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Some 'healthy' vegetable oils may actually increase risk of heart disease

Health Canada should reconsider health claim for omega-6 oils on food labels

Some vegetable oils that claim to be healthy may actually increase the risk of heart disease, and Health Canada should reconsider cholesterol-lowering claims on food labelling, states an analysis in CMAJ (Canadian Medical Association Journal).

Replacing saturated animal fats with polyunsaturated vegetable oils has become common practice because they can reduce serum cholesterol levels and help prevent heart disease. In 2009, Health Canada's Food Directorate, after reviewing published evidence, approved a request from the food industry to apply a heart disease risk reduction claim on vegetable oils and foods containing these oils. The label suggests "a reduced risk of heart disease by lowering blood cholesterol levels."

"Careful evaluation of recent evidence, however, suggests that allowing a health claim for vegetable oils rich in omega-6 linoleic acid but relatively poor in omega-3 α-linolenic acid may not be warranted," write Drs. Richard Bazinet, Department of Nutritional Sciences, University of Toronto and Michael Chu, Lawson Health Research Institute and Division of Cardiac Surgery, Western University, London, Ontario.

Corn and safflower oil, which are rich in omega-6 linoleic acid but contain almost no omega-3 α-linolenic acid, are not associated with beneficial effects on heart health according to recent evidence. The authors cite a study published earlier this year in February 2013 "… in which the intervention group replaced saturated fat with sources of safflower oil or safflower oil margarine (rich in omega-6 linoleic acid but low in omega-3 α-linoleic acid). They found that the intervention group had serum cholesterol levels that were significantly decreased (by about 8%□%) relative to baseline and the control group, which is consistent with the health claim." However, rates of death from all causes of cardiovascular disease and coronary artery disease significantly increased in the treatment group.

In Canada, corn and safflower oils can be used in foods such as mayonnaise, creamy dressings, margarine, chips and nuts. Canola and soybean oils, which contain both linoleic and α-linolenic acids, are the most common forms of oil in the Canadian diet. "… it is unclear whether oils rich in omega-6 linoleic acid but low in omega-3 α-linolenic acid also reduce this risk. We suggest that the health claim be modified such that foods rich in omega-6 linoleic acid but poor in omega-3 α-linolenic acid be excluded," conclude the authors.

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New cause found for muscle-weakening disease myasthenia gravis

An antibody to a protein critical to enabling the brain to talk to muscles has been identified as a cause of myasthenia gravis, researchers report.

Augusta, Ga. – The finding that an antibody to LRP4 is a cause of the most common disease affecting brain-muscle interaction helps explain why as many as 10 percent of patients have classic symptoms, like drooping eyelids and generalized muscle weakness, yet their blood provides no clue of the cause, said Dr. Lin Mei, Director of the Institute of Molecular Medicine and Genetics at the Medical College of Georgia at Georgia Regents University. "You end up with patients who have no real diagnosis," Mei said.

The finding also shows that LRP4 is important, not only to the formation of the neuromuscular junction – where the brain and muscle talk – but also maintaining this important connection, said Mei, corresponding author of the paper in The Journal of Clinical Investigation.

Mei and his colleagues first reported antibodies to LRP4 in the blood of myasthenia gravis patients in the Archives of Neurology in 2012. For the new study, they went back to animals to determine whether the antibodies were harmless or actually caused the disease. When they gave healthy mice LRP4 antibodies, they experienced classic symptoms of the disease along with clear evidence of degradation of the neuromuscular junction. LRP4 antibodies are the third cause identified for the autoimmune disease, which affects about 20 out of 100,000 people, primarily women under 40 and men over age 60, according to the National Institutes of Health and Myasthenia Gravis Foundation of America, Inc.

An antibody to the acetylcholine receptor is causative in about 80 percent of patients, said Dr. Michael H. Rivner, MCG neurologist and Director of the Electrodiagnostic Medicine Laboratory, who follows about 250 patients with myasthenia gravis. Acetylcholine is a chemical released by neurons which act on receptors on the muscle to activate the muscle. More recently, it was found that maybe 10 percent of patients have an antibody to MuSK, an enzyme that supports the clustering of these receptors on the surface of muscle cells.

"That leaves us with only about 10 percent of patients who are double negative, which means patients lack antibodies to acetylcholine receptors and MuSK," said Rivner, a troubling scenario for physicians and patients alike. "This is pretty exciting because it is a new form of the disease," Rivner said of the LRP4 finding.

Currently, physicians like Rivner tell patients who lack antibody evidence that clinically they appear to have the disease. Identifying specific causes enables a more complete diagnosis for more patients in the short term and hopefully will lead to development of more targeted therapies with fewer side effects, Rivner said.
To learn more about the role of the LRP4 antibody, Mei now wants to know if there are defining characteristics of patients who have it, such as more severe disease or whether it's found more commonly in a certain age or sex. He and Rivner have teamed up to develop a network of 17 centers, like GR Medical Center, where patients are treated to get these questions answered. They are currently pursuing federal funding for studies they hope will include examining blood, physical characteristics, therapies and more.
Regardless of the specific cause, disease symptoms tend to respond well to therapy, which typically includes chronic use of drugs that suppress the immune response, Rivner said. However, immunosuppressive drugs carry significant risk, including infection and cancer, he said.
Removal of the thymus, a sort of classroom where T cells, which direct the immune response, learn early in life what to attack and what to ignore, is another common therapy for myasthenia gravis. While the gland usually atrophies in adults, patients with myasthenia gravis tend to have enlarged glands. Rivner is part of an NIH-funded study to determine whether gland removal really benefits patients. Other therapies include a plasma exchange for acutely ill patients.
The Journal of Clinical Investigation study was funded by the NIH and the Muscular Dystrophy Association. Mei is a Georgia Research Alliance Eminent Scholar in Neuroscience.

http://www.eurekalert.org/pub_releases/2013-11/uoe-nrf110713.php

New research finds high tungsten levels double stroke risk

High levels of tungsten in the body could double the risk of suffering a stroke, a new study published in the open access journal PLOS ONE has found

Using data from a large US health survey, the study has shown that high concentrations of tungsten – as measured in urine samples – is strongly linked with an increase in the occurrence of stroke, roughly equal to a doubling of the odds of experiencing the condition. Conducted by a team from the University of Exeter, the study represents the most comprehensive analysis to date of the potential health effects of the metal.
According to figures from the World Health Organisation, stroke is currently the second leading cause of death in the Western world, ranking only second to heart disease. It is also the leading cause of disability in adults, often resulting in loss of motor control, urinary incontinence, depression and memory loss.
The research used data from the US based National Health and Nutrition Examination Survey (NHANES), analysing information for 8614 participants aged between 18 and 74 over a 12 year period.
Higher tungsten levels were found to be strongly associated with an increase in the prevalence of stroke, independent of typical risk factors. Importantly, the findings show that tungsten could be a significant risk factor for stroke in people under the age of 50.
Whilst our current exposure to tungsten is thought to be very low, recent years have seen a significant increase in the demand and supply of the material - which is commonly used in consumer products such as mobile phones and computers, as well as a number of industrial and military products.
During its production, small amounts of the metal can be deposited in the environment, eventually making their way into water systems and onto agricultural land. With largely unknown health consequences, tungsten has been identified as a toxicant of emerging concern.
Lead author of the research, Dr Jessica Tyrrell, of the University of Exeter Medical School's European Centre for Environment and Human Health, said "Whilst currently very low, human exposure to tungsten is set to increase. We're not yet sure why some members of the population have higher levels of the metal in their make-up, and an important step in understanding and preventing the risks it may pose to health will be to get to the bottom of how it's ending up in our bodies."
The tungsten-stroke relationship observed in this research highlights another example of the potentially negative impact new materials can have on health. Recent years have seen an exponential increase in the production of chemicals for commercial exploitation, including the introduction of nanotechnology. In many cases the health effects of these chemicals are largely unknown and there are few controls to prevent their discharge into the environment.
Another of the paper's authors, Dr Nicholas Osborne, added "The relationship we're seeing between tungsten and stroke may only be the tip of the iceberg. As numerous new substances make their way into the environment, we're accumulating a complex 'chemical cocktail' in our bodies. Currently we have incredibly limited information on the health effects of individual chemicals and no research has explored how these compounds might interact together to impact human health."

http://www.eurekalert.org/pub_releases/2013-11/nu-pli111113.php

Putting Lupus in permanent remission

Nontoxic therapy shows encouraging results in blood samples from lupus patients

CHICAGO --- Northwestern Medicine® scientists have successfully tested a nontoxic therapy that suppresses Lupus in blood samples of people with the autoimmune disease.

This is a positive step toward one day developing a vaccine-like therapy that could keep Lupus in remission in the human body without the use of toxic drugs. The study was published online in Clinical Immunology, the journal of the Federation of Clinical Immunology Societies.

Lupus is a chronic, autoimmune disease that causes the body to create autoantibodies that attack and destroy healthy tissue and cause inflammation, pain and damage in various vital organs of the body. According to the Lupus Foundation of America, it is believed that 5 million people throughout the world have a form of lupus.

In past studies, Northwestern scientists showed that a nontoxic therapy (which uses synthetic peptides -- small bits of protein -- to generate special regulatory T cells) blocks lupus in mice that are prone to the disease.

For this new study, 30 lupus patients (10 active and 20 in remission) and 15 healthy patients were enrolled and their blood samples were cultured with low doses of the special peptides.

"We found that the peptides could not only generate regulatory T cells, but also that they block and reduce autoantibody production to almost baseline levels in the blood cultures from people with active Lupus," said Syamal Datta, M.D., senior author of the study. "This approach shows that the peptides have the potential to work like a vaccine in the human body, to boost the regulatory immune system of those with Lupus, fight autoimmune antibodies and keep the disease in remission." Datta is a professor of medicine-rheumatology and microbiology-immunology at Northwestern University Feinberg School of Medicine.

Steroids and Cytoxan are the most common therapies used to help treat people with lupus and even at very low doses the side effects of the drugs are toxic. Much like chemotherapy, lupus drugs can compromise fertility and weaken the immune system, making it difficult for patients to have children and leaving their bodies susceptible to infections. Also, such toxic drugs cannot be given indefinitely.

"This nontoxic therapy works like a vaccine in that the peptides are recognized by the bodies of almost every individual we have seen," Datta said. "It can be given to both subjects with and without lupus and boost their regulatory response with no side effects. We don't have to design something specifically for an unusual person. It works in everybody."

This study relates to Datta's more than 27 years of research in the lupus field focused on the cloning of the T cells that drive lupus autoimmunity. Datta's team identified the peptides used in this study in 1996, and Northwestern University holds the intellectual rights to these patented discoveries but has published the sequences of the peptides for open access to everyone.

"It is our hope that the next step is a phase one clinical trial in humans to show the efficacy of the peptide therapy in patients with lupus," Datta said. "The key is to find an industry partner that has experience in these kind of therapies so that we can move forward."

This study was supported by funding from Alliance for Lupus Research (TIL grant #187305 to S.K.D.) and the National Institutes of Health (National Institute of Allergy and Infectious Diseases grant, R01AI41985 to S.K.D, and National Institute of Arthritis and Musculoskeletal and Skin Diseases, P60 AR30692 to R. R-G). - See more at: http://www.northwestern.edu/newscenter/stories/2013/11/putting-lupus-in-permanent-remission.html#sthash.ankpXJSi.dpuf

http://www.sciencedaily.com/releases/2013/11/131113080129.htm

Needle in a Haystack: New Research Shows How Brain Prepares to Start Searching

Many of us have steeled ourselves for those 'needle in a haystack' tasks of finding our vehicle in an airport car park, or scouring the supermarket shelves for a favorite brand.

A new scientific study has revealed that our understanding of how the human brain prepares to perform visual search tasks of varying difficulty may now need to be revised.

When people search for a specific object, they tend to hold in mind a visual representation of it, based on key attributes like shape, size or color. Scientists call this 'advanced specification'. For example, we might search for a friend at a busy railway station by scanning the platform for someone who is very tall or who is wearing a green coat, or a combination of these characteristics.

Researchers from the School of Psychology at the University of Lincoln, UK, set out to better explain how these abstract visual representations are formed. They used fMRI scanners to record neural activity when volunteers prepared to search for a target object: a colored letter amid a screen of other colored letters.

Their findings, published in the journal 'Brain Research', are the first to fully isolate the different areas of the human brain involved in this 'prepare to search' function. Surprisingly, they show that the advanced frontal

areas of the brain, usually key to advanced cognitive tasks, appear to take a backseat. Instead it is the basic back areas of the brain and the sub-cortical areas that do the work.
Dr Patrick Bourke from the University of Lincoln's School of Psychology, who led the study, said: "Up until now, when researchers have studied visual search tasks they have also found that frontal areas of the brain were active. This has been assumed to indicate a control system: an 'executive' that largely resides in the advanced front of the brain which sends signals to the simpler back of the brain, activating visual memories. Here, when we isolated the 'prepare' part of the task from the actual search and response phase we found that this activation in the front was no longer present."
This finding has important implications for understanding the fundamental brain processes involved. It was previously thought that the Intra-parietal region of the brain, which is linked to visual attention, was the central component of the supposed 'front-back' control network, relaying useful information (such as a shape or color bias) from frontal areas of the brain to the back, where simple visual representations of the object are held. If the frontal areas are not activated in the preparation phase, this cannot be the case.
The study also showed that the pattern of brain activation varied depending on the anticipated difficulty of the search task, even when the target object was the same. This indicates that rather than holding in mind a single representation of an object, a new target is constructed each time, depending on the nature of the task.
Dr Bourke added: "While consistent with previous brain imaging work on visual search, these results change the interpretations and assumptions that have been applied previously. Notably, they highlight a difference between studies of animals' brains and those of humans. Studies with monkeys convincingly show the front-back control system and we thought we understood how this worked. At the same time our findings are consistent with a growing body of brain imaging work in humans that also shows no frontal brain activation when short term memories are held."
The paper 'Functional brain organization of preparatory attentional control in visual search' was published in the journal Brain Research.
Patrick Bourke, Steven Brown, Elton Ngan, Mario Liotti. Functional brain organization of preparatory attentional control in visual search. Brain Research, 2013; 1530: 32 DOI: 10.1016/j.brainres.2013.07.032

http://www.medscape.com/viewarticle/814204?src=rss

Green Tea for Cancer Prevention: A Mixed Bag

Can something as simple as drinking green tea prevent cancer?

Roxanne Nelson

A large and growing body of evidence - both preclinical and human trials - suggests that there is a protective effect across different types of cancer. However, the data are not definitive. The preventive effects of tea for a number of cancer types have been demonstrated in laboratory models, including cancers of the gastrointestinal tract, lung, prostate, breast, and skin. The proposed mechanisms of action include antioxidant effects, inhibition of growth-factor signaling, and enhancement of chemotherapy agents.
Much of the research to date, both experimental and clinical, and suggestions for future studies are outlined in 2 reviews published online October 30 in the American Journal of Clinical Nutrition.
Tea contains a large number of bioactive compounds, including catechins, flavonols, lignans, and phenolic acids, notes Jian-Min Yuan, MD, PhD, from the division of epidemiology and community health at the University of Minnesota in Minneapolis. In his review, he asserts that recent epidemiologic studies "neither confirm nor refute a definitive cancer-preventive role of green tea intake."
The large number of experimental studies conducted have consistently shown the inhibitory activities of green tea extract and/or green tea polyphenols against tumorigenesis at various organ sites, Dr. Yuan notes. However, results from epidemiologic studies have been inconsistent.

Inconsistent Results

For example, Dr. Yuan recently reviewed epidemiologic studies looking at the association between esophageal cancer and green tea consumption in Asian populations, which have a high incidence of esophageal cancer and a high consumption of green tea (Mol Nutr Food Res. 2011;55:886-904). Of the 15 such studies, 6 reported a significantly reduced risk for esophageal cancer associated with high amounts of tea consumption, 4 reported a lower but nonsignificant risk, 3 reported a significantly positive association between tea consumption and esophageal cancer risk, and 2 reported no association. Other reviews have reported similar inconsistencies for different cancer types, including colon, liver, breast, and prostate.
In the future, "we should conduct phase 2 intervention studies to understand the biologic mechanism of green tea polyphenols or other constituents in humans, given that current knowledge on tea and cancer protection is primarily derived from in vitro and in vivo animal experiments," Dr. Yuan told Medscape Medical News.

It would not be difficult to design and conduct phase 2 studies to learn the biologic mechanisms related to some of the known cancer-risk pathways in humans, Dr. Yuan contends. "The limiting factor is funding," he noted. "Of course, the final word on the effect of tea polyphenols on cancer prevention should come from phase 3 randomized large intervention trials that evaluate cancer incidence and mortality as study outcomes. Such trials would require a large number of subjects (more than 50,000), a long study period (at least 5 years), and a large number of institutions and investigators."

Dr. Yuan points out that a number of uncontrolled variables could account for inconsistent results from epidemiologic studies. Human exposure to tea polyphenols is relatively low - in the range of 1 to 2 orders lower than those generally used in in vitro and in vivo experimental studies. There is also the "residual confounding effect of cigarette smoking and alcohol consumption," along with the "adverse effect of the high temperature of tea beverages, which could mask or complicate the tea–cancer risk association."

The heterogeneity of the amount of tea consumed and the eating habits of different populations can also contribute to the inconsistencies seen in the results. These confounders help emphasize the need for randomized intervention studies that can ultimately provide "definitive data to determine the beneficial or deleterious effects of green tea consumption on cancer development in humans," Dr. Yuan writes.

Promising in Early-Stage Disease Only

In his review, Joshua D. Lambert, PhD, associate professor of food science at Pennsylvania State University in University Park, looked at human and experimental studies. He notes that green tea and green tea catechin have been shown to inhibit tumorigenesis and that, although it has not been as well studied as green tea, black tea has also shown cancer preventive effects. The polyphenolic constituents in tea, along with the caffeine content, have been implicated as potential cancer-preventive compounds.

In his comprehensive review of available data from both experimental studies and human clinical trials, he notes that the number of human studies that have directly examined the effects of green tea on cancer progression is limited.

Dr. Lambert cites an example of the effect of green tea on high-grade prostatic intraepithelial neoplasia. After a year of daily supplementation with green tea catechins 600 mg or placebo, fewer men in the tea group than in the placebo group progressed to prostate cancer (9% vs 30%) (Cancer Res. 2006;66:1234-1240).

Similar results were observed in a study that looked at the association between green tea consumption and oral premalignant lesions and the recurrence of metachronous colorectal adenomas in polypectomy patients (Cancer Epidemiol Biomarkers Prev. 2008;17:3020-3025).

In addition, a number of studies that have examined the effects of green tea on carcinogenesis-relevant biomarkers in humans have shown positive effects.

"As might be expected, studies that have examined early-stage disease have been promising, whereas those that have dealt with late-stage disease have largely yielded negative results," writes Dr. Lambert. "These data indicate that tea and tea compounds likely lack sufficient potency to serve as first-line chemotherapeutic compounds but do have a role to play in both primary prevention and prevention of cancer recurrence."

Research is needed to develop additional preventive combinations involving tea and pharmaceutical or dietary components. There is also a "dearth of information regarding the biological activity of the metabolites of the tea polyphenols," he notes. Dr. Lambert adds that even though the number of human intervention studies is increasing, the available data remain scant and are relatively limited in scope.

Tea or Supplements?

Although some studies used supplements and others involved tea consumption, Dr. Yuan recommends drinking tea to get a potential health benefit.

"The best approach is to drink a sufficient amount of tea on daily basis that hopefully provides a potential health benefit," he said. "Dietary supplementation with a concentrated form of tea polyphenols to receive a cancer-protection effect is premature and not supported by research evidence, particularly in humans."

In addition, he pointed out that it is not known which specific tea polyphenols provide the protective effect, or how much is actually needed. "Tea polyphenols at very high doses have side effects," he noted.

For now, drinking tea is safe and inexpensive, and many enjoy the taste. "For people at high risk for oral cancer, for example, tea supplementation seems to slow the progression of oral precancer lesions," Dr. Yuan said. "However, it is premature to say that drinking green tea can help normal healthy individuals stay cancer-free, since the cancer preventive effect of green tea and its constituents have yet to be confirmed."

Dr. Yuan's review was partially supported by a grant from the National Institutes of Health. He reports receiving honorarium and travel support from the Tea Council of the USA. Dr. Lambert's review was supported in part by the American Institute for Cancer Research. He has disclosed no relevant financial relationships.

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Evidence of 3.5 billion-year-old bacterial ecosystems found in Australia

Well-preserved remnants of a complex ecosystem in a nearly 3.5 billion-year-old sedimentary rock sequence in Australia

Washington, D.C. - Reconstructing the rise of life during the period of Earth's history when it first evolved is challenging. Earth's oldest sedimentary rocks are not only rare, but also almost always altered by hydrothermal and tectonic activity. A new study from a team including Carnegie's Nora Noffke, a visiting investigator, and Robert Hazen revealed the well-preserved remnants of a complex ecosystem in a nearly 3.5 billion-year-old sedimentary rock sequence in Australia. Their work is published in Astrobiology.

A rock surface is displaying "polygonal oscillation cracks" in the 3.48 billion years old Dresser Formation, Pilbara region, Western Australia. Such and similar sedimentary structures are of biological origin. They document ancient microorganisms that formed carpet-like microbial mats on the former sediment surface. The Dresser Formation records an ancient playa-like setting -- similar environments are occurring on Mars as well. The MISS constitute a novel approach to detect and to understand Earth's earliest life. **Nora Noffke**

The Pilbara district of Western Australia constitutes one of the famous geological regions that allow insight into the early evolution of life. Mound-like deposits created by ancient photosynthetic bacteria, called stromatolites, and microfossils of bacteria have been described by scientists in detail. However, a phenomenon called microbially induced sedimentary structures, or MISS, had not previously been seen in this region. These structures are formed from mats of microbial material, much like mats seen today on stagnant waters or in coastal flats.

The team included Noffke, Hazen, Daniel Christian of Old Dominion University, and David Wacey of the University of Western Australia. They described various MISS preserved in the region's Dresser Formation. Advanced chemical analyses point toward a biological origin of the material.

The Dresser MISS fossils resemble strongly in form and preservation the MISS from several other younger rock samples, such as a 2.9 billion-year-old ecosystem Noffke and her colleagues found in South Africa.

"This work extends the geological record of MISS by almost 300 million years," said Noffke, who is also a professor at ODU. "Complex mat-forming microbial communities likely existed almost 3.5 billion years ago."

The team proposes that the sedimentary structures arose from the interactions of bacterial films with shoreline sediments from the region.

"The structures give a very clear signal on what the ancient conditions were, and what the bacteria composing the biofilms were able to do," Noffke said.

MISS are among the targets of Mars rovers, which search for similar formations on that planet's surface. Thus, the team's findings could have relevance for studies of our larger Solar System as well.

This work was supported by the NSF Paleobiology and Sedimentary Geology program, NASA Astrobiology Institute, NASA Exobiology and Evolutionary Biology Programs, and the Deep Carbon Observatory and the Carnegie Institution for Science.

http://www.eurekalert.org/pub_releases/2013-11/gumc-cte110113.php

Can the eyes help diagnose Alzheimer's disease?

An international team of researchers studying the link between vision loss and Alzheimer's disease report that the loss of a particular layer of retinal cells not previously investigated may reveal the disease's presence and provide a new way to track disease progression.

SAN DIEGO - The researchers, from Georgetown University Medical Center (GUMC) and the University of Hong Kong, examined retinas from the eyes of mice genetically engineered to develop Alzheimer's disease (AD). They presented their findings today at Neuroscience 2013, the annual meeting of the Society for Neuroscience.

"The retina is an extension of the brain so it makes sense to see if the same pathologic processes found in an Alzheimer's brain are also found in the eye," explains R. Scott Turner, MD, PhD, director of the Memory Disorders Program at GUMC and the only U.S. author on the study. "We know there's an association between glaucoma and Alzheimer's in that both are characterized by loss of neurons, but the mechanisms are not clear."

Turner says many researchers increasingly view glaucoma as a neurodegenerative disorder similar to AD. Most of the research to date examining the relationship between glaucoma and Alzheimer's focused on the retinal ganglion cell layer, which transmits visual information via the optic nerve into the brain. Before that transmission happens, though, the retinal ganglion cells receive information from another layer in the retina called the inner nuclear layer.

In their study, the researchers looked at the thickness of the retina, including the inner nuclear layer (not previously study in this setting) and the retinal ganglion cell layer. They found a significant loss of thickness in both. The inner nuclear layer had a 37 percent loss of neurons and the retinal ganglion cell layer a 49 percent loss, compared with healthy, age-matched control mice.

In humans, the structure and thickness of the retina can be readily measured using optical coherence tomography. Turner says this new tool is increasing finding applications in research and clinical care.

"This study suggests another path forward in understanding the disease process and could lead to new ways to diagnose or predict Alzheimer's that could be as simple as looking into the eyes," Turner says. "Parallel disease mechanisms suggest that new treatments developed for Alzheimer's may also be useful for glaucoma."

Support for this research comes from the Hong Kong University Alzheimer's Disease Research Network and from Ms. Kit Wan Chow.

The lead author of the research is R. C. Chang from the University of Hong Kong. Other authors include K. Chiu, C. K. M. Lok, Y. Matsuoka and K. F. So, all of the University of Hong Kong. The authors report having no personal financial interests related to the study.

http://www.eurekalert.org/pub_releases/2013-11/k-mcc111113.php

Moderate coffee consumption may reduce risk of type 2 diabetes by 25 percent

The Institute for Scientific Information on Coffee highlights the latest research on coffee consumption in the prevention of type 2 diabetes

Regular, moderate coffee consumption may decrease an individual's risk of developing type 2 diabetes, according to research highlighted in a report published by the Institute for Scientific Information on Coffee (ISIC).

More than 370 million people worldwide have diabetes making it one of the most significant health problems(1). To mark World Diabetes Day, ISIC has published an updated report outlining the latest research on coffee and type 2 diabetes.

Key research findings include:

Epidemiological evidence shows that drinking three to four cups of coffee per day is associated with an approximate 25% lower risk of developing type 2 diabetes, compared to consuming none or less than two cups per day(2,3)

Research has also suggested an inverse dose response, with each additional cup of coffee reducing the relative risk of developing type 2 diabetes by 7-8 per cent(2,3).

Caffeine is unlikely to be responsible for the protective effects of coffee, as one study(4) suggested that both caffeinated and decaffeinated coffee are associated with a lower risk of type 2 diabetes

Recent work(5) showed an advantage of filtered coffee over boiled, decaffeinated coffee over caffeinated coffee and a stronger inverse correlation in those under 60 years age group

Another study(6) shows that regular but not decaffeinated coffee was much more protective against type 2 diabetes in women of all ethnic groups than in men

The report also puts forward some of the key mechanistic theories that underlie the possible relationship between coffee consumption and the reduced risk of diabetes. These includes the 'Energy Expenditure Hypothesis', which suggests that the caffeine in coffee stimulates metabolism and increases energy expenditure and the 'Carbohydrate Metabolic Hypothesis', whereby it is thought that coffee components play a key role by influencing the glucose balance within the body.

There is also a subset of theories that suggest coffee contains components that may improve insulin sensitivity though mechanisms such as modulating inflammatory pathways, mediating the oxidative stress of cells, hormonal effects or by reducing iron stores.

The updated report is based on a report from the World Congress on Prevention of Diabetes, held in 2012 and is updated with the latest research from this field published over the past year. Please contact us for the full summary.

Further information on coffee and diabetes can be found on the Coffee and Health website: http://www.coffeeandhealth.org

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Monkeys 'understand' rules underlying language musicality

Many of us have mixed feelings when remembering painful lessons in German or Latin grammar in school.

Languages feature a large number of complex rules and patterns: using them correctly makes the difference between something which "sounds good", and something which does not. However, cognitive biologists at the University of Vienna have shown that sensitivity to very simple structural and melodic patterns does not require much learning, or even being human: South American squirrel monkeys can do it, too.

Language and music are structured systems, featuring particular relationships between syllables, words and musical notes. For instance, implicit knowledge of the musical and grammatical patterns of our language makes us notice right away whether a speaker is native or not. Similarly, the perceived musicality of some languages results from dependency relations between vowels within a word. In Turkish, for example, the last syllable in words like "kaplanlar" or "güller" must "harmonize" with the previous vowels. (Try it yourself: "güllar" requires more movement and does not sound as good as "güller".)

Similar "dependencies" between words, syllables or musical notes can be found in languages and musical cultures around the world. The biological question is whether the ability to process dependencies evolved in human cognition along with human language, or is rather a more general skill, also present in other animal species who lack language.

Andrea Ravignani, a PhD candidate at the Department of Cognitive Biology at the University of Vienna, and his colleagues looked for this "dependency detection" ability in squirrel monkeys, small arboreal primates living in Central and South America. Inspired by the monkeys' natural calls and hearing predispositions, the researchers designed a sort of "musical system" for monkeys. These "musical patterns" had overall acoustic features similar to monkeys' calls, while their structural features mimicked syntactic or phonological patterns like those found in Turkish and many human languages.

Monkeys were first presented with "phrases" containing structural dependencies, and later tested using stimuli either with or without dependencies. Their reactions were measured using the "violation of expectations" paradigm. "Show up at work in your pyjamas, people will turn around and stare at you, while at a slumber party nobody will notice", explains Ravignani: In other words, one looks longer at something that breaks the "standard" pattern. "This is not about absolute perception, rather how something is categorized and contrasted within a broader system." Using this paradigm, the scientists found that monkeys reacted more to the "ungrammatical" patterns, demonstrating perception of dependencies. "This kind of experiment is usually done by presenting monkeys with human speech: Designing species-specific, music-like stimuli may have helped the squirrel monkeys' perception", argues primatologist and co-author Ruth Sonnweber.

"Our ancestors may have already acquired this simple dependency-detection ability some 30 million years ago, and modern humans would thus share it with many other living primates. Mastering basic phonological patterns and syntactic rules is not an issue for squirrel monkeys: the bar for human uniqueness has to be raised", says Ravignani: "This is only a tiny step: we will keep working hard to unveil the evolutionary origins and potential connections between language and music".

The research was funded by an ERC Advanced Grant, SOMACCA, to Prof. Tecumseh Fitch, which is exploring the broad biological basis for music, language, and visual art.

Publication in "Biology Letters": Ravignani A, Sonnweber R-S, Stobbe N, Fitch WT. 2013 Action at a distance: dependency sensitivity in a New World primate. Biol Lett 20130852. http://dx.doi.org/10.1098/rsbl.2013.0852

http://www.eurekalert.org/pub_releases/2013-11/wsu-add111313.php

Accidental discovery dramatically improves electrical conductivity

Crystal could improve performance of electronic devices

PULLMAN, Wash. - Quite by accident, Washington State University researchers have achieved a 400-fold increase in the electrical conductivity of a crystal simply by exposing it to light. The effect, which lasted for days after the light was turned off, could dramatically improve the performance of devices like computer chips.

WSU doctoral student Marianne Tarun chanced upon the discovery when she noticed that the conductivity of some strontium titanate shot up after it was left out one day. At first, she and her fellow researchers thought the sample was contaminated, but a series of experiments showed the effect was from light.

"It came by accident," said Tarun. "It's not something we expected. That makes it very exciting to share."

The phenomenon they witnessed - "persistent photoconductivity" - is a far cry from superconductivity, the complete lack of electrical resistance pursued by other physicists, usually using temperatures near absolute zero. But the fact that they've achieved this at room temperature makes the phenomenon more immediately practical.

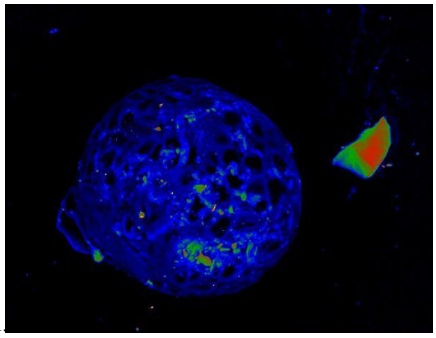
And while other researchers have created persistent photoconductivity in other materials, this is the most dramatic display of the phenomenon.
The research, which was funded by the National Science Foundation, appears this month in the journal Physical Review Letters.
"The discovery of this effect at room temperature opens up new possibilities for practical devices," said Matthew McCluskey, co-author of the paper and chair of WSU's physics department. "In standard computer memory, information is stored on the surface of a computer chip or hard drive. A device using persistent photoconductivity, however, could store information throughout the entire volume of a crystal." This approach, called holographic memory, "could lead to huge increases in information capacity," McCluskey said.
Strontium titanate and other oxides, which contain oxygen and two or more other elements, often display a dizzying variety of electronic phenomena, from the high resistance used for insulation to superconductivity's lack of resistance. "These diverse properties provide a fascinating playground for scientists but applications so far have been limited," said McCluskey.
McCluskey, Tarun and physicist Farida Selim, now at Bowling Green State University, exposed a sample of strontium titanate to light for 10 minutes. Its improved conductivity lasted for days. They theorize that the light frees electrons in the material, letting it carry more current.

http://bit.ly/18f8wR0

Meteor impact trapped ancient swamp plants in glass

Remnants of an ancient swamp have been found preserved inside glass created during a meteorite strike.

19:28 11 November 2013 by Lisa Grossman



This image of a carbon-bearing inclusion from Darwin glass was produced using X-ray absorption. Dark spots indicate the honeycomb-like pockets thought to have formed when water in plant material boiled off **Image: Kieren Torres Howard**

The discovery marks the first time that traces of life have been found to survive the heat and pressure of an impact, adding weight to arguments that microbes travelling on space rocks could have seeded the solar system.
Astrobiologists have long suggested that simple life forms could have hitched a ride to Earth inside meteors, or that impacts on early Earth could have sent terrestrial microbes to other worlds on ejected pieces of our planet. We know that rocks kicked up by impacts can travel vast distances. Martian meteorites with soil trapped inside have landed on Earth, and theoretical calculations suggest that meteor strikes on Earth could have had enough energy to send rocks as far away as the moons of Jupiter and Saturn
But this concept, called panspermia, also assumes that the organic compounds essential to life as we know it can survive the extreme pressures and temperatures of a crash-landing. Now, evidence has been found around Darwin crater in Tasmania, which was formed by an impact about 800,000 years ago.

Swamp life

Glass created when rock melted during the impact is strewn in a 400-square-kilometre field around the crater. Kieren Torres Howard was conducting doctoral research at the University of Tasmania in Hobart, Australia, studying the distribution and composition of the impact glass. Taking a closer look with an X-ray diffraction machine, he found that the glass is unexpectedly shot through with tiny spherical inclusions. The glass is also riddled with geometrically regular pockets, like a honeycomb.
Howard and colleagues ground up the glass and sorted through the fragments with an acupuncture needle to pick out the inclusions, the largest of which was about 200 micrometres across. Chemical analysis showed that the inclusions were rich in organic material similar to that in a peat swamp, including cellulose and polymers that might derive from leaf cuticles.
"They looked really pristine," says Howard, who is now at the City University of New York in Brooklyn. "It's not just that you see a signature of organic materials, it's almost as if you took the signature of a swamp today."
Previous evidence found at the crater site, including a species of burrowing crayfish that has probably lived in the area for the past million years, had suggested that the region was a swamp or rainforest when Darwin crater was formed.
"That's what allowed us to really believe we'd found some organics. We knew this was a swamp impact," says Howard. The team think that a meteor smacked into the ground and melted some of the upper rock to form the impact glass. Bits of plant matter found its way into the molten glass as everything was hurled away by the impact. The water and other volatile compounds in the plants immediately boiled, making a bubbling froth that froze inside the glass as it cooled, creating the honeycomb of pockets.

Funky implications

"I think it is well argued, and they made a very interesting discovery," says Christian Koeberl of the Natural History Museum in Vienna, Austria, who was not involved in the new work. "It is the first time to my knowledge that organic material has been found preserved in such a way within impact glass."

So could pieces of an ancient swamp on Earth have gone flying off into space? It's plausible, the team says, and organics trapped inside glass would be somewhat protected from cosmic radiation on an interplanetary journey.

"That's when the implications get much more funky," says Howard. "There's not much challenge in dispersing this stuff. Some material might end up on the moon, some might end up on Mars. The material would be ejected into space in a well-preserved state."

NASA's Curiosity rover may have already found Martian impact glass at its home in the Red Planet's Gale crater, according to a presentation at the Geological Society of America meeting in Colorado last month. Curiosity doesn't have the dexterity to pick up these shards and run analyses on them, says John Mustard of Brown University in Providence, Rhode Island. But such glasses could be good targets for future sample-return missions aiming to bring Mars rocks back to Earth. Scientists here could then run tests to see if terrestrial material has landed on Mars, or if the glass contains preserved traces of long-lost Martian vegetation.

"Could it have been the mechanism by which panspermia happened? Sure," says Mustard. "It allows the packaging and interplanetary transfer of organic material."

Journal reference: Nature Geosciences, DOI: 10.1038/ngeo1996

http://www.livescience.com/41194-new-bird-flu-h6n1.html

New 'H6N1' Bird Flu Reported in Taiwan

A 20-year-old woman in Taiwan is the first person known to be infected with a strain of bird flu called H6N1, according to a new report of the case.

Rachael Rettner, Senior Writer | November 13, 2013 06:30pm ET

In May, the woman was hospitalized after she developed a high fever, cough and shortness of breath. Tests for common respiratory infections came up negative, but more detailed tests revealed she had H6N1, a flu virus that's common in birds, but has never before been seen in people. The woman was treated with the anti-viral medication oseltamivir (Tamiflu), and made a full recovery. [10 Deadly Diseases That Hopped Across Species]

So far, there's no evidence that H6N1 can spread between people. Of the 125 cases of flu reported in Taiwan since the woman became ill, none were caused by H6N1. The researchers also tracked down 36 people who came into contact with the woman, six of whom became sick around the time she did, but there was no indication they had H6N1.

It's not clear how the woman became infected with the virus. She worked in a deli, and did not have close contact with chickens or wild birds.

H6N1 is the latest bird flu virus to hop over to humans. Earlier this year, the first human infections with the H7N9 bird flu virus were reported in people in China. The H7N9 virus has since sickened 139 people, including 45 who died, according to the World Health Organization.

The new finding "shows the unpredictability of influenza viruses in human populations," the researchers, from the Taiwan Centers for Disease Control, wrote in the Nov. 14 issue of the journal The Lancet Respiratory Medicine.

Further studies are needed to better understand the potential threat posed by H6N1, including research that investigates how the virus passes from animals to people, the researchers said. The findings also highlight the need for continued surveillance for new flu viruses, the researchers said.

An analysis of H6N1 genes showed that the strain found in the woman is similar to those seen in chickens. However, through a genetic mutation, the virus appears to have evolved the ability to bind to human cells in the upper respiratory tract. Further genetic changes in the virus could increase its ability to pass from chickens to people, or from person to person, the researchers said.

Given how common H6N1 is in birds, and that several other types of bird flu viruses are known to cross over to people, it could have been anticipated that an H6 flu virus would eventually appear in people, said Dr. Richard Webby, a bird flu expert at St. Jude Children's Research Hospital in Memphis, Tenn., who was not involved in the new study.

The big question is whether the genetic mutation in H6N1 means that it will now infect more people (causing an outbreak), or if the current report is just a sporadic case, Webby said.

"All of these viruses are, of course, a concern," Webby said. The new finding means that health officials will view H6N1 as slightly more risky, in terms of its pandemic potential, than they did in the past, Webby said.

The woman's case was reported by Taiwanese officials in June, but the new study is the first detailed report of the case.

http://www.sciencedaily.com/releases/2013/11/131113144109.htm

New Treatment Discovered to Cure MRSA Infection

Recent work from University Distinguished Professor of Biology Kim Lewis promises to overcome one of the leading public health threats of our time.

In a groundbreaking study published today in the journal Nature, Lewis' team presents a novel approach to treat and eliminate methicillin resistant staphylococcus aureus, or MRSA, a potent bacterium whose resistance to antibiotics has kept it one step ahead of researchers. That is, until now.

The so-called "superbug" infects 1 million Americans each year. A major problem with MRSA is the development of deep-seated chronic infections such as osteomyelitis (bone infection), endocarditis (heart infection), or infections of implanted medical devices. Once established, these infections are often incurable, even when appropriate antibiotics are used.

Bacteria such as MRSA have evolved to actively resist certain antibiotics, a fact that has generated significant interest among the scientific and medical communities. But Lewis, Director of Northeastern's Antimicrobial Discovery Center, suspected that a different adaptive function of bacteria might be the true culprit in making these infections so devastating.

The new work represents the culmination of more than a decade of research on a specialized class of cells produced by all pathogens called persisters. According to Lewis, these cells evolved to survive. "Survival is their only function," he said. "They don't do anything else."

Lewis and his research team posited that if they could kill these expert survivors, perhaps they could cure chronic infections -- even those resistant to multiple antibiotics such as MRSA. Furthermore, said Brian Conlon, a postdoctoral researcher in Lewis' lab and first author on the paper, "if you can eradicate the persisters, there's less of a chance that resistance will develop at all."

Lewis, who was elected to the American Academy of Microbiology in 2011 for his scholarship in the field, has found that persisters achieve their singular goal by entering a dormant state that makes them impervious to traditional antibiotics. Since these drugs work by targeting active cellular functions, they are useless against dormant persisters, which aren't active at all. For this reason, persisters are critical to the success of chronic infections and biofilms, because as soon as a treatment runs its course, their reawakening allows for the infection to establish itself anew.

In the recent study, which also includes contributions from assistant professor Steve Leonard of the Department of Pharmacy Practice, Lewis' team found that a drug called ADEP effectively wakes up the dormant cells and then initiates a self-destruct mechanism. The approach completely eradicated MRSA cells in a variety of laboratory experiments and, importantly, in a mouse model of chronic MRSA infection.

Coupling ADEP with a traditional antibiotic, Conlon noted, allowed the team to completely destroy the bacterial population without leaving any survivors.

As with all other antibiotics, actively growing bacterial cells will likely develop resistance to ADEP. However, Lewis said, "cells that develop ADEP resistance become rather wimpy." That is, other traditional drugs such as rifampicin or linezolid work well against ADEP-resistant cells, providing a unique cocktail that not only kills persisters but also eliminates ADEP-resistant mutant bacteria.

Dr. Richard Novick of New York University's Langone Medical Center and a leader in the field said the research is a "brilliant outgrowth of Kim Lewis' pioneering work on bacterial persisters and represents a highly creative initiative in this era of diminishing antibiotic utility."

While ADEP targets MRSA, Lewis' team believes similar compounds will be useful for treating other infections as well as any other disease model that can only be overcome by eliminating a population of rogue cells, including cancerous tumors. They are pursuing several already.

B. P. Conlon, E. S. Nakayasu, L. E. Fleck, M. D. Lafleur, V. M. Isabella, K. Coleman, S. N. Leonard, R. D. Smith, J. N. Adkins & K. Lewis. Activated ClpP kills persisters and eradicates a chronic biofilm infection. Nature, November 2013

http://bit.ly/19vMXaY

World's oldest string found at French Neanderthal site

CALL it prehistoric string theory. The earliest evidence of string has been found – apparently created by our Neanderthal cousins.

Editorial: "Why string is one of the greatest inventions"

13 November 2013 by Colin Barras

Perishable materials usually rot away, so the oldest string on record only dates back 30,000 years. But perforations in small stone and tooth artefacts from Neanderthal sites in France suggest the pieces were threaded on string and worn as pendants. "The wear patterns provide circumstantial evidence of early use of

string, but the evidence is not definitive," says Bruce Hardy at Kenyon College in Gambier, Ohio. Similar circumstantial evidence has been found in perforated shells.
Now, Hardy and his colleagues have found slender, 0.7-millimetre-long plant fibres that are twisted together near some stone artefacts at a site in south-east France that was occupied by Neanderthals 90,000 years ago. Such fibres are not twisted together in nature, says the team, suggesting that the Neanderthals were responsible (Quaternary Science Reviews, doi.org/pzx).
"If they are indeed remnants of string or cordage, then they would be the earliest direct evidence of string," says Hardy. "Albeit very fragmentary evidence."
At 90,000 years old, the material purported to be string predates the arrival of Homo sapiens in Europe. That means the Neanderthals occupying the French site learned to make it themselves, rather than imitating modern humans, says Hardy. In fact, a growing body of evidence suggests our extinct cousins developed a number of sophisticated behaviours – and perhaps even taught some skills to our species when the two met.
Last year, stone tools created by Neanderthals were found on Mediterranean islands, hinting that the species may have made and used boats to cross the sea – although no direct evidence of boats has been found. Hardy points out that sturdy ropes would have been necessary to build and use rafts and boats. "The ability of Neanderthals to manufacture string and cordage certainly does make the idea of Neanderthal seafaring more plausible," he says.

Why string is one of the greatest inventions

FIRE. The wheel. String.

The invention of string might not leap to mind when you think of humanity's greatest early feats ("World's oldest string found at French Neanderthal site"). Tying our shoelaces is as close to it as many of us get.

But consider how your distant ancestors would have joined an axe head to a haft or turned beads into a necklace without it. Then there are its mechanical uses – from bowstrings to traps and pulley cables. And of course, the intertwining of fibres is the basis of weaving, and textiles, without which we'd all be a lot colder.

The likes of adhesives, nails and moulded plastic might be tying up many of string's everyday uses, but textiles are going from strength to strength. Luxury car components, for example, are now being woven from carbon fibre. So we are a long way off running out of uses for string. Just don't ask how long.

http://www.sciencedaily.com/releases/2013/11/131113162535.htm

Deletion of Any Single Gene Provokes Mutations Elsewhere in the Genome

Deletion of Gene B causes instability in the genome that is compensated for through a secondary mutation in Gene A.

Johns Hopkins researchers report that the deletion of any single gene in yeast cells puts pressure on the organism's genome to compensate, leading to a mutation in another gene.
Their discovery, which is likely applicable to human genetics because of the way DNA is conserved across species, could have significant consequences for the way genetic analysis is done in cancer and other areas of research, they say.
Summarized in a report to be published on Nov. 21 in the journal Molecular Cell, the team's results add new evidence that genomes, the sum total of species' genes, are like supremely intricate machines, in that the removal of a single, tiny part stresses the whole mechanism and might cause another part to warp elsewhere to fill in for the missing part.
"The deletion of any given gene usually results in one, or sometimes two, specific genes being 'warped' in response," says J. Marie Hardwick, Ph.D., the David Bodian Professor of Molecular Microbiology and Immunology at the Johns Hopkins Bloomberg School of Public Health and a professor of pharmacology and molecular sciences at the school of medicine. "Pairing the originally deleted gene with the gene that was secondarily mutated gave us a list of gene interactions that were largely unknown before."
Hardwick says the findings call researchers to greater scrutiny in their genetic analyses because they could unwittingly attribute a phenomenon to a gene they mutated, when it is actually due to a secondary mutation.
"This work has the potential to transform the field of cancer genetics," Hardwick says. "We had been thinking of cancer as progressing from an initial mutation in a tumor-suppressor gene, followed by additional mutations that help the cancer thrive. Our work provides hard evidence that a single one of those 'additional mutations' might come first and actively provoke the mutations seen in tumor-suppressor genes. We hope that our findings in yeast will help to identify these 'first' mutations in tumors."
The beauty of working with yeast, Hardwick says, is that it is easy to delete, or "knock out," any given gene. Her team started with a readily available collection of thousands of different yeast strains, each with a different gene knockout.

At their preferred temperature, each of these strains of yeast grows robustly even though they each have a different gene missing. Hardwick's team first asked a fundamental question: Within a given strain of yeast, does each cell have the same genetic sequence as the other cells, as had generally been presumed?
"We know, for example, that within a given tumor, different cells have different mutations or versions of a gene," explains Hardwick. "So it seemed plausible that other cell populations would exhibit a similar genetic diversity."
To test this idea, her team randomly chose 250 single-knockout strains from the thousands of strains in the collection. For each strain, they generated six sub-strains, each derived from a single yeast cell from the "parental batch."
They then put each sub-strain through a "stress test" designed to detect sub-strains with behaviors that varied from the behavior of the parental batch. All of the sub-strains grew indistinguishably without stress, but when the temperature was gradually raised for only a few minutes, some sub-strains died because they could not handle the stress. When the Hardwick team examined their genes, they found that, in addition to the originally knocked-out gene, each of the sub-strains that faltered also had a mutation in another gene, leading the team to conclude that the cells in each strain of the single-gene knockouts do not all share the same genetic sequence.
They then tested all 5,000 of the original single-gene knockout strains to find sub-strains that could overgrow when given low-nutrient food -- a trait that tumor cells often possess. This was another stress test designed to detect differences between the individual cells taken from the parental batches. They identified 749 such knockout strains and showed that their growth differences were often due to secondary mutations.
In total, the team's evidence indicates that 77 percent of all the knockout strains have acquired one or two additional mutations that affect cell survival and/or excessive growth when food is scarce.
Hardwick believes that stressing yeast in other ways may lead to an even higher percentage of double-mutant strains. In fact, she said she believes that "essentially any gene, when mutated, has the power to alter other genes in the genome." Deleting the first gene seems to cause a biological imbalance that is sufficient to provoke additional adaptive genetic changes, she explains.
Furthermore, in all of the strains that they examined, they found that the secondary mutations that appeared after a given knockout were always in the same one or two genes as in their earlier observations. Unexpectedly, Hardwick said, the altered growth of the sub-strains was usually due to the secondary mutations, not the original knockout, and many of those secondary mutations were in genes that are known to be cancer-causing in humans.

Xinchen Teng, Margaret Dayhoff-Brannigan, Wen-Chih Cheng, Catherine E. Gilbert, Cierra N. Sing, Nicola L. Diny, Sarah J. Wheelan, Maitreya J. Dunham, Jef D. Boeke, Fernando J. Pineda, J. Marie Hardwick. Genome-wide Consequences of Deleting Any Single Gene. Molecular Cell, 2013; DOI: 10.1016/j.molcel.2013.09.026

http://phys.org/news/2013-11-meteorite-impact-reveals-mineral-deposit.html

Meteorite impact structure reveals mineral deposit hotspots

The world's largest and oldest meteorite impact structure has been discovered through research on the formation of gold deposits in WA's Eastern Goldfields.

Located in the eastern Yilgarn, the Watchorn Impact Structure (WIS) is 560km in diameter at its widest point and estimated to be more than 2.6 billion years old. Geologist Bob Watchorn says he has been analysing the structure using gravity and seismic databases since 1999 but has only recently discovered the prima facie evidence necessary to confirm its impact origin.

"I pinpointed where the rings should cut the roads ... [and] you can see lines of hills heading perpendicular to the trend of hills in the eastern Yilgarn which is usually north-south," he says. "On the northern rings especially you can see large in situ shatter cones and striated rocks and various other prima facie evidence of a big impact.

The location of gold and nickel deposits on the WIS rings indicate its significance to the makeup of the Eastern Goldfields. **Credit: Allan Rostron**

"It was satisfying to find the prima facie evidence on the interpreted Landsat rings when I have had so many eminent geologists and geophysicists say that they couldn't see any circular features."
He says the link between mineral deposits and the rings of the WIS could impact mineral exploration in WA.
"I plotted all the gold and nickel mines [in the Eastern Goldfields] onto the Western Mining database," he says.

"All of the big gold mines - I mean every single mine that was over one million ounces fell on the rings. "If you're going to go looking for deposits you should be looking in an entirely different location than what you would have before."
He says careful analysis of the Yilgarn regional gravity data using small incremental changes to the sun angle dip and azimuth facilitated the discovery of the structure. "I got the geophysicists to treat the databases in a very different way than what they normally treated it," he says. "I could see many concentric circular structures... at different levels of the lithosphere and then check them against seismic traverses that had been done.
"Eventually I was able to correlate different depth plans of the gravity data with the seismic data and noticed concentric bowl and dome shaped structures which correlated to the impact structures."
He says the location of gold and nickel deposits on the rings are indicative of its significance to the makeup of the Eastern Goldfields. "I know the gold deposits are 2.6 to 2.64 billion years old and they've actually formed on the rings," he says. "However the nickel formed 2.67 to 2.72 billion years ago and as most of the big nickel mines are on the rings there are still unanswered questions. "It's a paradigm-shifting discovery."

Notes:

The Vredefort Crater, in South Africa, was previously thought to be the largest known impact structure at 300km in diameter and just over 2 billion years old

Shatter cones are rare geological structures known only to form beneath meteorite impact craters - they are evidence the rock has been subjected to significant pressure

Lithosphere - refers to the earth's crust and upper mantle

http://www.eurekalert.org/pub_releases/2013-11/su-ssc111213.php

Stanford scientists create a low-cost, long-lasting water splitter made of silicon and nickel

Stanford University scientists have created a silicon-based water splitter that is both low-cost and corrosion-free.

This article was written by Mark Shwartz, Precourt Institute for Energy at Stanford University.

The novel device – a silicon semiconductor coated in an ultrathin layer of nickel – could help pave the way for large-scale production of clean hydrogen fuel from sunlight, according to the scientists. Their results are published in the Nov. 15 issue of the journal Science.
"Solar cells only work when the sun is shining," said study co-author Hongjie Dai, a professor of chemistry at Stanford. "When there's no sunlight, utilities often have to rely on electricity from conventional power plants that run on coal or natural gas." A greener solution, Dai explained, is to supplement the solar cells with hydrogen-powered fuel cells that generate electricity at night or when demand is especially high.
To produce clean hydrogen for fuel cells, scientists have turned to an emerging technology called water splitting: Two semiconducting electrodes are connected and placed in water. The electrodes absorb light and use the energy to split the water into its basic components, oxygen and hydrogen. The oxygen is released into the atmosphere, and the hydrogen is stored as fuel. When energy is needed, the process is reversed: The stored hydrogen and atmospheric oxygen are combined in a fuel cell to generate electricity and pure water.
The entire process is sustainable and emits no greenhouse gases. But finding a cheap way to split water has been a major challenge. Today, researchers continue searching for inexpensive materials that can be used to build water splitters efficient enough to be of practical use.

Silicon solution

"Silicon, which is widely used in solar cells, would be an ideal, low-cost material," said Stanford graduate student Michael J. Kenney, co-lead author of the Science study. "But silicon degrades in contact with an electrolyte solution. In fact, a submerged electrode made of silicon corrodes as soon as the water-splitting reaction starts."
In 2011, another Stanford research team addressed this challenge by coating silicon electrodes with ultrathin layers of titanium dioxide and iridium. That experimental water splitter produced hydrogen and oxygen for eight hours without corroding. "Those were inspiring results, but for practical water splitting, longer-term stability is needed," Dai said. "Also, the precious metal iridium is costly. A non-precious metal catalyst would be desirable."
To find a low-cost alternative, Dai suggested that Kenney and his colleagues try coating silicon electrodes with ordinary nickel. "Nickel is corrosion resistant," Kenney said. "It's also an active oxygen-producing catalyst, and it's earth abundant. That makes it very attractive for this type of application."

Nickel nanofilm

For the experiment, the Dai team applied a 2-nanometer-thick layer of nickel onto a silicon electrode, paired it with another electrode and placed both in a solution of water and potassium borate. When light and electricity

were applied, the electrodes began splitting the water into oxygen and hydrogen, a process that continued for about 24 hours with no sign of corrosion.
To improve performance, the researchers mixed lithium into the water-based solution. "Remarkably, adding lithium imparted superior stability to the electrodes," Kenney said. "They generated hydrogen and oxygen continuously for 80 hours – more than three days – with no sign of surface corrosion."
These results represent a significant advance over previous experimental efforts, added Dai . "Our lab has produced one of the longest lasting silicon-based photoanodes," he said. "The results suggest that an ultrathin nickel coating not only suppresses corrosion but also serves as an electrocatalyst to expedite the otherwise sluggish water-splitting reaction.
"Interestingly, a lithium addition to electrolytes has been used to make better nickel batteries since the Thomas Edison days. Many years later we are excited to find that it also helps to make better water-splitting devices"
The scientists plan to do additional work on improving the stability and durability of nickel-treated electrodes of silicon as well as other materials.
Other authors of the study are Ming Gong and Yanguang Li (co-lead authors), Justin Z. Wu, Ju Feng and Mario Lanza of Stanford.
Support was provided by the Precourt Institute for Energy and the Global Climate and Energy Project at Stanford; and the National Science Foundation. ***Dai Laboratory***

http://www.eurekalert.org/pub_releases/2013-11/uop-ecs111413.php

Evolution can select for evolvability, Penn biologists find

Evolution does not operate with a goal in mind; it does not have foresight. But organisms that have a greater capacity to evolve may fare better in rapidly changing environments. This raises the question: does evolution favor characteristics that increase a species' ability to evolve?

For several years, biologists have attempted to provide evidence that natural selection has acted on evolvability. Now a new paper by University of Pennsylvania researchers offers, for the first time, clear evidence that the answer is yes.
The senior author on the study, published in the journal PLOS Pathogens, is Dustin Brisson, an assistant professor in the School of Arts and Sciences' Department of Biology. His coauthors include Penn's Christopher J. Graves, Vera I. D. Ros and Paul D. Sniegowski, and the University of Kentucky's Brian Stevenson.
"It's not controversial that populations evolve and that some traits are more apt to evolve than others," Brisson said. "What we were asking is whether the ability of an organism to evolve is a trait that natural selection can pick."
For species of viruses, pathogenic bacteria and parasites to survive over the long-term, they must possess an ability to rapidly adapt and evolve, enabling them to stay one step ahead of their hosts' immune systems. But these pathogens don't need to foresee what conditions lie ahead of them. They only must change into something that the immune system has never seen before. "Pathogens face a very strong selection pressure from the host's immune system," Brisson said. "If they don't adapt, they will die."
The researchers used this fact to seek evidence that natural selection had favored increased evolvability, focusing on the Lyme disease bacteria, Borrelia burgdorferi. B. burgdorferi possesses one protein that is essential for establishing a long-term infection of a mammalian host: VlsE.
In the Lyme bacteria's genome, the VlsE gene is preceded by "cassettes" which are normally not expressed, or made into individual proteins, but can recombine with VlsE to alter the expressed protein and thus present a novel challenge to a host's immune defenses.
Though earlier studies had suggested that selection may directly favor the capacity to evolve, they could not definitively rule out that evolvability had arisen for other reasons. In particular, it has been difficult in empirical studies to rule out the possibility that evolvability arises and is maintained as a byproduct of selection on organismal features more directly related to fitness.
In the Lyme disease system, the researchers got around this confounding factor by looking at diversity in the unexpressed cassettes, which would not have been the object of direct selection because they have no known function on their own; they simply exist as a way of increasing the potential diversity of the VlsE protein. Thus diversity in the cassettes would offer a window into past natural selection for a more "evolvable" VlsE.
"Organisms with greater diversity among the cassettes will have a selective advantage as they will be more antigenically evolvable, or better able to repeatedly generate novel antigens, and will thus be more likely to persist within hosts," the researchers wrote.
Using long-established methods in molecular evolution, the researchers evaluated 12 strains of B. burgdorferi for signs that natural selection had acted to increase the diversity of the cassettes.

"The evidence was remarkably strong in favor of evolution for more diversity among cassettes and thus greater evolvability in the expressed protein," Brisson said.
The researchers confirmed that the more genetically diverse the cassettes, the more genetically diverse the expressed protein, VlsE. They also found that mutations in the cassettes that could affect the portion of VlsE that is recognized by the immune system were as much as eight times more common than would be expected by chance alone and more common than mutations that affected other parts of the VlsE protein. In addition, the rate of mutation at the unexpressed cassettes was greater than that at other locations in the bacterial genome. Taken together, the results provide direct evidence that evolvability was the target of natural selection. The researchers note, however, that this doesn't mean that "natural selection for evolvability" is necessarily a common trait across all living things.
"It would be incredibly difficult to demonstrate this for free-living eukaryotic organisms, like humans," Brisson said. "But we can now say that evolvability can be the object of selection in the face of environmental pressure."
The study was supported by the Burroughs Wellcome Fund and the National Institute of Allergy and Infectious Diseases.

http://www.eurekalert.org/pub_releases/2013-11/uoc--dlo111313.php

Dogs likely originated in Europe more than 18,000 years ago, UCLA biologists report

Wolves likely were domesticated by European hunter–gatherers more than 18,000 years ago and gradually evolved into dogs that became household pets, UCLA life scientists report.

"We found that instead of recent wolves being closest to domestic dogs, ancient European wolves were directly related to them," said Robert Wayne, a professor of ecology and evolutionary biology in UCLA's College of Letters and Science and senior author of the research. "This brings the genetic record into agreement with the archaeological record. Europe is where the oldest dogs are found."
The UCLA researchers' genetic analysis is published Nov. 15 in the journal Science and featured on the journal's cover.
In related research last May, Wayne and his colleagues reported at the Biology of Genomes meeting in New York the results of their comparison of the complete nuclear genomes of three recent wolf breeds (from the Middle East, East Asia and Europe), two ancient dog breeds and the boxer dog breed.
"We analyzed those six genomes with cutting-edge approaches and found that none of those wolf populations seemed to be closest to domestic dogs," Wayne said. "We thought one of them would be, because they represent wolves from the three possible centers of dog domestication, but none was. All the wolves formed their own group, and all the dogs formed another group." The UCLA biologists also hypothesized at that conference that a now-extinct population of wolves was more directly related to dogs.
For the current study in Science, the researchers studied 10 ancient "wolf-like" animals and eight "dog-like" animals, mostly from Europe. These animals were all more than 1,000 years old, most were thousands of years old, and two were more than 30,000 years old.
The biologists studied the mitochondrial DNA of the animals, which is abundant in ancient remains. (Mitochondria are tiny sub-cellular structures with their own small genome.) By comparing this ancient mitochondrial DNA with the modern mitochondrial genomes of 77 domestic dogs, 49 wolves and four coyotes, the researchers determined that the domestic dogs were genetically grouped with ancient wolves or dogs from Europe - not with wolves found anywhere else in the world or even with modern European wolves. Dogs, they concluded, derived from ancient wolves that inhabited Europe and are now extinct.
Wayne said that that the domestication of predatory wolves likely occurred among ancient hunter–gatherer groups rather than as part of humans' development of sedentary, agricultural-based communities.
"The wolf is the first domesticated species and the only large carnivore humans ever domesticated," Wayne said. "This always seemed odd to me. Other wild species were domesticated in association with the development of agriculture and then needed to exist in close proximity to humans. This would be a difficult position for a large, aggressive predator. But if domestication occurred in association with hunter–gatherers, one can imagine wolves first taking advantage of the carcasses that humans left behind - a natural role for any large carnivore - and then over time moving more closely into the human niche through a co-evolutionary process."
The idea of wolves following hunter–gatherers also helps to explain the eventual genetic divergence that led to the appearance of dogs, he said. Wolves following the migratory patterns of these early human groups would have given up their territoriality and would have been less likely to reproduce with resident territorial wolves. Wayne noted that a group of modern wolves illustrates this process.
"We have an analog of this process today, in the only migratory population of wolves known existing in the tundra and boreal forest of North America," he said. "This population follows the barren-ground caribou during their thousand-kilometer migration. When these wolves return from the tundra to the boreal forest during the

winter, they do not reproduce with resident wolves there that never migrate. We feel this is a model for domestication and the reproductive divergence of the earliest dogs from wild wolves.
"We know also that there were distinct wolf populations existing ten of thousands of years ago," Wayne added. "One such wolf, which we call the megafaunal wolf, preyed on large game such as horses, bison and perhaps very young mammoths. Isotope data show that they ate these species, and the dog may have been derived from a wolf similar to these ancient wolves in the late Pleistocene of Europe."
In research published in the journal nature in 2010, Wayne and colleagues reported that dogs seem to share more genetic similarity with living Middle Eastern gray wolves than with any other wolf population, which suggested a Middle East origin for modern dogs. The new genetic data have convinced him otherwise.
"When we previously found some similarity between Middle Eastern wolves and domestic dogs, that similarity, we are now able to show, likely was the result of interbreeding between dog and wolves during dog history. It does not necessarily suggest an origin in the Middle East," Wayne said. "This alternative hypothesis, in retrospect, is one that we should have considered more closely. As hunter–gatherers moved around the globe, their dogs trailing behind probably interbred with wolves."
Wayne considers the new genetic data "persuasive" but said they need to be confirmed with an analysis of genetic sequences from the nucleus of the cell (roughly 2 billion base pairs) - a significantly larger sample than that found in mitochondrial DNA (approximately 20,000 base pairs). This is challenging because the nuclear DNA of ancient remains tends to become degraded.
While Wayne plans to pursue this follow-up research, he said he does not expect a nuclear genome analysis to change the central finding. However, he said, it will fill in more of the details.
"This is not the end-story in the debate about dog domestication, but I think it is a powerful argument opposing other hypotheses of origin," he said.
There is a scientific debate over when dogs were domesticated and whether it was linked with the development of agriculture fewer than 10,000 years ago, or whether it occurred much earlier. In the new Science research, Wayne and his colleagues estimate that dogs were domesticated between 18,000 and 32,000 years ago.
The research was federally funded by the National Science Foundation.
Co-authors on the Science paper include Olaf Thalmann, a former postdoctoral scholar in Wayne's laboratory who is currently the Marie Curie Postdoctoral Fellow at Finland's University of Turku; Daniel Greenfield, a former technician in Wayne's laboratory; Francesc López-Giráldez, a former graduate student in Wayne's laboratory who is currently a postdoctoral scholar at Yale University; Adam Freedman, a former postdoctoral scholar in Wayne's laboratory; Rena Schweizer, a current UCLA graduate student in Wayne's laboratory; Klaus Koepfli, a former postdoctoral scholar in Wayne's laboratory; and Jennifer Leonard, who earned her doctorate from UCLA.
Approximately 80 percent of dog breeds are modern breeds that evolved in the last few hundred years, Wayne said. But some dog breeds have ancient histories that go back thousands of years.
Wolves have been in the Old World for hundreds of thousands of years. The oldest dogs from the archaeological record come from Europe and Western Russia. A dog from Belgium dates back approximately 36,000 years, and a group of dogs from Western Russia is approximately 15,000 years old, Wayne said.

http://nyti.ms/1fEKj8q

Wolf to Dog: Scientists Agree on How, but Not Where

Where did dogs come from? That simple question is the subject of a scientific debate right now.

By CARL ZIMMER

In May, a team of scientists published a study pointing to East Asia as the place where dogs evolved from wolves. Now, another group of researchers has announced that dogs evolved several thousand miles to the west, in Europe. This controversy is intriguing even if you're not a dog lover. It illuminates the challenges scientists face as they excavate the history of any species from its DNA.

The side view of a Palaeolithic dog fossil recovered from a cave in Belgium. **Royal Belgian Institute of Natural Sciences**

Scientists have long agreed that the closest living relatives of dogs are wolves, their link confirmed by both anatomy and DNA. Somewhere, at some point, some wolves became domesticated. They evolved not only a different body shape, but also a different behavior. Instead of traveling in a pack to hunt down prey, dogs began lingering around humans. Eventually, those humans bred them into their many forms, from shar-peis to Newfoundlands.

A few fossils supply some tantalizing clues to that transformation. Dating back as far as 36,000 years, they look like wolfish dogs or doggish wolves. The oldest of these fossils have mostly turned up in Europe.

In the 1990s, scientists started using new techniques to explore the origin of dogs. They sequenced bits of DNA from living dog breeds and wolves from various parts of the world to see how they were related. And the DNA told a different story than the bones. In fact, it told different stories.

In a 2002 study, for example, Peter Savolainen, now at the Royal Institute of Technology in Sweden, and his colleagues concluded that dogs evolved in East Asia. Eight years later, however, Robert Wayne, a geneticist at the University of California, Los Angeles, and his colleagues analyzed some new dog breeds and concluded that the Middle East was where dogs got their start. (All such studies suggest that a few breeds may have been independently domesticated, although they differ on which ones and where.)

Dr. Savolainen and his colleagues continued to sequence DNA from more dogs, and they published more evidence for an East Asian origin of dogs - narrowing it down to South China.

While early studies of canine origins were limited to fragments of DNA, scientists are now starting to sequence entire genomes of dogs and wolves. In May, for example, Dr. Salovainen and Chinese colleagues reported that Chinese native dogs had the most wolflike genomes. By tallying up the mutations in the different dog and wolf genomes, they estimated that the ancestors of Chinese village dogs and wolves split about 32,000 years ago.

If this were true, then the first dogs would have become domesticated not by farmers, but by Chinese hunter-gatherers more than 20,000 years before the dawn of agriculture.

Dr. Wayne and his colleagues think that is wrong. A dog may have wolflike DNA because it is a dog-wolf hybrid. In a paper that is not yet published, they analyze wolf and dog genomes to look for signs of ancient interbreeding. They cite evidence that, indeed, some of the DNA in dogs in East Asia comes from wolf interbreeding. “That’s going to pump up the resemblance,” Dr. Wayne said.

Now Dr. Wayne and his colleagues are introducing a new line of evidence to the dog debate: ancient DNA. Over the past two decades, scientists have developed increasingly powerful tools to rescue fragments of DNA from fossils, producing “an explosion in the samples,” said Beth Shapiro of the University of California, Santa Cruz, a collaborator with Dr. Wayne.

On Thursday in the journal Science, Dr. Wayne, Dr. Shapiro and their colleagues report on the first large-scale comparison of DNA from both living and fossil dogs and wolves. They managed to extract DNA from 18 fossils found in Europe, Russia and the New World. They compared their genes to those from 49 wolves, 77 dogs and 4 coyotes.

The scientists examined a special kind of DNA found in a structure in the cell called the mitochondrion. Mitochondrial DNA comes only from mothers. Because each cell may have thousands of mitochondria, it is easier to gather enough genetic fragments to reconstruct its DNA.

The scientists did not find that living dogs were closely related to wolves from the Middle East or China. Instead, their closest relatives were ancient dogs and wolves from Europe.

“It’s a simple story, and the story is they were domesticated in Europe,” Dr. Shapiro said.

Dr. Shapiro and Dr. Wayne and their colleagues estimate that dogs split off from European wolves sometime between 18,000 and 30,000 years ago. At the time, Northern Europe was covered in glaciers and the southern portion was a grassland steppe where humans hunted for mammoths, horses and other big game.

“Humans couldn’t take everything, and that was a great treasure trove,” Dr. Wayne said. Some wolves began to follow the European hunters to scavenge on the carcasses they left behind. As they migrated along with people, they became isolated from other wolves.

Dog evolution experts praised the scientists for gathering so much new data. “I think it’s terrific,” said Adam Boyko, a Cornell biologist. Dr. Savolainen agreed. “I think it’s a fantastic sample,” he said. But Dr. Savolainen said the analysis was flawed. “It’s not a correct scientific study, because it’s geographically biased,” he said. The study lacks ancient DNA from fossils from East Asia or the Middle East, and so it’s not possible to tell whether the roots of dog evolution are anchored in those regions. “You just need to have samples from everywhere,” Dr. Savolainen said.

He also rejects Dr. Wayne’s argument that interbreeding in East Asia creates an illusion that dogs originated there. Dr. Savolainen points out that the study suggesting interbreeding was based on a wolf from northern China. “What they need to have is samples from south China,” he said.

There’s just one catch. South China is now so densely settled by people that no wolves live there. A similar problem applies to the fossil record. “It may be impossible to go this way,” Dr. Savolainen said.

Dr. Wayne is not quite so pessimistic. He and his colleagues are hoping to widen their scope and find more DNA from fossils of dogs outside of Europe, while also looking at the genes of living dogs that might hold important clues. Yet he thinks it unlikely that the new evidence will change the basic conclusion of his latest study. “But there have been so many surprises in the history of this research on dog domestication that I’m holding my breath till we get more information,” Dr. Wayne said.

http://www.eurekalert.org/pub_releases/2013-11/epfd-cim111413.php

Copper intake makes tumors breathe

EPFL researchers have shown that copper is essential for the energy production of malignant cells, and that reducing its intake via food and water can slow down tumor growth

Copper imbalances have been associated with a number of pathological conditions, including cancer. Publishing in PNAS scientists at EPFL have found that copper in drinking water – given at the maximum levels permitted in public water supplies – accelerated the growth of tumors in mice. On the other hand, reducing copper levels reduced tumor growth. The study strongly suggests that copper is an essential factor for the growth of tumors in humans as well.

Copper is a key player in cell growth. In order to proliferate, cells require energy, which they produce and store in the form of a molecule called ATP. Like all cells, tumor cells produce energy in two different ways: respiration, which requires oxygen, and glycolysis, which does not. Of the two, respiration is the more efficient way to make ATP. However it involves a number of enzymes, and one of the most important ones requires copper for its activity.

In a study led by Douglas Hanahan, researcher at EPFL and holder of the Merck Serono Chair in Oncology, scientists sought to examine the role of copper in cancer. To do this, they used genetically engineered mice with pancreatic neuroendocrine tumors. "This study was motivated by our previous puzzling observation; namely that cancers, unlike healthy tissues, are especially sensitive to changes in systemic copper levels", said Seiko Ishida, the lead author of the paper.

Their research provides direct evidence that copper can enhance the proliferation of cancer cells. "The biggest surprise was that a small amount of copper added to drinking water accelerated the growth of tumors, indicating that copper is an essential nutrient for them, said Ishida.

Teaming up with Johan Auwerx, also at EPFL, the researchers found that copper insufficiency resulted in a lower activity of the respiration enzyme in tumors. PET scans also revealed that copper-deficient tumors took higher levels of glucose, suggesting that their cells were compensating more and more by using glycolysis rather than respiration for their energy. But despite this, ATP levels did not fully recover, and tumors did not grow further.

Importantly, the researchers do not think that copper causes cancer. Exposure of healthy mice to the same amount of copper via drinking water for up to two years did not result in an increased incidence of cancer. The authors suggest that copper levels could be monitored in cancer patients. They propose that minimizing copper in the patient's system may be beneficial in cancer therapy, especially when combined with drugs that block glycolysis. This two-step strategy would starve cancer cells – which tend to require much higher amounts of energy than normal cells – by limiting their two major pathways for ATP production.

http://www.sciencedaily.com/releases/2013/11/131114101925.htm

Controversial Cholesterol Guidelines Biggest Change in 25 Years

New cholesterol guidelines for identifying adults at risk for heart disease represent the biggest change in such expert advice in more than 25 years, according to Loyola University Health System preventive cardiology experts.

"This is very big news," said Binh An P. Phan, MD, director of Loyola's Preventive Cardiology and Lipid Program. "These new guidelines could dramatically affect how cholesterol is treated."

Under the guidelines, patients generally would be put on a cholesterol-reducing statin medication based on a formula that estimates their risk for cardiovascular disease. This is a major change from previous guidelines that placed more emphasis on patients' cholesterol numbers.

The clinical practice guidelines were issued by the American College of Cardiology and American Heart Association. They are intended to better identify adults who may be at risk for cardiovascular disease and who thus may benefit from lifestyle changes or statin cholesterol medications.

The guidelines could simplify the process of identifying patients who could benefit from statin therapy, said Loyola cardiologist Ivan V. Pacold, MD, an expert in preventive cardiology. Dr. Pacold is medical director of Cardiology at Loyola's Gottlieb Memorial Hospital.

"The guidelines emphasize that starting and keeping patients on statin treatment is more important than looking at the actual cholesterol-lowering effect of the treatment," Dr. Pacold said.

However, the guidelines are controversial. They have not been endorsed by the National Lipid Association, a multidisciplinary medical society that focuses on controlling cholesterol.

The guidelines are intended to meet the needs of patients in most circumstances. They are not meant to be a replacement for clinical judgment.

"For the many questions regarding complex lipid (cholesterol) disorders that are beyond the scope of our systemic evidence review, or which little or no RCT [randomized clinical trial] data are available, it is anticipated that clinicians with lipid expertise can contribute to their management," the guidelines say. Cardiologists in Loyola's Preventive Cardiology and Lipid Program have special expertise in preventive cardiology and are board-certified in the field of lipidology and advanced cholesterol management by the American Board of Clinical Lipidology.

http://www.eurekalert.org/pub_releases/2013-11/d-ssb111313.php

Study shows being an elite male athlete protects against type 2 diabetes in later life

A study of almost 400 former elite male athletes shows that former status as an elite athlete reduces the risk of developing type 2 diabetes in later life by 28%.

The research appears in Diabetologia, the journal of the European Association for the Study of Diabetes (EASD), and is by Dr Merja Laine, University of Helsinki, Helsinki, Finland, and colleagues.

The study of Finnish male athletes follows-up on work that began in 1985, when a questionnaire was sent to 1,518 former athletes and 1,010 controls, and further questionnaires were sent out in1995 and 2001. In 2008, an invitation to participate in a clinical study was sent to all former athletes who were still alive (747, of whom 392 participated) and controls (436, of whom 207 participated) and had answered at least one of the previous questionnaires. The clinical study included a physical examination, laboratory tests and questionnaires.

The former athletes were divided into three groups based on their active career sport: endurance, mixed and power sports. Participants without a history of diabetes (n=537) underwent an oral glucose tolerance test (75g of glucose delivered over 2 hours). Current volume of leisure-time physical activity (LTPA) was determined by self-reported questionnaires and expressed in metabolic equivalent hours. Data on reimbursable diabetes medication from participants and non-participants were obtained from a central Finnish register.

The researchers found that being a former elite athlete reduced the risk of developing type 2 diabetes by a statistically significant 28%. However, this reduction varied among the different sports categories: the risk reduction was 61% for those who had had careers in endurance sports (a statistically significant finding) while for mixed sports the reduction was 21% and power sports was 23% (both not statistically significant).

The risk of type 2 diabetes decreased with increased LTPA volume, by 2% per 1 MET-h per week. The former elite athletes also had a 42% lower risk of impaired glucose tolerance (IGT), a precursor state to full blown diabetes. The authors say: "With ageing, the former athletes maintained their physically active lifestyle better than the controls." They conclude: "A former career as an elite athlete protected from both type 2 diabetes and IGT in later life. In addition, the volume of current leisure-time physical activity was inversely associated with the prevalence of type 2 diabetes."

http://www.eurekalert.org/pub_releases/2013-11/slu-cch111513.php

Can certain herbs stave off Alzheimer's disease?

SLU animal research suggests antioxidant extracts from spearmint, rosemary improve learning and memory

ST. LOUIS -- Enhanced extracts made from special antioxidants in spearmint and rosemary improve learning and memory, a study in an animal model at Saint Louis University found. "We found that these proprietary compounds reduce deficits caused by mild cognitive impairment, which can be a precursor to Alzheimer's disease," said Susan Farr, Ph.D., research professor geriatrics at Saint Louis University School of Medicine.

Farr added, "This probably means eating spearmint and rosemary is good for you. However, our experiments were in an animal model and I don't know how much – or if any amount – of these herbs people would have to consume for learning and memory to improve. In other words, I'm not suggesting that people chew more gum at this point."

Farr presented the early findings at Neuroscience 2013, a meeting of 32,000 on Monday, Nov. 11. She tested a novel antioxidant-based ingredient made from spearmint extract and two different doses of a similar antioxidant made from rosemary extract on mice that have age-related cognitive decline.

She found that the higher dose rosemary extract compound was the most powerful in improving memory and learning in three tested behaviors. The lower dose rosemary extract improved memory in two of the behavioral tests, as did the compound made from spearmint extract.

Further, there were signs of reduced oxidative stress, which is considered a hallmark of age-related decline, in the part of the brain that controls learning and memory.

"Our research suggests these extracts made from herbs might have beneficial effects on altering the course of age-associated cognitive decline," Farr said. "It's worth additional study."

The research, which was supported by the VA Medical Center in St. Louis, was conducted in conjunction with Kemin Industries, which manufactures specialty ingredients for vitamin/dietary supplements or that can be added to food to enhance its nutritional and health benefits.

http://www.eurekalert.org/pub_releases/2013-11/bc-srh110713.php

Scientists report human dietary supplement cures lab animals infected with human intestinal parasite

Preliminary success using 'probiotics' against hookworms raises hope for treating afflictions that burden 1.5 billion and cause stunting, development delays in children

WASHINGTON, D.C.- Laboratory animals fed a modified version of a common human dietary supplement were completely cured of intestinal worms that belong to a family of parasites that currently infect 1.5 billion people, or almost one quarter of the world's population, according to new research presented today at the annual meeting of the American Society of Tropical Medicine and Hygiene (ASTMH).

"We need to replicate the results in other animals and also in humans, but this is an important development in our effort to find a safe, affordable and effective way to confront a major global health problem," said Raffi Aroian, PhD, principal investigator of a team of scientists at the University of California, San Diego who are seeking new treatments for a variety of parasitic worms known as "soil-transmitted helminths" or STHs.

While rarely fatal, STHs and other intestinal worms are leading contributors to disease in school-age children in low-income countries and are viewed by many experts as among the most burdensome of the world's "neglected tropical diseases" or NTDs.

The study conducted by Aroian's team focused on hookworms, common STHs that are found in soil that has been contaminated with human feces. Hookworms can linger in the intestines for years, where they feed on blood and tissue, robbing their hosts of iron and protein and interfering with absorption of critical nutrients. They frequently cause stunting and cognitive delays in infected children. They also can have long-term effects on educational achievement and productivity.

Currently, the only drugs available to treat hookworms in humans were originally developed to combat parasites that infect farm animals. Aroian said they are only partially effective against the range of intestinal parasites that infect humans. There is also evidence of reinfections occurring rapidly after treatment and low levels of efficacy in some places.

At the ASTMH meeting, Aroian's colleague Yan Hu, PhD reported findings from a study in which hamsters were deliberately infected with hookworms. The hamsters were later divided into two groups. One group received a common strain of the bacteria Bacillus subtilis, which is often marketed as a "probiotic" - a dietary supplement consumed as a pill or added to food that is intended to promote digestive health. It also is the key ingredient in a popular Japanese fermented soybean dish called Natto. The other group received the same probiotic, except the researchers modified it to express a protein derived from a closely related bacterium, Bacillus thuringiensis or Bt, which is known to be safe in humans but potentially lethal to intestinal worms.

"Five days after we administered the bacteria, we examined the animals' intestines," Hu said. "We found no worms in the animals that received the modified probiotic, while those that did not receive the modified probiotic remained infected."

Hu said the next step will be to conduct tests in different types of animals and against different types of STHs. If the probiotic continues to perform well against multiple intestinal parasites and is shown to be safe, then researchers would consider testing in humans, she said. The research is supported by grants from the Bill & Melinda Gates Foundation and the National Institutes of Health.

"While the research has yet to move beyond tests in animals, the human health burden is so immense and the solutions so few that it's gratifying to see progress being made toward finding new treatments for intestinal worm diseases," said ASTMH President David H. Walker, MD. "It shows that new investments in neglected tropical diseases are inspiring creative solutions for the more than a billion people in need."

Aroian said the overall goal of the work is to produce a treatment for intestinal worms that is safe, effective and affordable in the world's poorest countries, where hookworms and other STHs do the most damage. "This probiotic is a food-grade bacterial product that can be easily produced in large quantities in a simple fermenter, and it can be manufactured in a form that has a long shelf-life," he said. "It could be well-suited to providing the cheap, mass treatment we need to substantially reduce the burden of this disease."

Aroian said Bt is attractive because it is a well-understood, natural substance for controlling plant pests that is believed to be safe for animals and humans. It is frequently sprayed on organic crops and is mainly lethal to insects in their larva stage. Bt also is a bacteria used in genetically engineered corn and soybean to endow the crops with resistance to plant pests.

Aroian said that while the modified probiotic under development in his lab should be safe to consume, if it proves to be an effective intervention for intestinal worms it would be marketed as a treatment, not as a dietary supplement.

http://bit.ly/HXJHPH

Vastly diluted bleach may have protective effect on skin

When vastly diluted, bleach can have healing effects

18:28 15 November 2013 by Alyssa Botelho

Forget Crème de la Mer, Crème de la bleach may be next on your bathroom shelf.

So suggests a discovery that highly diluted household bleach inhibits inflammation in the skin, a finding that might help protect skin from sun exposure, radiation therapy and even the natural ageing process.

Don't try it at home, but doctors have known for decades that bathing in diluted bleach helps alleviate severe eczema. "But no one really knew why," says Thomas Leung, a dermatologist at Stanford University in California. Many thought the antimicrobial properties of bleach kept the skin clean, and therefore less irritated. "But we weren't fully convinced – the solution doctors use is so dilute that it isn't fully antiseptic," Leung says.

The typical concentration used, just 0.005 per cent, is weaker than the amount you would find in swimming pool water. Leung suspected that bleach might also be involved in stemming inflammation. An inflammatory response is vital for fighting infection but can cause damage when it spirals out of control – as it does in eczema.

Spa for mice

Leung's team suspected a protein called NF-kB, which triggers the recruitment of inflammatory cells to a site of infection, might be involved. To test that hunch, they exposed human skin cells to a solution containing 0.005 per cent bleach for an hour.

The solution completely blocked NF-kB signalling. Hypochlorite – the active chemical in bleach – oxidizes, or plucks electrons off, a molecule that activates NF-kB and begins the inflammatory cascade. By putting that activator out of commission, hypochlorite can completely inhibit the inflammatory pathway.

Leung's team next explored the therapeutic potential of the solution in mice with radiation dermatitis – a type of sunburn-like irritation often seen in people undergoing radiotherapy. They also tested the affect of bleach on healthy old mice with ageing skin.

Each group of mice was allowed to wade in a dilute bleach bath for 30 minutes a day. "We called it their spa treatment," says Leung. Mice that took a bleach bath before each of their 10 daily radiation treatments had milder, faster-healing burns than those who took water baths. That's important, Leung says, because people with cancer often have to take time off from radiotherapy to let such burns heal before resuming treatment.

Once more unto the bleach

The old mice that took a bleach bath every day for two weeks had increased skin cell production resulting in thicker, younger-looking skin than old mice that took plain water baths. In addition, they had lower expression of two genes classically associated with ageing. The effect was short lived, however. The rejuvenated skin returned to its elderly look after about two weeks because the action of bleach on Nf-kB is mild, and diminishes with time. It would have to be applied repeatedly to give anti-ageing effects, Leung says.

It is surprising that dilute hypochlorite is able to confer such protective effects on the skin, says Paul Robbins, who studies inflammatory and age-related diseases at the Scripps Research Institute in La Jolla, California. But given that hypochlorite is oxidative and so pulls electrons off other charged molecules, he adds, it could have many potential side effects, especially as dosage increases.

Leung says the fact that the action is reversible, and has not been shown to cause infection or other ill effects in his experiments, provides hope that side effects will be minimal in clinical trials.

"The novelty here is that we're taking an incredibly cheap, widely available chemical and exploring additional applications," Leung says. "Because we've been able to pinpoint hypochlorite's precise mechanism of action in the body, now we can expand the use of a safe and widely used treatment even more."

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http://www.bbc.co.uk/news/health-24957089

Cancer diversity has 'huge implications'

A single tumour can be made up of many separate cancers needing different treatments, say researchers.

By James Gallagher Health and science reporter, BBC News

A team at the Institute of Cancer Research, London, have developed a new technique for measuring the diversity within a cancer. They showed "extraordinary" differences between cancerous cells and say new targeted drugs may fail as they may be unable to kill all the mutated tissue. Experts said the findings would have "profound implications" for treatments.

A tumour starts as a single cell, which acquires mutations and eventually divides uncontrollably. But that is not the end of the process. Cancerous cells continue to mutate and become more aggressive, move round the body and resist drugs. This process is chaotic and results in a "diverse" tumour containing cancerous cells that have mutated in different ways.

"This has huge implications for medicine," researcher Prof Mel Greaves told the BBC. His team at the Institute of Cancer Research investigated cancer diversity in five children with leukaemia. They compared mutations in individual cancerous cells with a known database of mutations. Their results, published in the journal Genome Research, showed patients had between two and 10 genetically distinct leukaemias.
Prof Greaves said: "Every patient has a completely new tree and doesn't have one cancer, they have multiple cancers. "This is really a technical advance to get at this extraordinary complex diversity, it helps explain why we have such difficulty with advanced diseases."

Tree of cancer

Scientists compare cancer diversity to a tree. The initial mutations - the trunk - will be common to all cancer cells. But then the tumour branches out. It means a treatment that targets one "branch" or sub-clone of the cancer might slow the disease, but they will never stop it.
Prof Charles Swanton, who researches diversity at the University College London Cancer Institute, told the BBC: "We call it pruning the branches not cutting down the tree, targeted therapies will remove some of the sub-clones, but chopping down the tree is hard to do." The study investigated leukaemia as it is less diverse than other types of cancer. Other tumours such as melanoma could feasibly be made of hundreds of branches.
Prof Greaves says one implication of the research is that therapies need to be developed which target the trunk of the tumour and that current targeted therapies being researched may not tackle advanced cancers.
Another idea he suggests is focusing on the cancer's surroundings as well. "If it is diversifying like species in a habitat, why not target the habitat - the blood vessels supplying oxygen or inflammation. There's a lot of interest in that," he said. The research also emphasises the importance of catching cancers early before they have become too diverse to treat.
Prof Charles Swanton argues: "The bottom line is we need to understand cancer diversity to limit further adaptations, reduce the pace of evolution and prolong the activity of drugs."
Prof Chris Bunce, the research director at Leukaemia and Lymphoma Research, commented: "We are beginning to understand how unique and complex each patient's cancer is and the profound implications that this can have on the success of treatment.
"This study significantly advances our understanding of how cancers start and evolve."

http://www.eurekalert.org/pub_releases/2013-11/aha-cf3111213.php

CPR for 38 minutes or longer improves chance to survive cardiac arrest

Performing CPR for 38 minutes or longer can improve a patient's chance of surviving cardiac arrest, according to a study presented at the American Heart Association's Scientific Sessions 2013.

Sustaining CPR that long also improves the chances that survivors will have normal brain function, researchers said. Cardiac arrest occurs when electrical impulses in the heart become rapid or chaotic, causing it to suddenly stop beating. About 80 percent of cardiac arrests - nearly 288,000 people - occur outside of a hospital each year, and fewer than 10 percent survive, according to the American Heart Association.
Research has found that early return of spontaneous circulation - the body pumping blood on its own - is important for people to survive cardiac arrest with normal brain function. But little research has focused on the period between cardiac arrest and any return of spontaneous circulation.
Using a massive registry tracking all out-of-hospital cardiac arrests in Japan in 2005-11, researchers studied how much time passed between survivors' collapse and the return of spontaneous circulation, and how well brain function was preserved a month later. Survivors were considered to have fared well neurologically if they were alert and able to return to normal activities, or if they had moderate disability but were well enough to work part-time in a sheltered environment or take part in daily activities independently.
The time between collapse and return of spontaneous circulation for those who fared well was 13 minutes compared to about 21 minutes for those who suffered severe brain disability, said Ken Nagao, M.D., Ph.D., professor and director-in-chief of the Department of Cardiology, CPR and Emergency Cardiovascular Care at Surugadai Nihon University Hospital in Tokyo.
After adjusting for other factors that can affect neurological outcomes, researchers found that the odds of surviving an out-of-hospital cardiac arrest without severe brain damage dropped 5 percent for every 60 seconds that passed before spontaneous circulation was restored.
Based on the relationship between favorable brain outcomes and the time from collapse to a return of spontaneous circulation, the researchers calculated that CPR lasting 38 minutes or more was advisable.
"It may be appropriate to continue CPR if the return of spontaneous circulation occurs for any period of time," said Nagao. The 2010 AHA Guidelines for CPR and ECC advise bystanders to perform CPR until emergency crews arrive.
The Japanese Circulation Society Resuscitation Science Study group conducted the study.

Co-authors are Eizo Tachibana, M.D., Ph.D.; Tukasa Yagi, M.D., Ph.D; Naohiro Yonemoto, Dr.P.H.; Morimasa Takayama, M.D., Ph.D.; Hiroshi Nogoni, M.D., Ph.D.; Shinichi Shirai, M.D., Ph.D.; and Takeshi Kimura, M.D., Ph.D. Author disclosures are on the abstract.

http://www.sciencedaily.com/releases/2013/11/131115203658.htm

Large-Scale Analysis Describes Inappropriate Lab Testing Throughout Medicine

Laboratory testing is health care's single highest volume activity, with over 5 billion tests performed each year in the U.S.

Now a new study examining 15 years' worth of published research reveals some surprising findings about the humble blood test. Led by investigators at Beth Israel Deaconess Medical Center (BIDMC) and reported on-line in the journal PLOS ONE, the large-scale analysis of 1.6 million results from 46 of medicine's 50 most commonly ordered lab tests finds that, on average, 30 percent of all tests are probably unnecessary. Even more surprising, the results suggest that equally as many necessary tests may be going unordered.

"Lab tests are used in all medical specialties, affecting virtually all patients," explains senior author Ramy Arnaout, MD, DPhil, Associate Director of the Clinical Microbiology Laboratories in the Department of Pathology at BIDMC and Assistant Professor of Pathology at Harvard Medical School (HMS). "While working with my clinical colleagues around the hospital, I often found myself wondering about the appropriateness or inappropriateness of all of these tests. In developing this study, my coauthors and I wanted to learn more about overall lab test utilization so that we could better understand how and where errors were occurring in this extremely high-volume activity."

Their findings revealed a stark problem: Not only was there a 30 percent overall rate of test overuse- there was a similar rate of underuse.

While the authors found both overuse and underuse to be prevalent problems throughout laboratory testing, the overall findings point to a bigger issue, says Arnaout. "It's not ordering more tests or fewer tests that we should be aiming for, it's ordering the right tests, however few or many that is," he notes. "Remember, lab tests are inexpensive. Ordering one more test or one less test isn't going to 'bend the curve,' even if we do it across the board. It's everything that happens next -- the downstream visits, the surgeries, the hospital stays -- that matters to patients and to the economy and should matter to us."

"This paper explores many of the nuances surrounding exactly how, when and why lab tests are ordered and misordered," says Jeffrey Saffitz, MD, PhD, BIDMC Chairman of Pathology. "Many times, the reasons for ordering tests seems to be based on dogma, the way it's always been done. This comprehensive and meticulous analysis shows that there are patterns in laboratory test utilization that can reveal when we do a good job at ordering tests and where we need to do better."

To conduct the study, the authors undertook a thorough review of the medical literature. Going back to 1997 -- the year that the last previous review of lab tests had been conducted -- Arnaout, together with first author Ming Zhi, MD, then a student at Harvard Medical School and currently an intern at Kaiser Permanente Santa Clara Medical Center, began by scouring a host of databases matching terms such as "laboratory," "blood test," "utilization," "overuse," and "underuse." They came up with approximately 34,000 papers.

"We cast a wide net, then filtered things out and eventually got down to a couple of hundred papers on laboratory utilization," says Arnaout. Further refinement led to an examination of 42 papers covering 1.6 million orders of 46 of the 50 most commonly ordered lab tests. These ranged from common tests such as the complete blood count and basic metabolic panel to less common tests like D-dimer (for pulmonary embolism) and HIV-1 tests.

From these measurements, they set about estimating the overall prevalence of inappropriate testing, including overuse (tests that are ordered but not indicated) and underuse (tests that are indicated but not ordered.) They also distinguished between inappropriate initial testing -- during a clinician's first evaluation of a patient or in response to new signs or symptoms -- and inappropriate repeat testing, which occurs when the same tests are repeated -- often multiple times -- during a patient's hospitalization.

"Most of the time when doctors talk about inappropriate lab testing, there's a generally accepted notion that it's too many 'repeat' tests being ordered," says Arnaout. "But, unexpectedly, on a per-test basis, we actually found that the main problem was tests being over-ordered during a patient's initial examination, rather than during repeat tests. This indicates to us that ordering the right test during the initial evaluation may lead to fewer errors and better patient care."

The authors also established a number of criteria that influence how doctors order lab tests and examined their final outcomes in the context of these criteria, for example, what they call restrictive vs. permissive criteria.

"In medicine, as a rule, we only do things if there is a reason," says Arnaout. "You'd never have a situation where you drop a loved one off at the doctor and when you pick them up at the end of a day, they're missing a

foot because the doctor went down a checklist and couldn't see any reason not to remove the foot. That doesn't happen because medicine adheres to 'restrictive' policies. However, as our findings showed, laboratory medicine is the exception to this rule. In ordering blood tests, we too often tend to be permissive, asking 'why not?' instead of 'why?'"

In fact, first author Ming Zhi notes that as a medical resident, he now finds himself in this very position as he decides which tests to order on a day-to-day basis. "I think there's often a mindset of 'just go ahead and order the tests,'" he explains. "But I've now discovered that it's a lot more nuanced in the clinical setting. Working on this project has had a direct impact on my own behavior. I find myself asking, 'Do my patients really need another set of tests? Do they really need another needle stick? Is there a test they may need that I left out?"

"Because laboratory tests play such a crucial and ubiquitous role in medicine, efforts to identify opportunities for improvement in the selection of tests have the potential to contribute greatly to the care patients receive," adds William Taylor, MD, a clinician in BIDMC's Division of General Medicine and Primary Care. "By drawing attention to this important topic, Dr. Arnaout and his colleagues are setting the stage for further work to help more patients benefit from proper test selection, while protecting patients from the potential harm and wasted resources induced by unnecessary tests."

"These findings offer the field of pathology both an opportunity and challenge for the future," adds Saffitz. "When it comes to appropriate lab testing I think the pathologist has as much responsibility to get it right as the doctor who is ordering the test. This paper focuses attention on this important issue."

Ming Zhi, Eric L. Ding, Jesse Theisen-Toupal, Julia Whelan, Ramy Arnaout. The Landscape of Inappropriate Laboratory Testing: A 15-Year Meta-Analysis. PLoS ONE, 2013; 8 (11): e78962 DOI: 10.1371/journal.pone.0078962

http://www.eurekalert.org/pub_releases/2013-11/wuis-vds111213.php

Volcano discovered smoldering under a kilometer of ice in West Antarctica

Its heat may increase the rate of ice loss from one of the continent's major ice streams

It wasn't what they were looking for but that only made the discovery all the more exciting.

In January 2010 a team of scientists had set up two crossing lines of seismographs across Marie Byrd Land in West Antarctica. It was the first time the scientists had deployed many instruments in the interior of the continent that could operate year-round even in the coldest parts of Antarctica.

Like a giant CT machine, the seismograph array used disturbances created by distant earthquakes to make images of the ice and rock deep within West Antarctica.

There were big questions to be asked and answered. The goal, says Doug Wiens, professor of earth and planetary science at Washington University in St. Louis and one of the project's principle investigators, was essentially to weigh the ice sheet to help reconstruct Antarctica's climate history. But to do this accurately the scientists had to know how the earth's mantle would respond to an ice burden, and that depended on whether it was hot and fluid or cool and viscous. The seismic data would allow them to map the mantle's properties.

In the meantime, automated-event-detection software was put to work to comb the data for anything unusual. When it found two bursts of seismic events between January 2010 and March 2011, Wiens' PhD student Amanda Lough looked more closely to see what was rattling the continent's bones.

Was it rock grinding on rock, ice groaning over ice, or, perhaps, hot gases and liquid rock forcing their way through cracks in a volcanic complex?

Uncertain at first, the more Lough and her colleagues looked, the more convinced they became that a new volcano was forming a kilometer beneath the ice. The discovery of the new as yet unnamed volcano is announced in the Nov. 17 advanced online issue of Nature Geoscience.

Following the trail of clues

The teams that install seismographs in Antarctica are given first crack at the data. Lough had done her bit as part of the WUSTL team, traveling to East Antarctica three times to install or remove stations in East Antarctica. In 2010 many of the instruments were moved to West Antarctica and Wiens asked Lough to look at the seismic data coming in, the first large-scale dataset from this part of the continent.

"I started seeing events that kept occurring at the same location, which was odd, "Lough said. "Then I realized they were close to some mountains–but not right on top of them." "My first thought was, 'Okay, maybe its just coincidence.' But then I looked more closely and realized that the mountains were actually volcanoes and there was an age progression to the range. The volcanoes closest to the seismic events were the youngest ones."

The events were weak and very low frequency, which strongly suggested they weren't tectonic in origin. While low-magnitude seismic events of tectonic origin typically have frequencies of 10 to 20 cycles per second, this shaking was dominated by frequencies of 2 to 4 cycles per second.

Ruling out ice

But glacial processes can generate low-frequency events. If the events weren't tectonic could they be glacial?

To probe farther, Lough used a global computer model of seismic velocities to "relocate" the hypocenters of the events to account for the known seismic velocities along different paths through the Earth. This procedure collapsed the swarm clusters to a third their original size.
It also showed that almost all of the events had occurred at depths of 25 to 40 kilometers (15 to 25 miles below the surface). This is extraordinarily deep—deep enough to be near the boundary between the earth's crust and mantle, called the Moho, and more or less rules out a glacial origin.
It also casts doubt on a tectonic one. "A tectonic event might have a hypocenter 10 to 15 kilometers (6 to 9 miles) deep, but at 25 to 40 kilometers, these were way too deep," Lough says. A colleague suggested that the event waveforms looked like Deep Long Period earthquakes, or DPLs, which occur in volcanic areas, have the same frequency characteristics and are as deep. "Everything matches up," Lough says.

An ash layer encased in ice

The seismologists also talked to Duncan Young and Don Blankenship of the University of Texas who fly airborne radar over Antarctica to produce topographic maps of the bedrock. "In these maps, you can see that there's elevation in the bed topography at the same location as the seismic events," Lough says.
The radar images also showed a layer of ash buried under the ice. "They see this layer all around our group of earthquakes and only in this area," Lough says.
"Their best guess is that it came from Mount Waesche, an existing volcano near Mt Sidley. But that is also interesting because scientists had no idea when Mount Waesche was last active, and the ash layer is sets the age of the eruption at 8,000 years ago. "

What's up down there?

The case for volcanic origin has been made. But what exactly is causing the seismic activity?
"Most mountains in Antarctica are not volcanic," Wiens says, "but most in this area are. Is it because East and West Antarctica are slowly rifting apart? We don't know exactly. But we think there is probably a hot spot in the mantle here producing magma far beneath the surface."
"People aren't really sure what causes DPLs," Lough says. "It seems to vary by volcanic complex, but most people think it's the movement of magma and other fluids that leads to pressure-induced vibrations in cracks within volcanic and hydrothermal systems."

Will the new volcano erupt?

"Definitely," Lough says. "In fact because of the radar shows a mountain beneath the ice I think it has erupted in the past, before the rumblings we recorded. Will the eruptions punch through a kilometer or more of ice above it?
The scientists calculated that an enormous eruption, one that released a thousand times more energy than the typical eruption, would be necessary to breach the ice above the volcano.
On the other hand a subglacial eruption and the accompanying heat flow will melt a lot of ice. "The volcano will create millions of gallons of water beneath the ice—many lakes full," says Wiens. This water will rush beneath the ice towards the sea and feed into the hydrological catchment of the MacAyeal Ice Stream, one of several major ice streams draining ice from Marie Byrd Land into the Ross Ice Shelf.
By lubricating the bedrock, it will speed the flow of the overlying ice, perhaps increasing the rate of ice-mass loss in West Antarctica. "We weren't expecting to find anything like this," Wiens says
This research was funded by the National Science Foundation, Division of Polar Programs.

http://www.sciencedaily.com/releases/2013/11/131117155406.htm

'Mini-Kidney' Structures Generated from Human Stem Cells for First Time

For the first time pluripotent stem cells can be made to develop into cells similar to those found in the ureteric bud, and then be further differentiated into three-dimensional structures in organ cultures.

Diseases affecting the kidneys represent a major and unsolved health issue worldwide. The kidneys rarely recover function once they are damaged by disease, highlighting the urgent need for better knowledge of kidney development and physiology.
Now, a team of researchers led by scientists at the Salk Institute for Biological Studies has developed a novel platform to study kidney diseases, opening new avenues for the future application of regenerative medicine strategies to help restore kidney function.
For the first time, the Salk researchers have generated three-dimensional kidney structures from human stem cells, opening new avenues for studying the development and diseases of the kidneys and to the discovery of new drugs that target human kidney cells. The findings were reported November 17 in Nature Cell Biology.
Scientists had created precursors of kidney cells using stem cells as recently as this past summer, but the Salk team was the first to coax human stem cells into forming three-dimensional cellular structures similar to those found in our kidneys.

"Attempts to differentiate human stem cells into renal cells have had limited success," says senior study author Juan Carlos Izpisua Belmonte, a professor in Salk's Gene Expression Laboratory and holder of the Roger Guillemin Chair. "We have developed a simple and efficient method that allows for the differentiation of human stem cells into well-organized 3D structures of the ureteric bud (UB), which later develops into the collecting duct system."

The Salk findings demonstrate for the first time that pluripotent stem cells (PSCs) -- cells capable of differentiating into the many cells and tissue types that make up the body -- can made to develop into cells similar to those found in the ureteric bud, an early developmental structure of the kidneys, and then be further differentiated into three-dimensional structures in organ cultures. UB cells form the early stages of the human urinary and reproductive organs during development and later develop into a conduit for urine drainage from the kidneys. The scientists accomplished this with both human embryonic stem cells and induced pluripotent stem cells (iPSCs), human cells from the skin that have been reprogrammed into their pluripotent state.

After generating iPSCs that demonstrated pluripotent properties and were able to differentiate into mesoderm, a germ cell layer from which the kidneys develop, the researchers made use of growth factors known to be essential during the natural development of our kidneys for the culturing of both iPSCs and embryonic stem cells. The combination of signals from these growth factors, molecules that guide the differentiation of stem cells into specific tissues, was sufficient to commit the cells toward progenitors that exhibit clear characteristics of renal cells in only four days.

The researchers then guided these cells to further differentiated into organ structures similar to those found in the ureteric bud by culturing them with kidney cells from mice. This demonstrated that the mouse cells were able to provide the appropriate developmental cues to allow human stem cells to form three-dimensional structures of the kidney.

In addition, Izpisua Belmonte's team tested their protocol on iPSCs from a patient clinically diagnosed with polycystic kidney disease (PKD), a genetic disorder characterized by multiple, fluid-filled cysts that can lead to decreased kidney function and kidney failure. They found that their methodology could produce kidney structures from patient-derived iPSCs.

Because of the many clinical manifestations of the disease, neither gene- nor antibody-based therapies are realistic approaches for treating PKD. The Salk team's technique might help circumvent this obstacle and provide a reliable platform for pharmaceutical companies and other investigators studying drug-based therapeutics for PKD and other kidney diseases.

"Our differentiation strategies represent the cornerstone of disease modeling and drug discovery studies," says lead study author Ignacio Sancho-Martinez, a research associate in Izpisua Belmonte's laboratory. "Our observations will help guide future studies on the precise cellular implications that PKD might play in the context of kidney development."

Yun Xia, Emmanuel Nivet, Ignacio Sancho-Martinez, Thomas Gallegos, Keiichiro Suzuki, Daiji Okamura, Min-Zu Wu, Ilir Dubova, Concepcion Rodriguez Esteban, Nuria Montserrat, Josep M. Campistol, Juan Carlos Izpisua Belmonte. Directed differentiation of human pluripotent cells to ureteric bud kidney progenitor-like cells. Nature Cell Biology, 2013; DOI: 10.1038/ncb2872

http://nyti.ms/1jfhgbd

Developing a Fax Machine to Copy Life on Mars

J. Craig Venter wants to detect life on Mars bring it to Earth using a device called a digital biological converter

By ANDREW POLLACK

Mojave National Preserve, Calif. - J. Craig Venter, the maverick scientist, is looking for a new world to conquer — Mars. He wants to detect life on Mars and bring it to Earth using a device called a digital biological converter, or biological teleporter.

Although the idea conjures up “Star Trek,” the analogy is not exact. The transporter on that program actually moves Captain Kirk from one location to another. Dr. Venter’s machine would merely create a copy of an organism from a distant location - more like a biological fax machine.

Still, Dr. Venter, known for his early sequencing of the human genome and for his bold proclamations, predicts the biological converter will be his next innovation and will be useful on Earth well before it could ever be deployed on the red planet.

The idea behind it, not original to him, is that the genetic code that governs life can be stored in a computer and transmitted just like any other information.

Dr. Venter’s system would determine the sequence of the DNA units in an organism’s genome and transmit that information electronically. At the distant location, the genome would be synthesized - or chemically recreated

— inserted into what amounts to a blank cell, and "booted up," as Mr. Venter puts it. In other words, the inserted DNA would take command of the cell and recreate a copy of the original organism.
To test some ideas, he and a small team of scientists from his company and from NASA spent the weekend here in the Mojave Desert, the closest stand-in they could find for the dry surface of Mars.
The biological fax is not as far-fetched as it seems. DNA sequencing and DNA synthesis are rapidly becoming faster and cheaper. For now, however, synthesizing an organism's entire genome is still generally too difficult. So the system will first be used to remotely clone individual genes, or perhaps viruses. Single-celled organisms like bacteria might come later. More complex creatures, earthly or Martian, will probably never be possible.
Dr. Venter's company, Synthetic Genomics, and his namesake nonprofit research institute have already used the technology to help develop an experimental vaccine for the H7N9 bird flu with the drug maker Novartis. Typically, when a new strain of flu virus appears, scientists must transport it to labs, which can spend weeks perfecting a strain that can be grown in eggs or animal cells to make vaccine.
But when H7N9 appeared in China in February, its genome was sequenced by scientists there and made publicly available. Within days, Dr. Venter's team had synthesized the two main genes and used them to make a vaccine strain, without having to wait for the virus to arrive from China.
Dr. Venter said Synthetic Genomics would start selling a machine next year that would automate the synthesis of genes by stringing small pieces of DNA together to make larger ones.
Eventually, he said, "we'll have a small box like a printer attached to your computer." A person with a bacterial infection might be sent the code to recreate a virus intended to kill that specific bacterium.
"We can send an antibiotic as an email," said Dr. Venter, who has outlined his ideas in a new book, "Life at the Speed of Light: From the Double Helix to the Dawn of Digital Life." Proteins might also be made, so that diabetics, for instance, could "download insulin from the Internet."
Dr. Venter, 67, has many scientific achievements — though critics deride some of them as stunts — but has had less success converting his ideas into successful businesses.
A previous company, Celera Genomics, raced the federally funded Human Genome Project to determine the complete DNA sequence in human chromosomes. The race was declared a tie in 2000, but Celera could not sustain a business selling the genomic information.
A deal worth up to $600 million that Synthetic Genomics made with Exxon Mobil in 2009 to produce biofuels using algae has been scaled back to a research project.
In 2010, Dr. Venter made headlines by creating what some considered the first man-made life. His team synthesized the genome of one species of bacterium and transplanted it into a slightly different species. The transplanted DNA took command of its new host cell, which then multiplied, passing on the synthetic genome.
Critics said Dr. Venter had not really created life, just copied it. Dr. Venter said in the interview that while he did not create life from scratch, he had created a new type of life.
"DNA is the software of life, and to get new life, you just have to change the software," he said.
Dr. Venter said his team was designing a genome that was not a copy of an existing one and trying to insert it into a host cell. "It's not alive yet," he said. "We're close."
George Church, a professor of genetics at Harvard Medical School, said there was nothing unique about Dr. Venter's work so far because others had already synthesized viruses based on DNA sequence information available on the Internet.
"Most people in the past didn't call it teleportation," he said, "but if you want to, fine."
He also questioned the utility of doing genome engineering to make a copy of something, rather than "doing genome engineering to make something new and exotic and potentially useful."
Space exploration is one area where the teleporter might be especially useful. It would be extremely costly and time-consuming to send a medicine physically to a colonist on another planet who becomes sick. And it would be difficult to send a sample from Mars back to Earth.
That is why Dr. Venter's team was camped here this weekend, about 200 miles northeast of Los Angeles. The mission was to find microbial life in the desert, determine its sequence and transmit it to Synthetic Genomics' headquarters in San Diego.
This dry run was far from the automated process that would be needed on Mars. Two scientists spent hours Friday in a bus filled with laboratory equipment, carefully scraping green microbes off rocks and preparing their DNA for sampling. The sequencing, done on a desktop machine in the bus, took 26 hours.
Chris McKay, a scientist at NASA's Ames Research Center who is working on the project, said the bus would have to be shrunk to a shoe box to make it feasible for a Mars mission, which would take many years and dollars. "By the time we get to Mars, we will have spent $500 million on that shoe box," he said.

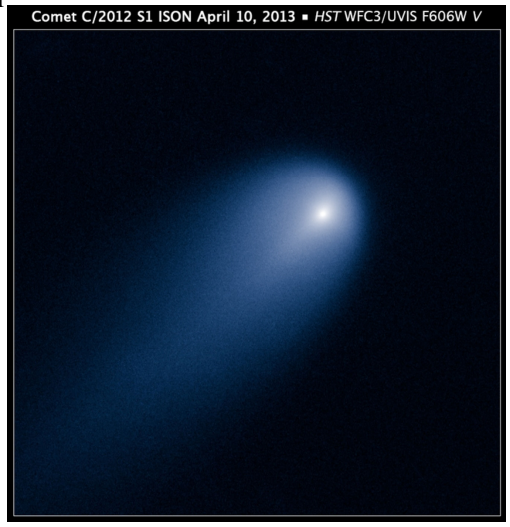
But sequencing machines are rapidly becoming smaller. A team at Harvard and M.I.T. is hoping to have a sequencer ready for use in a Mars mission departing in 2020.
Of course, all this assumes there is life on Mars to begin with and that it is based on DNA.
But that can be left for another day. Dr. Venter is known for combining business with pleasure, such as when he sailed his yacht around the world to collect ocean life for sequencing. He arrived here Friday in a pickup truck hauling three motorcycles and some libations.
After touring a site on Friday from which his scientists had collected rocks on which green cyanobacteria were growing, Dr. Venter declared: "We've had the quartz. Now, let's get a pint."
Beam us up, Craig!

http://www.nasa.gov/content/goddard/timeline-of-comet-ison-s-dangerous-journey/#.UongtVeNAs-

A Timeline Of Comet ISON's Dangerous Journey

Comet ISON, which will round the sun on Nov. 28, 2013, at a distance of just 730,000 miles from the sun, is what's known as a sungrazing comet, due to its close approach.

A comet's journey through the solar system is perilous and violent. A giant ejection of solar material from the sun could rip its tail off. Before it reaches Mars -- at some 230 million miles away from the sun -- the radiation of the sun begins to boil its water, the first step toward breaking apart. And, if it survives all this, the intense radiation and pressure as it flies near the surface of the sun could destroy it altogether.
Right now, Comet ISON is making that journey. It began its trip from the Oort cloud region of our solar system and is now travelling toward the sun. The comet will reach its closest approach to the sun on Thanksgiving Day -- Nov. 28, 2013 -- skimming just 730,000 miles above the sun's surface. If it comes around the sun without breaking up, the comet will be visible in the Northern Hemisphere with the naked eye, and from what we see now, ISON is predicted to be a particularly bright and beautiful comet.
Cataloged as C/2012 S1, Comet ISON was first spotted 585 million miles away in September 2012. This is its very first trip around the sun, which means it is still made of pristine matter from the earliest days of the solar system's formation, its top layers never having been lost by a trip near the sun. Scientists will point as many ground-based observatories as they can and at least 15 space-based assets towards the comet along the way, in order to learn more about this time capsule from when the solar system first formed.



Hubble's view of Comet ISON (C/2012 S1) on April 10, 2013. This image was taken in visible light. The blue false color was added to bring out details in the comet structure.
Image Credit: NASA, ESA, J.-Y. Li (Planetary Science Institute)

Even if the comet does not survive, tracking its journey will help scientists understand what the comet is made of, how it reacts to its environment, and what this explains about the origins of the solar system. Closer to the sun, watching how the comet and its tail interact with the vast solar atmosphere can teach scientists more about the sun itself.
NASA has initiated a Comet ISON Observing Campaign to facilitate a massive global observation campaign incorporating both space-based and ground-based telescopes and encouraging citizen scientists and both professional and amateur astronomers to participate.