report has not been published." He said

in an email that “the oldest chemically confirmed ‘wine cellars’ are those in the tomb Scorpion I of Egypt” about 3150 B.C. “If we are making the claim only for ancient Canaan, and put the emphasis on ‘palatial,’ ” Dr. McGovern suggested, “the Kabri might well be the earliest.”

Dr. McGovern and other researchers have been able to re-create ancient wines and beers from the dregs from long-ago tastings. Dr. Koh said his group expected to produce a reasonable facsimile of the 1700 B.C. vintage favored by the palace elite in the land of Canaan.

In the Middle Bronze Age, from 2000 to 1550 B.C., Canaan was a confederation of city-states, the most important of which seems to have been Hazor, in a region that included what today is Israel, Lebanon, northwestern Jordan and parts of western Syria. At the time, Canaanites were farmers, merchants and early seafarers to Cyprus and the Aegean Islands. These were the centuries preceding the appearance of the biblical Hebrews. In the biblical narrative, God promised Canaan as a gift to Abraham; some modern scholars have stirred controversy suggesting that the early Israelites were in fact themselves Canaanites.

As for the ancient beverage, the presence of tartaric acid was “a surefire marker” of grape juice or wine, Dr. Koh said in a teleconference briefing with reporters on Thursday. Other recognized ingredients were consistent with winemaking recipes in ancient texts from the ruins of Mari, an early city on the Euphrates River in what is now Syria.

“They wrote about the recipes,” Dr. Cline said, referring to the Mari texts. “Here, for the first time, we believed, we have these crafted wines that verified the recipes beyond shadow of doubt.”

Thirty-eight of the 40 vessels contained recognizable wine residues. “This wasn’t moonshine that someone was brewing in their basement, eyeballing the measurements,” Dr. Koh noted. “This wine’s recipe was strictly followed in each and every jar.”

The current excavations began in 2005. Four years later, archaeologists uncovered spectacular frescoes from the Aegean Islands, and last year they found the banquet hall. This July, they started finding one after another of the ceramic jugs in the 15-by-25-foot storage room. Support for the project was provided by the National Geographic Society, the Israel Science Foundation, the Institute for Aegean Prehistory, the Bronfman Philanthropies, George Washington University, Haifa University and private donations.

More discoveries may be in the offing. Just days before the archaeologists wrapped up this summer’s work, they came upon two doors leading out of the wine cellar where they had been digging, one to the south, and one to the west. They will have to wait until the next excavation season, in 2015, to find out if the doors lead to additional storage rooms, possibly with more wine that the Canaanite connoisseurs of the grape never got to swoon over at their goat-meat banquets.

http://www.eurekalert.org/pub_releases/2013-11/ind-cwo112213.php

Chemotherapy: When our intestinal bacteria provide reinforcement

Bacteria from the intestinal flora stimulate fresh immune defences which then enhance the body's ability to fight the malignant tumour

Indeed, the researchers have just shown that the efficacy of one of the molecules most often used in chemotherapy relies to an extent on its capacity to mobilise certain bacteria from the intestinal flora toward the bloodstream and lymph nodes. Once inside the lymph nodes, these bacteria stimulate fresh immune defences which then enhance the body's ability to fight the malignant tumour.

Results of this work are published in the journal *Science* on 22 November 2013.

The intestinal microbiota is made up of 100,000 billion bacteria. It is a genuine organ, since the bacterial species that comprise it carry out functions crucial to our health, such as the elimination of substances that are foreign to the body (and potentially toxic), or keeping the pathogens that contaminate us at bay. They also ensure the degradation of ingested food, for better intestinal absorption and optimal metabolism. These millions of bacteria colonise the intestine from birth, and play a key role in the maturation of the immune defences. However, the bacterial species that make up the intestinal microbiota vary from one individual to another, and the presence or absence of one or another bacterial species seems to influence the occurrence of some diseases, or, conversely, may protect us.

In the cancer area, the French team directed by Prof Laurence Zitvogel, Director of Inserm Unit 1015, "Tumour Immunology and Immunotherapy," at Institut Gustave Roussy, in close collaboration with Institut Pasteur (Dr Ivo Gomperts Boneca, "Biology and Genetics of the Bacterial Cell Wall" Unit) and researchers at INRA (Drs Patricia Lepage and Joël Doré, Micalis Unit, "Food Microbiology in the Service of Health"), has just provided evidence that the intestinal flora stimulates an individual's immune responses to combat cancer during chemotherapy.

Cyclophosphamide is one of the most widely used drugs in chemotherapy. However, like any treatment, it involves side effects (inflammation of the mucosa etc.), and disrupts the normal balance of the intestinal microbiota. Certain bacteria (of the Gram+ group of bacteria) can pass the intestinal barrier and enter the bloodstream and lymph nodes.

These bacteria, once in the general circulation of the body, may be considered harmful, and the body generates an immune response.

"This chain reaction, a side effect of the treatment, actually turns out to be very useful," explains Laurence Zitvogel. "Surprisingly, the immune response directed against these bacteria helps the patient to better fight his/her tumour, by stimulating fresh immune defence mechanisms." More specifically, immunisation against bacteria leads to the recruitment of effector lymphocytes different to those mobilised by chemotherapy. Their role consists of helping anti-tumour lymphocytes to stem the growth of tumours.

To verify these observations in mice, researchers suppressed all Gram+ bacteria from their intestinal microbiota. Results showed that the efficacy of the chemotherapy was reduced. The researchers also suggest that some antibiotics used during chemotherapy may destroy these Gram+ bacteria, and thus negate their beneficial effect. "Now that these "beneficial" bacteria that potentiate the anti-tumour immune response have been identified, we should soon succeed in supplying more to the body, especially via pro- or prebiotics and/or a specific diet," the researcher concludes.

This work has received support from the French National Cancer League, the French National Cancer Institute (INCa; SIRIC SOCRATES) and from LABEX Onco-Immunology

The intestinal microbiota modulates the anticancer immune effects of cyclophosphamide

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Science November 2013 <http://dx.doi.org/10.1126/science.1240537>

http://www.eurekalert.org/pub_releases/2013-11/lsuh-lrf112213.php

LSUHSC research finds combo of plant nutrients kills breast cancer cells

Super cocktail of six natural plant compounds killed 100% of sample breast cancer cells without toxic side effects

New Orleans, LA – A study led by Madhwa Raj, PhD, Research Professor in Obstetrics and Gynecology at LSU Health Sciences Center New Orleans and its Stanley S. Scott Cancer Center, has found that a super cocktail of six natural compounds in vegetables, fruits, spices and plant roots killed 100% of sample breast cancer cells without toxic side effects on normal cells.

The results, which also revealed potential treatment target genes, are published in the November 2013 issue of The Journal of Cancer.

"One of the primary causes of both the recurrence of breast cancer and deaths is a small group of cancer stem cells that evade therapy," notes Dr. Raj. "These often multi-drug-resistant cells have the ability to generate new tumors, so it is critically important to develop new approaches to more effective and safer treatment or prevention of breast cancer."

The research team tested ten known protective chemical nutrients found in foods like broccoli, grapes, apples, tofu, and turmeric root (a spice used in Indian curry) before settling upon six – Curcumin known as tumeric, Isoflavone from soybeans, Indo-3-Carbinol from cruciferous plants, C-phycocyanin from spirulina, Resveratrol from grapes, and Quercetin, a flavonoid present in fruits, vegetables, and tea.

The researchers administered these six at bioavailable levels to both breast cancer and control cells. They tested the compounds individually and in combination. They found that the compounds were ineffective individually. When combined, though, the super cocktail suppressed breast cancer cell growth by more than 80%, inhibited migration and invasion, caused cell cycle arrest, and triggered the process leading to cell death resulting in the death of 100% of the breast cancer cells in the sample.

The researchers observed no harmful effects on the control cells. Further analysis also identified several key genes, which could serve as markers to follow the progress of therapy.

Although the cocktail was not tested against BRCA1 and BRAC2, previous studies have shown that they are molecular targets of four of the six compounds. The researchers also earlier demonstrated that two of the compounds synergize effectively to kill ovarian cancer cells.

According to the National Cancer Institute's SEER Program, which includes data from LSU Health Sciences Center New Orleans, breast cancer is the second most common cancer with 232,340 new cases estimated this year and 39,620 deaths.

There are an estimated 2,829,041 women currently living with breast cancer in the United States.

The LSUHSC research team also included Andrew Hollenbach, PhD, with collaboration from David Welsh, MD, and Udai Pandey, PhD. Other local participants included Drs. Shubha Ireland at Xavier University and Shailaja Raj at Protegene Corporation.

<http://www.medscape.com/viewarticle/814903?src=rss>

Antibiotics Common Cause of Perioperative Anaphylaxis

Antibiotics are the most common identifiable cause of perioperative anaphylaxis, according a new Cleveland Clinic study — a finding that contrasts with results from several European studies.

Kate Johnson

BALTIMORE - "By using a systematic approach to evaluation and management of patients who have experienced intraoperative anaphylaxis, allergy and immunology consultation can determine an etiology in virtually all cases, and this information can direct management," senior investigator David Lang, MD, from the Cleveland Clinic in Ohio, told Medscape Medical News.

"Using skin or in vitro tests is recommended and should be performed within 4 to 6 weeks after the event," added lead investigator Alexei Gonzalez-Estrada, MD, who presented the results here at the American College of Allergy, Asthma & Immunology (ACAAI) 2013 Annual Scientific Meeting.

Perioperative anaphylaxis occurs infrequently, and identifying the cause of the reaction can be challenging. Previous reports have found that it is most frequently triggered by neuromuscular blocking agents, according to Dr. Gonzalez-Estrada and his team. In this study, the researchers reviewed cases of anaphylaxis that occurred between 2002 and 2013 at the Cleveland Clinic. They identified a total of 30 cases.

Skin and in vitro tests were performed for neuromuscular blocking agents (rocuronium, pancuronium, atracurium, and succinylcholine); induction agents (midazolam, propofol, thiopental, and etomidate); analgesics (fentanyl); antibiotics (cefazolin, cefuroxime, penicillin G, penicilloyl-polylysine [Pre-Pen], and metronidazole); local anesthetics (lidocaine); and others, such as povidone, chlorhexidine, and latex.

Testing identified the cause of anaphylaxis in 57% of cases, which were further classified as IgE mediated. The other 43% had no identifiable cause and "likely reflect non-IgE-mediated reactions to neuromuscular blocking agents," Dr. Lang told Medscape Medical News.

The most common identifiable cause of perioperative anaphylaxis was antibiotics (58%) followed by neuromuscular blocking agents (23%) and latex (17%), said Dr. Gonzalez-Estrada.

The antibiotics included cefazolin (60%), penicillin (20%), cefuroxime (10%), and metronidazole (10%).

There were no deaths in the cohort, but 96.6% of the reactions included hypotension, and cardiac arrest occurred in 23.3% of the cases. Cutaneous signs included flushing (33.3%), urticaria (16.7%), angioedema (16.7%), bronchospasm (43.3%), and diarrhea (3.3%).

All patients in whom an IgE-mediated cause was identified had elevated tryptase levels vs only 40% of those with non-IgE-mediated reactions ($P = .001$). Mean tryptase levels were significantly higher in IgE-mediated reactions (41.3 vs 23.8 $\mu\text{g/L}$; $P = .096$). Non-IgE-mediated reactions occurred earlier in surgery compared with IgE-mediated reactions (median, 10 min vs 19.5 min).

"It is challenging to establish an etiology of perioperative anaphylaxis since patients receive multiple medications," said Dr. Gonzalez-Estrada. "Cardiovascular collapse may be the sole manifestation, and elevated tryptase levels support the diagnosis."

He pointed out that preoperative skin testing is not universally recommended for patients: "It should only be performed for individuals who have had a prior episode of perioperative anaphylaxis."

Asked by Medscape Medical News to comment on the findings, Lene Heise Garvey, PhD, from the Danish Anaesthesia Allergy Centre in Copenhagen, said that North American studies of perioperative anaphylaxis are rare.

"I have worked in this area since 1998, and very little literature has come out of the US on perioperative anaphylaxis during this time," she said, adding that several European countries, such as Denmark, France, Belgium, and the United Kingdom, as well as Australia, have dedicated anesthesia allergy centers such as hers. She said the causes of perioperative anaphylaxis seem to vary between countries.

Different Countries, Different Causes

"In France, Norway, the UK, and Australia, neuromuscular blocking agents are the most common cause, while in Denmark, where my center has been investigating patients with perioperative anaphylaxis from all over the

country since 1999, the most common causes are chlorhexidine, antibiotics, latex, and patent blue," said Dr. Garvey.

Although the current study included chlorhexidine in its investigation, Dr. Garvey said that many investigators fail to do this, which may explain some of the global variation in identified causes.

"Unfortunately, this is often missed, as people investigating these reactions focus on drugs given intravenously and overlook potentially hidden causes like chlorhexidine, blue dyes, ethylene oxide used in sterilization, premedications, or drugs administered by the surgeons," she said.

In the Danish Anaesthesia Allergy Centre, studies of perioperative anaphylaxis include all the drugs and substances a patient has been exposed to, including latex, chlorhexidine, and ethylene oxide, and all records are reviewed by Dr. Garvey and another anesthesiologist who knows how to read anesthetic charts and interpret the patient's reaction.

"In many centers, only allergists are involved, and they may miss potential allergens, as they are not used to interpreting anesthetic charts," explained Dr. Garvey. She added, "The diagnosis of anaphylaxis is difficult to make in the perioperative setting, and a number of other diagnoses may be misinterpreted as anaphylaxis. In our center, we find an identifiable allergen in about half of the investigated cases."

Dr. Lang reports financial relationships with GlaxoSmithKline, Hycor, Merck, sanofi-aventis, Genentech, and Novartis. Dr. Gonzales-Estrada and Dr. Garvey report no relevant financial relationships.

American College of Allergy, Asthma & Immunology (ACAAI) Annual Scientific Meeting: Abstract 1. Presented November 10, 2013.

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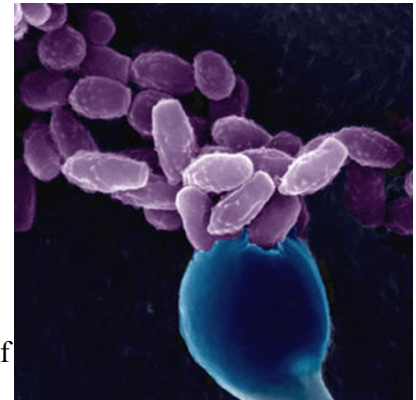
Accident of Evolution Allows Fungi to Thrive in Our Bodies

Cryptococcal fungi have evolved mechanisms for eluding their protist predators, giving them an inadvertent advantage over look-alike immune cells in humans, porpoises and other mammals

By Jennifer Frazer | Saturday, November 23, 2013 | 10

Sudden fungal outbreaks have long been routine among plants, and more recently, animals. A recent outbreak among humans in the Pacific Northwest raises the disturbing prospect that we are not immune either. The mystery of this outbreak's origins is detailed in "Strange Fungi Now Stalk Healthy People" in the December issue of Scientific American.

The outbreak is ongoing but, in spite of appearances, *Cryptococcus gattii* doesn't exist to plague us. The fungus prefers to live in soil and on trees, where it subsists quite happily on decaying matter. So how can an organism that seems to enjoy a full and rich life on plants and dirt possibly find itself suited to living inside humans? The answer, it turns out, may be an accident of evolution.



***Cryptococcus neoformans* spores.** Image: Joseph Heitman, Center for Microbial Pathogenesis at Duke University
Life in the wild is not all sunshine and rotting roses for *C. gattii*. "Microorganisms are in a constant fight for territory, for food sources, for their place in that microbial community," says Karen Bartlett of the University of British Columbia, an expert in the behavior of biological aerosols. Yeasts have many predators, and formidable among them are amoebas. These protists ooze their way through the soil and water of the world, engulfing and digesting tiny prey. To prevent amoebic annihilation, *Cryptococcus* species have evolved mechanisms to elude their would-be predators, such as a drying- and digestion-resistant coat, UV-protective pigments and the ability to survive being swallowed by predators.

Those same mechanisms allow yeast to evade a type of human immune cell that looks and acts just like an amoeba (similar cells are also found in other animals). We call them macrophages. Macrophages, which may share evolutionary roots with free-living amoebas, do virtually the same job in humans that amoebas do in the environment: they crawl around eating things. In our case, those things are bits of junk and microbes, which they ingest and kill with digestive enzymes—just like wild amoebas. "If you didn't know the difference, you'd think that they were amoebas," Bartlett says.

And apparently, neither does *Cryptococcus*. In our lungs macrophages scour the surface, mopping up the many foreign objects that land but don't belong there. In susceptible people and animals *Cryptococcus* species are just as skillful in duping macrophages as they are their soil attackers. And they use the same methods, at least in the lab.

C. gattii not only can kill macrophages, they can also hide inside them. If ingested, the fungal cells resist digestion while hiding from antibodies, T cells, and other immune system components, effectively converting a macrophage into a microbial Trojan horse. Macrophages travel extensively through the body and can cross the

blood–brain barrier. If a yeast cells finds its way from the lung to the brain via a phage or other routes, “that's very bad news,” Bartlett says, “because once it gets into the central nervous system it's in heaven. It has all of the sugars it wants to be able to rapidly proliferate.” When Cryptococcus kills it's generally because such a brain infection has happened.

There are other reasons Cryptococcus has an easy job when it infects us. Unlike the vast majority of fungi, it can survive at 37 degrees Celsius—human body temperature. And it has a tough polysaccharide coat that helps prevent it from drying out in the environment but also helps protect it from macrophages. Finally, its exterior contains melanin, the same pigment that colors human skin, which both protects it from UV radiation as well as inhibits the digestive action of macrophages. “All of these things are protective mechanisms that have allowed it to become established in the environment,” Bartlett says, “and unfortunately those same protective mechanisms make it a pathogen for us.”

Amazingly, this is not an isolated phenomenon. Legionella pneumophila, the bacterial cause of Legionnaires' disease, lives symbiotically inside wild aquatic amoebas and similarly mistakenly infects human macrophages when victims inhale it. Arturo Casadevall, chair of the Department of Microbiology and Immunology and director of the Center for Immunological Sciences at the Albert Einstein College of Medicine, who has been studying Cryptococcus for over 20 years, has compared the phenomenon with a card game where soil microbes are playing for survival, but by chance, a few hands confer “accidental virulence” on other hosts.

“Virulence is not their business,” Casadevall says. “Their business is survival. But the same pressures that are allowing them to survive results in traits that gives them capacity to survive in mammals.”

http://www.eurekalert.org/pub_releases/2013-11/uobc-sfb112213.php

Scientists find brain region that helps you make up your mind

One of the smallest parts of the brain is getting a second look after new research suggests it plays a crucial role in decision making.

A University of British Columbia study published today in Nature Neuroscience says the lateral habenula, a region of the brain linked to depression and avoidance behaviors, has been largely misunderstood and may be integral in cost-benefit decisions.

"These findings clarify the brain processes involved in the important decisions that we make on a daily basis, from choosing between job offers to deciding which house or car to buy," says Prof. Stan Floresco of UBC's Dept. of Psychology and Brain Research Centre (BRC). "It also suggests that the scientific community has misunderstood the true functioning of this mysterious, but important, region of the brain."

In the study, scientists trained lab rats to choose between a consistent small reward (one food pellet) or a potentially larger reward (four food pellets) that appeared sporadically. Like humans, the rats tended to choose larger rewards when costs—in this case, the amount of time they had to wait before receiving food--were low and preferred smaller rewards when such risks were higher.

Previous studies suggest that turning off the lateral habenula would cause rats to choose the larger, riskier reward more often, but that was not the case. Instead, the rats selected either option at random, no longer showing the ability to choose the best option for them.

The findings have important implications for depression treatment. "Deep brain stimulation – which is thought to inactivate the lateral habenula -- has been reported to improve depressive symptoms in humans," Floresco says. "But our findings suggest these improvements may not be because patients feel happier. They may simply no longer care as much about what is making them feel depressed."

Background

Floresco, who conducted the study with PhD candidate Colin Stopper, says more investigation is needed to understand the complete brain functions involved in cost-benefit decision processes and related behaviour. A greater understanding of decision-making processes is also crucial, they say, because many psychiatric disorders, such as schizophrenia, stimulant abuse and depression, are associated with impairments in these processes. The lateral habenula is considered one of the oldest regions of the brain, evolution-wise.

http://www.eurekalert.org/pub_releases/2013-11/ps-ugg112213.php

Unusual greenhouse gases may have raised ancient Martian temperature

Much like the Grand Canyon, Nani Valles snakes across the Martian surface suggesting that liquid water once crossed the landscape, according to a team of researchers who believe that molecular hydrogen made it warm enough for water to flow.

The presence of molecular hydrogen, in addition to carbon dioxide and water, could have created a greenhouse effect on Mars 3.8 billion years ago that pushed temperatures high enough to allow for liquid water, the researchers state in the current issue of Nature Geoscience.

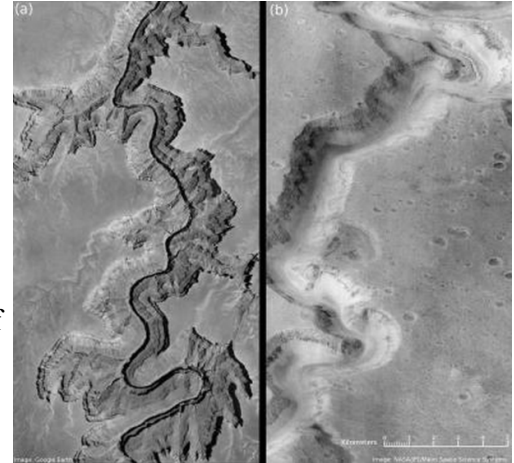
The team includes Ramses M. Ramirez, a doctoral student working with James Kasting, Evan Pugh Professor of Geosciences, Penn State.

Previous efforts to produce temperatures warm enough to allow for liquid water used climate models that include only carbon dioxide and water and were unsuccessful. The researchers used a model to show that an atmosphere with sufficient carbon dioxide, water and hydrogen could have made the surface temperatures of Mars warm to above freezing. Those above-freezing temperatures would allow liquid water to flow across the Martian surface over 3.8 billion years ago and form the ancient valley networks, such as Nanedi Valles, much the way sections of the Grand Canyon snake across the western United States today.

"This is exciting because explaining how early Mars could have been warm and wet enough to form the ancient valleys had scientists scratching their heads for the past 30 years," said Ramirez. "We think we may have a credible solution to this great mystery."

The researchers note that one alternative theory is that the Martian valleys formed after large meteorites bombarded the planet, generating steam atmospheres that then rained out. But this mechanism cannot produce the large volumes of water thought necessary to carve the valleys.

"We think that there is no way to form the ancient valleys with any of the alternate cold early Mars models," said Ramirez. "However, the problem with selling a warm early Mars is that nobody had been able to put forth a feasible mechanism in the past three decades. So, we hope that our results will get people to reconsider their positions."



This is a split panel comparing a section of Arizona's Grand Canyon on left against a section of Mars' Nanedi Valles on right. Nanedi Valles is located in the Lunae Palus quadrangle of Mars. The northern part of the Nanedi Valles image shows a river once cut through it, similar to the one flowing through the Grand Canyon. Although this section of Nanedi Valles is nearly 2.5 km in width, other portions are at least twice as wide. Slight morphologic differences between the two canyons are attributable to the great age differences between the regions and the correspondingly higher degree of erosion on Mars. Penn State

Ramirez and post-doctoral researcher Ravi Kopparapu co-developed a one-dimensional climate model to demonstrate the possibility that the gas levels from volcanic activity could have created enough hydrogen and carbon dioxide to form a greenhouse and raise temperatures sufficiently to allow for liquid water. Once they developed the model, Ramirez ran the model using new hydrogen absorption data and used it to recreate the conditions on early Mars, a time when the sun was about 30 percent less bright than it is today.

"It's kind of surprising to think that Mars could have been warm and wet because at the time the sun was much dimmer," Ramirez said.

Mars' mantle appears to be more reduced than Earth's, based on evidence from Shergotty, Nahkla, and Chassigny meteorites, Martian meteorites named for the towns near which they were found. A more reduced mantle outgasses more hydrogen relative to water, thus bolstering the hydrogen greenhouse effect.

"The hydrogen molecule is symmetric and appears to be quite boring by itself," said Ramirez. "However, other background gases, such as carbon dioxide, can perturb it and get it to function as a powerful greenhouse gas at wavelengths where carbon dioxide and water don't absorb too strongly. So, hydrogen fills in the gaps left by the other two greenhouse gases."

In addition to Ramirez, Kopparapu and Kasting, researchers on the project include Michael E. Zuger, senior research engineer, Applied Research Laboratory, Penn State; Tyler D. Robinson, University of Washington; and Richard Freedman, SETI Institute.

Support for the research comes from NASA Astrobiology Institute's Virtual Planetary Laboratory.