

## Arctic Ocean freshwater bulge detected

### *The growth of a bulge of freshwater in the Arctic Ocean*

Jonathan Amos By Jonathan Amos Science correspondent, BBC News

UK scientists have detected a huge dome of fresh water that is developing in the western Arctic Ocean. The bulge is some 8,000 cubic km in size and has risen by about 15cm since 2002. The team thinks it may be the result of strong winds whipping up a great clockwise current in the northern polar region called the Beaufort Gyre. This would force the water together, raising sea surface height, the group tells the journal *Nature Geoscience*.

In the western Arctic, the Beaufort Gyre is driven by a permanent anti-cyclonic wind circulation. It drives the water, forcing it to pile up in the centre of gyre, and this domes the sea surface," explained lead author Dr Katharine Giles from the Centre for Polar Observation and Modelling (CPOM) at University College London. "In our data, we see the trend being biggest in the centre of the gyre and less around the edges," she told BBC News.

Dr Giles and colleagues made their discovery using radar satellites belonging to the European Space Agency (Esa). These spacecraft can measure sea-surface height even when there is widespread ice cover because they are adept at picking out the cracks, or leads, that frequently appear in the frozen floes. The data (1995-2010) indicates a significant swelling of water in the Beaufort Gyre, particularly since the early part of the 2000s. The rising trend has been running at 2cm per year.

#### Model prediction

A lot of research from buoys and other in-situ sampling had already indicated that water in this region of the Arctic had been freshening. This fresh water is coming in large part from the rivers running off the Eurasian (Russian) side of the Arctic basin.

Winds and currents have transported this fresh water around the ocean until it has been pulled into the gyre. The volume currently held in the circulation probably represents about 10% of all the fresh water in the Arctic. Of interest to future observations is what might happen if the anticyclonic winds, which have been whipping up the bulge, change behaviour.

"What we seen occurring is precisely what the climate models had predicted," said Dr Giles. "When you have clockwise rotation - the fresh water is stored. If the wind goes the other way - and that has happened in the past - then the fresh water can be pushed to the margins of the Arctic Ocean. "If the spin-up starts to spin down, the fresh water could be released. It could go to the rest of the Arctic Ocean or even leave the Arctic Ocean."

If the fresh water were to enter the North Atlantic in large volumes, the concern would be that it might disturb the currents that have such a great influence on European weather patterns. These currents draw warm waters up from the tropics, maintaining milder temperatures in winter than would ordinarily be expected at northern European latitudes.

The creation of the Beaufort Gyre bulge is not a continuous development throughout the 15-year data-set, and only becomes a dominant feature in the latter half of the study period. This may indicate a change in the relationship between the wind and the ocean in the Arctic brought about by the recent rapid decline in sea-ice cover, the CPOM team argues in its *Nature Geoscience* paper. It is possible that the wind is now imparting momentum to the water in ways that were not possible when the sea-ice was thicker and more extensive.

"The ice is now much freer to move around," said Dr Giles. "So, as the wind acts on the ice, it's able to pull the water around with it. Depending on how ridged the surface of ice is or how smooth the bottom of the ice is - this will all affect the drag on the water. If you have more leads, this also might provide more vertical ice surfaces for the wind to blow against."

One consequence of less sea-ice in the region is the possibility that winds could now initiate greater mixing of the different layers in the Arctic Ocean. Scientists are aware that there is a lot of warm water at depth.

At present, this deep water's energy is unable to influence the sea-ice because of a buffer of colder, less dense water lying between it and the floes above. But if this warm water were made to well up because of wind-driven changes at the surface, it could further accelerate the loss of seasonal ice cover.

The CPOM team is now investigating the likelihood of this happening with Cryosat-2, Esa's first radar satellite dedicated to the study of the polar regions. "We now have the means to measure not only the ice

Arctic Ocean currents



thickness but also to monitor how the ocean under the ice is changing," says Dr Seymour Laxon, director of CPOM and co-author of the study, "and with CryoSat-2, we can now do so over the entire Arctic Ocean."

[http://www.eurekalert.org/pub\\_releases/2012-01/bawh-uo012312.php](http://www.eurekalert.org/pub_releases/2012-01/bawh-uo012312.php)

### **Use of iodinated contrast media in imaging procedures appears to affect thyroid function** ***Exposure to iodinated contrast media during imaging procedures is associated with changes in thyroid function, and increased risk of developing hyperthyroidism***

CHICAGO—Exposure to iodinated contrast media during imaging procedures is associated with changes in thyroid function, and increased risk of developing hyperthyroidism, according to a report in the January 23 issue of Archives of Internal Medicine, one of the JAMA/Archives journals.

"Iodinated contrast media (ICM) are commonly administered pharmaceutical agents," the authors write as background information. ICM are frequently used in scans and imaging procedures such as cardiac catheterization and computed tomography (CT scans). "Although certain complications of ICM (e.g., contrast-induced nephropathy) have been extensively studied, there has been little examination of the effect of ICM on thyroid function."

Connie M. Rhee, MD, Brigham and Women's Hospital (BWH) Renal Division and colleagues from Massachusetts General Hospital examined data from patients treated between January 1990 and June 2010 who did not have preexisting hyperthyroidism or hypothyroidism. Patients were matched with euthyroid (normal thyroid function) controls, and exposure to iodinated contrast media was assessed using claims data.

A total of 178 patients with incident hyperthyroidism and 213 patients with incident hypothyroidism were matched to 655 and 779 euthyroid persons, respectively. The authors found that iodinated contrast media exposure was associated with incident hyperthyroidism, but no statistically significant association was found with incident hypothyroidism.

Secondary analysis indicated an association between iodinated contrast media exposure and incident overt (clinical; diagnosed based on characteristic clinical features) hypothyroidism and incident overt (clinical) hyperthyroidism.

"In summary, these data support association between ICM exposure and incident hyperthyroidism, incident overt hyperthyroidism and incident overt hypothyroidism," the authors conclude. "Given the pervasive use of ICM in contemporary practice and the known sequelae of thyroid functional derangements, further studies are needed to confirm and evaluate generalizability of these findings, to establish causality and to explore mechanisms."

#### ***Invited Commentary: Iodine-Induced Thyroid Dysfunction***

In an accompanying invited commentary, Elizabeth N. Pearce, MD, MSc, of Boston University School of Medicine writes that Rhee et al "describe significant associations between contrast exposure and the development of hyperthyroidism. While no overall association exists between contrast exposure and all forms of hypothyroidism, an association was noted when cases were restricted to those with overt hypothyroidism."

"These data represent an important contribution to our knowledge about a clinically relevant and understudied area," Pearce writes. "Rhee et al have demonstrated that a relatively large proportion of individuals who developed iodine-induced thyroid dysfunction were not known to have underlying risk factors. Therefore, patients who may be particularly unable to tolerate thyroid dysfunction, such as those with underlying unstable cardiovascular disease, are also good candidates for monitoring of thyroid function after iodine exposure."

*This research was supported by the National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health; Veracyte, Inc.; and Asuragen, Inc.*

[http://www.eurekalert.org/pub\\_releases/2012-01/icl-mme012312.php](http://www.eurekalert.org/pub_releases/2012-01/icl-mme012312.php)

### **Magic mushrooms' effects illuminated in brain imaging studies** ***Brain scans of people under the influence of the psilocybin, the active ingredient in magic mushrooms, have given scientists the most detailed picture to date of how psychedelic drugs work.***

The findings of two studies being published in scientific journals this week identify areas of the brain where activity is suppressed by psilocybin and suggest that it helps people to experience memories more vividly.

In the first study, published today in Proceedings of the National Academy of Sciences (PNAS), 30 healthy volunteers had psilocybin infused into their blood while inside magnetic resonance imaging (MRI) scanners, which measure changes in brain activity. The scans showed that activity decreased in "hub" regions of the brain – areas that are especially well-connected with other areas.

The second study, due to be published online by the British Journal of Psychiatry on Thursday, found that psilocybin enhanced volunteers' recollections of personal memories, which the researchers suggest could make it useful as an adjunct to psychotherapy.

Professor David Nutt, from the Department of Medicine at Imperial College London, the senior author of both studies, said: "Psychedelics are thought of as 'mind-expanding' drugs so it has commonly been assumed that they work by increasing brain activity, but surprisingly, we found that psilocybin actually caused activity to decrease in areas that have the densest connections with other areas. These hubs constrain our experience of the world and keep it orderly. We now know that deactivating these regions leads to a state in which the world is experienced as strange."

The intensity of the effects reported by the participants, including visions of geometric patterns, unusual bodily sensations and altered sense of space and time, correlated with a decrease in oxygenation and blood flow in certain parts of the brain. The function of these areas, the medial prefrontal cortex (mPFC) and the posterior cingulate cortex (PCC), is the subject of debate among neuroscientists, but the PCC is proposed to have a role in consciousness and self-identity. The mPFC is known to be hyperactive in depression, so psilocybin's action on this area could be responsible for some antidepressant effects that have been reported. Similarly, psilocybin reduced blood flow in the hypothalamus, where blood flow is increased during cluster headaches, perhaps explaining why some sufferers have said symptoms improved under psilocybin.

In the British Journal of Psychiatry study 10 volunteers viewed written cues that prompted them to think about memories associated with strong positive emotions while inside the brain scanner. The participants rated their recollections as being more vivid after taking psilocybin compared with a placebo, and with psilocybin there was increased activity in areas of the brain that process vision and other sensory information. Participants were also asked to rate changes in their emotional wellbeing two weeks after taking the psilocybin and placebo. Their ratings of memory vividness under the drug showed a significant positive correlation with their wellbeing two weeks afterwards. In a previous study of 12 people in 2011, researchers found that people with anxiety who were given a single psilocybin treatment had decreased depression scores six months later.

Dr Robin Carhart-Harris, from the Department of Medicine at Imperial College London, the first author of both papers, said: "Psilocybin was used extensively in psychotherapy in the 1950s, but the biological rationale for its use has not been properly investigated until now. Our findings support the idea that psilocybin facilitates access to personal memories and emotions.

"Previous studies have suggested that psilocybin can improve people's sense of emotional wellbeing and even reduce depression in people with anxiety. This is consistent with our finding that psilocybin decreases mPFC activity, as many effective depression treatments do. The effects need to be investigated further, and ours was only a small study, but we are interested in exploring psilocybin's potential as a therapeutic tool."

The researchers acknowledged that because the participants in this study had volunteered after having previous experience of psychedelics, they may have held prior assumptions about the drugs which could have contributed to the positive memory rating and the reports of improved wellbeing in the follow-up.

Functional MRI measures brain activity indirectly by mapping blood flow or the oxygen levels in the blood. When an area becomes more active, it uses more glucose, but generates energy in rapid chemical reactions that do not use oxygen. Consequently, blood flow increases but oxygen consumption does not, resulting in a higher concentration of oxygen in blood in the local veins.

In the PNAS study, the volunteers were split into two groups, each studied using a different type of fMRI: 15 were scanned using arterial spin labelling (ASL) perfusion fMRI, which measures blood flow, and 15 using blood-oxygen level-dependent (BOLD) fMRI. The two modalities produced similar results, strongly suggesting that the observed effects were genuine.

*The studies were carried out with a Home Office licence for storing and handling a schedule 1 drug and were approved by NHS research ethics committees. All the volunteers were mentally and physically healthy and had taken hallucinogenic drugs previously without any adverse response. The research involved scientists from Imperial, the University of Bristol and Cardiff University and was funded by the Beckley Foundation, the Neuropsychoanalysis Foundation, Multidisciplinary Association for Psychedelic Studies, and the Heffter Research Institute.*

[http://www.eurekalert.org/pub\\_releases/2012-01/uhn-pcs012312.php](http://www.eurekalert.org/pub_releases/2012-01/uhn-pcs012312.php)

### **Prostate cancer study proves drug delays disease progression**

***For men diagnosed with low-risk, localized prostate cancer, being treated with the drug dutasteride delays disease progression and initiating active treatment, and also reduces anxiety***  
TORONTO – For men diagnosed with low-risk, localized prostate cancer, being treated with the drug dutasteride ("Avodart") delays disease progression and initiating active treatment, and also reduces anxiety, show the



results of a three-year international clinical trial led by Dr. Neil Fleshner, Head of the Division of Urology, University Health Network (UHN).

The findings are published online today in *The Lancet*. "The results prove that using active surveillance plus dutasteride is a viable, safe and effective treatment option for men who often undergo aggressive local treatment despite low risk of dying from the disease," says Dr. Fleshner, a surgical oncologist in UHN's Princess Margaret Cancer Program and Professor of Surgery at the University of Toronto. Dr. Fleshner also holds the Love Chair in Prostate Cancer Prevention Research.

"This is very good news for men with low-risk disease because aggressive treatment can have a major impact on their quality of life, with risks of impotence and incontinence," says Dr. Fleshner.

The three-year clinical trial enrolled 302 men between the ages of 48 and 82 diagnosed with low-risk localized prostate cancer and regularly monitored for clinical changes – a treatment option called "active surveillance". In the trial – known as REDEEM (REduction by Dutasteride of clinical progression Events in Expectant Management of prostate cancer) – participants were randomized 1:1 to receive dutasteride or a matching placebo daily. The men also underwent biopsies at 1.5 and three years.

The study showed a significant delay in disease progression in the men treated with dutasteride - 38% compared with 48% who received the placebo. As well, the final biopsies showed the men treated with the drug were less likely to have cancer detected - 36% compared with 23%.

"This is the first study to show that a 5 $\alpha$ -reductase inhibitor such as dutasteride reduces the need for aggressive treatment in low-risk disease," says Dr. Fleshner. "The drug, currently commonly used to treat enlarged prostate, works by inhibiting the male sex hormone that causes the enlargement in the first place."

Dr. Fleshner says a small percentage of men reported drug-related side effects including sexual difficulty with either desire or erections (5%), or breast tenderness or enlargement (3%). "It's important to realize that these drugs have been around for almost 20 years in clinical practice to treat enlarged prostates and so we have a wealth of knowledge about their side effects, which are reversible if the drug is stopped."

Participants were also assessed for cancer-related anxiety and the men on dutasteride reported feeling much less anxious because their biopsies and PSA values improved, adds Dr. Fleshner. (PSA – or prostate-specific antigen – is a blood test used to help diagnose prostate cancer.) The Canadian Cancer Society estimates 25,500 new cases of prostate cancer will be diagnosed this year and that 4,100 men will die from the disease.

*The clinical research was funded by GlaxoSmithKline. Dr. Fleshner is affiliated with The Campbell Family Cancer Research Institute at PMH and his research is also supported by The Princess Margaret Hospital Foundation.*

[http://www.eurekalert.org/pub\\_releases/2012-01/uoic-cim012312.php](http://www.eurekalert.org/pub_releases/2012-01/uoic-cim012312.php)

### **Compounds in mate tea induce death in colon cancer cells**

#### ***Could preventing colon cancer be as simple as developing a taste for yerba mate tea?***

URBANA – In a recent University of Illinois study, scientists showed that human colon cancer cells die when they are exposed to the approximate number of bioactive compounds present in one cup of this brew, which has long been consumed in South America for its medicinal properties. "The caffeine derivatives in mate tea not only induced death in human colon cancer cells, they also reduced important markers of inflammation," said Elvira de Mejia, a U of I associate professor of food chemistry and food toxicology.

That's important because inflammation can trigger the steps of cancer progression, she said.

In the in vitro study, de Mejia and former graduate student Sirima Puangraphant isolated, purified, and then treated human colon cancer cells with caffeoylquinic acid (CQA) derivatives from mate tea. As the scientists increased the CQA concentration, cancer cells died as a result of apoptosis. "Put simply, the cancer cell self-destructs because its DNA has been damaged," she said. The ability to induce apoptosis, or cell death, is a promising tactic for therapeutic interventions in all types of cancer, she said.

de Mejia said they were able to identify the mechanism that led to cell death. Certain CQA derivatives dramatically decreased several markers of inflammation, including NF-kappa-B, which regulates many genes that affect the process through the production of important enzymes. Ultimately cancer cells died with the induction of two specific enzymes, caspase-3 and caspase-8, de Mejia said.

"If we can reduce the activity of NF-kappa-B, the important marker that links inflammation and cancer, we'll be better able to control the transformation of normal cells to cancer cells," she added.

The results of the study strongly suggest that the caffeine derivatives in mate tea have potential as anti-cancer agents and could also be helpful in other diseases associated with inflammation, she said.

But, because the colon and its microflora play a major role in the absorption and metabolism of caffeine-related compounds, the anti-inflammatory and anti-cancer effects of mate tea may be most useful in the colon.

"We believe there's ample evidence to support drinking mate tea for its bioactive benefits, especially if you have reason to be concerned about colon cancer. Mate tea bags are available in health food stores and are increasingly available in large supermarkets," she added.

The scientists have already completed and will soon publish the results of a study that compares the development of colon cancer in rats that drank mate tea as their only source of water with a control group that drank only water.

<http://medicalxpress.com/news/2012-01-pot-based-prescription-drug-fda.html>

### **Pot-based prescription drug looks for FDA OK**

#### ***Additional medicines derived from or inspired by the cannabis plant itself could soon be making their way to pharmacy shelves***

A quarter-century after the U.S. Food and Drug Administration approved the first prescription drugs based on the main psychoactive ingredient in marijuana, additional medicines derived from or inspired by the cannabis plant itself could soon be making their way to pharmacy shelves, according to drug companies, small biotech firms and university scientists.

A British company, GW Pharma, is in advanced clinical trials for the world's first pharmaceutical developed from raw marijuana instead of synthetic equivalents- a mouth spray it hopes to market in the U.S. as a treatment for cancer pain. And it hopes to see FDA approval by the end of 2013.

Sativex contains marijuana's two best known components - delta 9-THC and cannabidiol - and already has been approved in Canada, New Zealand and eight European countries for a different usage, relieving muscle spasms associated with multiple sclerosis.



***In this undated photo provided by GW Pharmaceuticals, a sample of the drug Sativex is shown. Sativex contains marijuana's two best known components\_delta 9-THC and cannabidiol\_and already has been approved in Canada, New Zealand and eight European countries for relieving muscle spasms associated with multiple sclerosis. GW Pharmaceuticals***

FDA approval would represent an important milestone in the nation's often uneasy relationship with marijuana, which 16 states and the District of Columbia already allow residents to use legally with doctors' recommendations. The U.S. Drug Enforcement Administration categorizes pot as a dangerous drug with no medical value, but the availability of a chemically similar prescription drug could increase pressure on the federal government to revisit its position and encourage other drug companies to follow in GW Pharma's footsteps.

"There is a real disconnect between what the public seems to be demanding and what the states have pushed for and what the market is providing," said Aron Lichtman, a Virginia Commonwealth University pharmacology professor and president of the International Cannabinoid Research Society. "It seems to me a company with a great deal of vision would say, 'If there is this demand and need, we could develop a drug that will help people and we will make a lot of money.'"

Possessing marijuana still is illegal in the United Kingdom, but about a decade ago GW Pharma's founder, Dr. Geoffrey Guy, received permission to grow it to develop a prescription drug. Guy proposed the idea at a scientific conference that heard anecdotal evidence that pot provides relief to multiple sclerosis patients, and the British government welcomed it as a potential way "to draw a clear line between recreational and medicinal use," company spokesman Mark Rogerson said.

In addition to exploring new applications for Sativex, the company is developing drugs with different cannabis formulations. "We were the first ones to charge forward and a lot of people were watching to see what happened to us," Rogerson said. "I think we are clearly past that stage."

In 1985, the FDA approved two drug capsules containing synthetic THC, Marinol and Cesamet, to ease side-effects of chemotherapy in cancer patients. The agency eventually allowed Marinol to be prescribed to stimulate the appetites of AIDS patients. The drug's patent expired last year, and other U.S. companies have been developing formulations that could be administered through dissolving pills, creams and skin patches and perhaps be used for other ailments.

Doctors and multiple sclerosis patients are cautiously optimistic about Sativex. The National Multiple Sclerosis Society has not endorsed marijuana use by patients, but the organization is sponsoring a study by a University of California, Davis neurologist to determine how smoking marijuana compares to Marinol in addressing painful muscle spasms.

"The cannabinoids and marijuana will, eventually, likely be part of the clinician's armamentarium, if they are shown to be clinically beneficial," said Timothy Coetzee, the society's chief research officer. "The big unknown in my mind is whether they are clearly beneficial."

Opponents and supporters of crude marijuana's effectiveness generally agree that more research is needed. And marijuana advocates fear that the government will use any new prescription products to justify a continued prohibition on marijuana use. .

"To the extent that companies can produce effective medication that utilizes the components of the plant, that's great. But that should not be the exclusive access for people who want to be able to use medical marijuana," Americans for Safe Access spokesman Kris Hermes said. "That's the race against time, in terms of how quickly can we put pressure on the federal government to recognize the plant has medical use versus the government coming out with the magic bullet pharmaceutical pill."

Interest in new and better marijuana-based medicines has been building since the discovery in the late 1980s and 1990s that mammals have receptors in their central nervous systems, several organs and immune systems for the chemicals in botanical cannabis and that their bodies also produce natural cannabinoids that work on the same receptors.

One of the first drugs to build on those breakthroughs was an anti-obesity medication that blocked the same chemical receptors that trigger the munchies in pot smokers. Under the name Acomplia, it was approved throughout Europe and heralded as a possible new treatment for smoking cessation and metabolic disorders that can lead to heart attacks.

The FDA was reviewing its safety as a diet drug when follow-up studies showed that people taking the drug were at heightened risk of suicide and other psychiatric disorders. French manufacturer Sanofi-Aventis, pulled it from the market in late 2008.

Given that drug companies already were reluctant "to touch anything that is THC-like with a 10-foot-pole," the setback had a chilling effect on cannabinoid drug development, according to Lichtman. "Big companies like Merck and Pfizer were developing their own versions (of Acomplia), so all of those programs they spent millions and millions on just went away..." he said.

But scientists and drug companies that are exploring pot's promise predict the path will ultimately be successful, if long and littered with setbacks.

One is Alexandros Makriyannis, director of the Center for Drug Discovery at Northeastern University and founder of a small Boston company that hopes to market synthetic pain products that are chemically unrelated to marijuana, but work similarly on the body or inhibit the cannabinoid receptors. He also has been working on a compound that functions like the failed Acomplia but without the depressive effects.

"I think within five to 10 years, we should get something," Makriyannis said.

<http://www.scientificamerican.com/article.cfm?id=toyota-finds-way-to-avoid-using-rar>

### **Toyota Finds Way to Make Hybrid and Electric Vehicles without Rare Earth Elements**

***Toyota could bring the technology to market in two years if the price of rare earths does not come down, according to one source***

**Reporting by Chang-Ran Kim and Risa Maeda; Editing by Kim Coghill**

TOKYO (Reuters) - Toyota Motor Corp has developed a way to make hybrid and electric vehicles without the use of expensive rare earth metals, in which China has a near-monopoly, Japan's Kyodo News reported.

Toyota, the world's top producer of fuel-saving hybrid cars such as the Prius, could bring the technology to market in two years if the price of rare earths does not come down, Kyodo said, citing a source familiar with the matter.

A Toyota spokeswoman said the company continues to research ways to reduce rare earth usage and has no time frame yet for commercialization.

Rare earth metals like neodymium and dysprosium are used in the powerful magnets in motors that power hybrid and electric cars, and demand is expected to surge as more of the environmentally friendly cars hit the market.

China produces more than 95 percent of the world's rare earth metals. Its efforts to limit exports, citing resource depletion and environmental degradation, have alarmed its customers and trading partners and have sent prices soaring.

Japan accounts for a third of global rare earth demand and is aiming to cut consumption, providing subsidies for recycling and investing in new ways to limit their use.

<http://www.scientificamerican.com/article.cfm?id=the-stuttering-brain>

## Stuttering Reflects Irregularities in Brain Setup

***A stutter indicates a massive change in brain wiring that affects more than just speech***

By Carrie Arnold | Monday, January 23, 2012 | 5

Put on a pair of headphones and turn up the volume so that you can't even hear yourself speak. For those who stutter, this is when the magic happens. Without the ability to hear their own voice, people with this speech impediment no longer stumble over their words—as was recently portrayed in the movie *The King's Speech*. This simple trick works because of the unusual way the brain of people who stutter is organized—a neural setup that affects other actions besides speech, according to a new study.

Normal speech requires the brain to control movement of the mouth and vocal chords using the sound of the speaker's own voice as a guide. This integration of movement and hearing typically happens in the brain's left hemisphere, in a region of the brain known as the premotor cortex. In those who stutter, however, the process occurs in the right hemisphere—probably because of a slight defect on the left side, according to past brain-imaging studies. Singing requires a similar integration of aural input and motor control, but the processing typically occurs in the right hemisphere, which may explain why those who stutter can sing as well as anyone else. (In a related vein, *The King's Speech* also mentioned the common belief that people who stutter are often left-handed, but studies have found no such link.)

In the new study, published in the September issue of *Cortex*, re-searchers found that the unusual neural organization underlying a stutter also includes motor tasks completely unrelated to speech. A group of 30 adults, half of whom stuttered and half of whom did not, tapped a finger in time to a metronome. When the scientists interfered with the function of their left hemisphere using transcranial magnetic stimulation, a non-invasive technique that temporarily dampens brain activity, nonstutterers found themselves unable to tap in time—but those who stuttered were unaffected. When the researchers interfered with the right hemisphere, the results were reversed: the stuttering group was impaired, and the nonstutterers were fine.

According to lead author Martin Sommer, a neuroscientist at the University of Göttingen in Germany, the results suggest that the left-hemisphere defect underlying a stutter causes trouble with sensory integration in general, rather than specifically speech-related problems as was historically thought. "Like in stroke patients, the right side seems to jump in and compensate," Sommer explains. But that part of the brain did not evolve to handle those tasks, so problems—such as a stutter—can emerge.

<http://www.sciencedaily.com/releases/2012/01/120123115520.htm>

## Mighty Mesh: Extracellular Matrix Identified as Source of Spreading in Biofilms

***New research at Harvard explains how bacterial biofilms expand to form slimy mats on teeth, pipes, surgical instruments, and crops.***

ScienceDaily - Through experiment and mathematical analysis, researchers have shown that the extracellular matrix (ECM), a mesh of proteins and sugars that can form outside bacterial cells, creates osmotic pressure that forces biofilms to swell and spread. The ECM mechanism is so powerful that it can increase the radius of some biofilms five-fold within 24 hours. The results have been published in the *Proceedings of the National Academy of Science*.

Biofilms, large colonies of bacteria that adhere to surfaces, can be harmful in a wide range of settings, resulting in tooth decay, hospital infections, agricultural damage, and corrosion. Finding ways to control or eliminate biofilms is a priority for many industries. In order for a biofilm to grow, a group of bacterial cells must first adhere to a surface and then proliferate and spread. When a vast number of cells are present, this can translate into the creation of a filmy surface spanning several meters.

*Top view of a Bacillus subtilis colony in conditions where extracellular matrix is produced, leading to biofilm formation. (Credit: Photo courtesy of Hera Vlamakis.)*

"Our work challenges the common picture of biofilms as sedentary communities by showing how cells in a biofilm cooperate to colonize surfaces," says lead author Agnese Seminara, a research associate at the Harvard School of Engineering and Applied Sciences (SEAS).

Several types of biofilms have been characterized based on composition and antibiotic resistance, but until now it has not been clear what roles the whip-like flagella and the ECM play in the outward movement of cells.





While the presence of a flagellum has traditionally been associated with greater movement capability, the new research has found that a flagellum actually confers little advantage in the formation of biofilms. In the Harvard study, mutant bacteria lacking flagella were able to spread at almost the same rate as the wild-type (natural) ones. Mutants that could not secrete the ECM, however, showed stunted growth.

The team of physicists, mathematicians, chemists, and biologists examined the formation of biofilms in *Bacillus subtilis*, a type of rod-shaped bacteria often found in soil. Their focus on this particular species was led by Roberto Kolter, Professor of Microbiology and Immunobiology at Harvard Medical School, an expert on biofilms and the genomics of *B. subtilis*.

"This project establishes a link between the phenotype, the physically observable traits of biofilm growth, and the genetic underpinning that allows spreading to happen in *B. subtilis*," notes co-principal investigator Michael Brenner, the Glover Professor of Applied Mathematics and Applied Physics at SEAS.

The researchers had speculated about a possible connection between the biofilm's quest for nutrition and the process of spreading. Because biofilms absorb nutrients through their exposed surface area, they can only swell vertically to a certain point before the surface-area-to-volume ratio makes it impossible to adequately nourish every cell. At this point, the biofilm must begin to spread outward so that the surface area increases along with the number of cells.

The ECM, a complex mesh of proteins, sugars, and other components outside of the individual cells, holds the key to one aspect of this movement: it apparently increases osmotic pressure within the biofilm.

In response to the increased pressure, the biofilm immediately absorbs water from its surroundings, causing the entire mass to swell upward. The final change in the shape of the biofilm is due to a combination of this swelling and the horizontal spreading that follows.

Seminara and Brenner created a mathematical model that mirrored many of the team's physical observations. The model supported the experimental observations; by considering the relationship between swelling and spreading, they were able to find the "critical" time at which horizontal outward motion begins.

"This work is led by theoretical predictions which were tested by experiment and proved to be correct," reflects co-principal investigator David Weitz, Mallinckrodt Professor of Physics and Applied Physics at SEAS and Co-Director of the BASF Advanced Research Initiative at Harvard. "The results also demonstrate how simple physical principles can provide considerable insight into the behavior of biofilms."

The motion of biofilms represents only a small part of a complex subject. Further research will investigate how biofilms adapt and possibly manipulate their environment. The ultimate goal is to alter biofilms' behavior to minimize their harmful effects.

"The natural question at this point is: do cells actively control biofilm expansion and can they direct it toward desired targets?" says Seminara. "This is a first step toward understanding the striking evolutionary success of these ubiquitous organisms, and it may open the way to unconventional methods of biofilm control." *Seminara, Brenner, and Weitz worked with Thomas Angelini, an Assistant Professor at the University of Florida and a former member of the Weitz lab; James Wilking, a SEAS research associate in applied chemistry; Senan Ebrahim '12, an undergraduate at Harvard; and Hera Vlamakis and Roberto Kolter of Harvard Medical School.*

*The research was supported by the BASF Advanced Research Initiative at Harvard, the 7th European Community Framework Programme, the National Institutes of Health, and the Harvard Materials Research Science and Engineering Center, which is supported by the National Science Foundation.*

<http://www.pasthorizonspr.com/index.php/archives/01/2012/why-men-exhibit-warrior-tendencies>

### **Why men exhibit warrior tendencies**

#### ***Men are biologically programmed to be warriors because of our deep ancestral history of inter-tribal war and conflict***

Following a review of current academic literature by psychologists, biologists and anthropologists, the study concludes that men are biologically programmed to be warriors because of our deep ancestral history of inter-tribal war and conflict.

Meanwhile, females have evolved a response to threats from male outsiders where they 'tend and befriend' as a way of protecting their offspring, suggests the study.

In a paper published in the journal *Philosophical Transactions of the Royal Society B*, researchers from Oxford, VU Amsterdam, and Michigan universities argue that although these responses may have evolved as a way of coping with threats posed by outsiders, they 'might not be functional in modern times and are often counter-productive'.

The researchers suggest that the study may help us to understand the evolutionary and biological roots of the aggressive behaviour between 'tribal' factions in today's world. The study points out that in modern cultures,



this 'evolved' behaviour can be observed in large-scale conflicts between countries and nations as well as in relatively small-scale skirmishes, such as between supporters of rival football teams or street gangs.

Professor Mark van Vugt, Research Fellow at the Institute for Cognitive and Evolutionary Anthropology (ICEA) at the University of Oxford, said: "A solution to conflict, which is an all too common problem in societies today, remains elusive. One reason for this might be the difficulty we have in changing our mindset, which has evolved over thousands of years. Our review of the academic literature suggests that the human mind is shaped in a way that tends to perpetuate conflict with "outsiders".

"Our research finds that conflict between rival groups of men has presented opportunities to gain access to mates, territory and increased status. We believe this has resulted through natural selection in an evolved psychology amongst men to initiate and display acts of intergroup aggression."

The study examines current literature by evolutionary anthropologists that supports what is known as the 'male warrior hypothesis'. It finds that self-report surveys consistently show that men are, on average, more likely than women to demonstrate prejudice and discrimination against men who are viewed as outsiders – and this is true across different cultures and times.

The study cites research showing that men prefer group-based social hierarchies and are more likely to strongly identify with their own group than women. Studies that show how men are more motivated to work closely together within their group if they are competing against another group are also cited.

Current academic literature demonstrates how men across all cultures have been more likely than women to initiate violence in order to win the fight, the study concludes. It also says the benefits for the males of this strategy, amongst humans and among other species, are that they gain more females in the group at their disposal, which results in them being more likely to successfully reproduce.

Professor Van Vugt said: "We see similar behaviour in chimpanzees. For example, the males continuously monitor the borders of their territory. If a female from another group comes along, she may be persuaded to emigrate to his group. When a male strays too far, however, he is likely to be brutally beaten and possibly killed." *Source: University of Oxford*

<http://medicalxpress.com/news/2012-01-cholera-outbreaks-months-advance.html>

## **Researchers develop computer model that can predict cholera outbreaks 11 months in advance**

### ***A new University of Michigan computer model of disease transmission in space and time can predict cholera outbreaks in Bangladesh up to 11 months in advance***

Medical Xpress - A new University of Michigan computer model of disease transmission in space and time can predict cholera outbreaks in Bangladesh up to 11 months in advance, providing an early warning system that could help public health officials there. The research team's latest findings were published online Monday in the Proceedings of the National Academy of Sciences.

The new forecast model applies specifically to the capital city of Dhaka and incorporates data on both year-to-year climate variability and the spatial location of cholera cases at the district level. This allowed the researchers to study both local variation in disease transmission and response to climate factors within the megacity of 14 million people.

UM theoretical ecologists Mercedes Pascual and Aaron King, along with former UM postdoctoral researcher Robert Reiner and other colleagues, found evidence for a climate-sensitive urban core in Dhaka that acts to propagate cholera risk to the rest of the city. By including those findings in their model, the researchers were able to increase its accuracy and extend its forecasting ability far beyond previous disease models for the city.

Earlier models had prediction lead times of a month or less — too short to be of use in an early warning systems. The longer lead time of the new model will help inform decisions about treatment preparedness, vaccination and other disease-prevention strategies.

"What is new here is that we have analyzed the data in space and time by considering the cholera cases at the level of districts within the city," said Pascual, the Rosemary Grant Collegiate Professor of Ecology and Evolutionary Biology. "Previous analyses here and in other places have aggregated the cases at the level of the whole city. This enables us to provide early warnings that are useful because they can help hospitals prepare for the effective treatment of large numbers of people."

In research done over the past decade, Pascual and her colleagues have found evidence that a phenomenon known as the El Niño-Southern Oscillation, a major source of climate variability from year to year, influences cycles of cholera in Bangladesh. Outbreaks increase after warm ENSO events and decrease following cold ENSO episodes.

The team also showed that the coupling between ENSO climate variability and cholera outbreaks has become stronger in recent decades, compared to the first part of the 20th century.

Cholera, a serious health problem in many parts of the world, results from a bacterial infection. The bacterium takes up residence in the intestines, causing vomiting and diarrhea, which can lead to severe dehydration and death if patients are not promptly treated. Sanitary conditions and access to clean water are the main determinants of disease risk for cholera and other fecal-oral diseases. Those risk factors, in turn, are linked to the intensity of annual monsoon flooding, which varies greatly from place to place in Dhaka.

After analyzing cholera case data collected over many years by the International Centre for Diarrheal Disease Research in Dhaka, the UM-led research team found evidence for two distinct regions within Dhaka: one comprising the older, central districts and another in the newer urban periphery.

Cholera attack rates in the core districts are higher than in the periphery. The core districts are largely those with the highest population density, the highest number of the poorest quality housing, and the greatest reliance on municipal tap water, as opposed to wells.

The core districts are also most sensitive to ENSO-related climate variability, including flooding. The researchers found that flooding correlates strongly with the mid-monsoon-season cholera level in the core regions of the city, but is essentially uncorrelated within the peripheral regions.

And the flooding-induced breakdown of sanitary conditions is likely the principal mediator of climate's effect on the post-monsoon peak in cholera cases in the core districts of Dhaka, the authors wrote. "We can infer that the spatial heterogeneity we have identified reflects differences in sanitary and socioeconomic conditions that affect susceptibility to the disease," Pascual said. This differs from the current emphasis placed in the literature on the ecology of the pathogen, the bacterium *Vibrio cholerae*, in its environmental aquatic reservoir, she said.

"Our results underscore instead the importance of well-known risk factors for the small-scale transmission of diarrheal diseases, including cholera, that have been somewhat neglected in the recent ecological/climate literature on cholera, and support a role of these same factors in the response of the disease to climate forcing," she said.

Pascual said she is working with Bangladesh researchers to implement the new warning system in Dhaka. Low-lying Bangladesh is widely recognized as one of the countries most vulnerable to climate change. Natural hazards that come from increased rainfall, rising sea levels and tropical cyclones are expected to increase as the climate changes. At the same time, Dhaka's population is expected to double over the next 25 years.

*More information:* The first author of the PNAS paper is Reiner, who is now at the University of California, Davis. Other authors, in addition to Pascual and King, are Michael Emch of the University of North Carolina, and Mohammad Yunus and A.S.G. Faruque, both from the International Centre for Diarrheal Disease Research in Dhaka. The research was supported by the U.S. National Oceanic and Atmospheric Administration. Current donors providing unrestricted support to the International Centre for Diarrheal Disease Research include the government of the People's Republic of Bangladesh, the Canadian International Development Agency, the Swedish International Development Cooperative Agency and the Department of International Development, United Kingdom. Provided by University of Michigan

[http://www.eurekalert.org/pub\\_releases/2012-01/f-sf-ccp012412.php](http://www.eurekalert.org/pub_releases/2012-01/f-sf-ccp012412.php)

## **Cocoa could prevent intestinal pathologies such as colon cancer**

### ***Eating cocoa can help to prevent intestinal complaints linked to oxidative stress***

A new study on living animals has shown for the first time that eating cocoa (the raw material in chocolate) can help to prevent intestinal complaints linked to oxidative stress, including colon carcinogenesis onset caused by chemical substances. The growing interest amongst the scientific community to identify those foods capable of preventing diseases has now categorized cocoa as a 'superfood'. It has been recognised as an excellent source of phytochemical compounds, which offer potential health benefits.

Headed by scientists from the Institute of Food Science and Technology and Nutrition (ICTAN) and recently published in the *Molecular Nutrition & Food Research* journal, the new study supports this idea and upholds that cacao consumption helps to prevent intestinal complaints linked to oxidative stress, such as the onset of chemically induced colon carcinogenesis.

"Being exposed to different poisons in the diet like toxins, mutagens and procarcinogens, the intestinal mucus is very susceptible to pathologies," explains María Ángeles Martín Arribas, lead author of the study and researcher at ICTAN. She adds that "foods like cocoa, which is rich in polyphenols, seems to play an important role in protecting against disease."

The study on live animals (rats) has for the first time confirmed the potential protection effect that flavonoids in cocoa have against colon cancer onset. For eight weeks the authors of the study fed the rats with a cocoa-rich (12%) diet and carcinogenesis was induced.

## Possible protection

Doctor Martín Arribas outlines that "four weeks after being administered with the chemical compound azoxymethane (AOM), intestinal mucus from premalignant neoplastic lesions appeared. These lesions are called 'aberrant crypt foci' and are considered to be good markers of colon cancer pathogenesis."

The results of the study showed that the rats fed a cocoa-rich diet had a significantly reduced number of aberrant crypts in the colon induced by the carcinogen. Likewise, this sample saw an improvement in their endogenous antioxidant defences and a decrease in the markers of oxidative damage induced by the toxic compound in this cell.

The researchers conclude that the protection effect of cocoa can stop cell-signalling pathways involved in cell proliferation and, therefore, subsequent neoplasia and tumour formation. Lastly, the animals fed with the cocoa-rich diet showed an increase in apoptosis or programmed cell death as a chemoprevention mechanism against the development of the carcinogenesis.

Although more research is required to determine what bioactive compounds in cocoa are responsible for such effects, the authors conclude that a cocoa-rich diet seems capable of reducing induced oxidative stress. It could also have protection properties in the initial stages of colon cancer as it reduces premalignant neoplastic lesion formation.

## A not-so-guilty pleasure

Cocoa is one of the ingredients in chocolate. It is one of the richest foods in phenolic compounds, mainly in flavonoids like procyanidins, catechins and epicatechins, which have numerous beneficial biological activities in the prevention of cardiovascular diseases and cancer (mainly colorectal cancer).

In fact, compared to other foods with a high flavonoid content, cocoa has a high level of procyanidins with limited bioavailability. These flavonoids are therefore found in their highest concentrations in the intestine where they neutralise many oxidants.

*References: Idefonso Rodríguez-Ramiro, Sonia Ramos, Elvira López-Oliva, Angel Agis-Torres, Miren Gómez-Juaristi, Raquel Mateos, Laura Bravo, Luis Goya, María Ángeles Martín. "Cocoa-rich diet prevents azoxymethane-induced colonic preneoplastic lesions in rats by restraining oxidative stress and cell proliferation and inducing apoptosis". Molecular Nutrition & Food Research, 55:1895-1899, diciembre de 2011. DOI 10.1002/mnfr.201100363.*

[http://www.eurekalert.org/pub\\_releases/2012-01/bu-wda011812.php](http://www.eurekalert.org/pub_releases/2012-01/bu-wda011812.php)

## Winged dinosaur Archaeopteryx dressed for flight

***Since its discovery 150 years ago, scientists have puzzled over whether the winged dinosaur Archaeopteryx represents the missing link in birds' evolution to powered flight.***

PROVIDENCE, R.I. - Much of the debate has focused on the iconic creature's wings and the mystery of whether - and how well - it could fly.

Some secrets have been revealed by an international team of researchers led by Brown University. Through a novel analytic approach, the researchers have determined that a well-preserved feather on the raven-sized dinosaur's wing was black. The color and parts of cells that would have supplied pigment are evidence the wing feathers were rigid and durable, traits that would have helped Archaeopteryx to fly.

The team also learned from its examination that Archaeopteryx's feather structure is identical to that of living birds, a discovery that shows modern wing feathers had evolved as early as 150 million years ago in the Jurassic period. The study, which appears in Nature Communications, was funded by the National Geographic Society and the U.S. Air Force Office of Scientific Research.

"If Archaeopteryx was flapping or gliding, the presence of melanosomes [pigment-producing parts of a cell] would have given the feathers additional structural support," said Ryan Carney, an evolutionary biologist at Brown and the paper's lead author. "This would have been advantageous during this early evolutionary stage of dinosaur flight."

The Archaeopteryx feather was discovered in a limestone deposit in Germany in 1861, a few years after the publication of Charles Darwin's On the Origin of Species. Paleontologists have long been excited about the fossil and other Archaeopteryx specimens, thinking they place the dinosaur at the base of the bird evolutionary tree. The traits that make Archaeopteryx an evolutionary intermediate between dinosaurs and birds, scientists say, are the combination of reptilian features (teeth, clawed fingers, and a bony tail) and avian features (feathered wings and a wishbone).

The lack of knowledge of Archaeopteryx's feather structure and color bedeviled scientists. Carney, with researchers from Yale University, the University of Akron, and the Carl Zeiss laboratory in Germany, analyzed the feather and discovered that it is a covert, so named because these feathers cover the primary and secondary wing feathers birds use in flight. After two unsuccessful attempts to image the melanosomes, the group tried a

more powerful type of scanning electron microscope at Zeiss, where the group located patches of hundreds of the structures still encased in the fossilized feather. "The third time was the charm, and we finally found the keys to unlocking the feather's original color, hidden in the rock for the past 150 million years," said Carney, a graduate student in the Department of Ecology and Evolutionary Biology, studying with Stephen Gatesy.

Melanosomes had long been known to be present in other fossil feathers, but had been misidentified as bacteria. In 2006, coauthor Jakob Vinther, then a graduate student at Yale, discovered melanin preserved in the ink sac of a fossilized squid. "This made me think that melanin could be fossilized in many other fossils such as feathers," said Vinther, now a postdoctoral researcher at the University of Texas–Austin. "I realized that I had opened a whole new chapter of what we can do to understand the nature of extinct feathered dinosaurs and birds."

The team measured the length and width of the sausage-shaped melanosomes, roughly 1 micron long and 250 nanometers wide. To determine the melanosome's color, Akron researchers Matthew Shawkey and Liliana D'Alba statistically compared Archaeopteryx's melanosomes with those found in 87 species of living birds, representing four feather classes: black, gray, brown, and a type found in penguins. "What we found was that the feather was predicted to be black with 95 percent certainty," Carney said.

Next, the team sought to better define the melanosomes' structure. For that, they examined the fossilized barbules — tiny, rib-like appendages that overlap and interlock like zippers to give a feather rigidity and strength. The barbules and the alignment of melanosomes within them, Carney said, are identical to those found in modern birds.

What the pigment was used for is less clear. The black color of the Archaeopteryx wing feather may have served to regulate body temperature, act as camouflage or be employed for display. But it could have been for flight, too.

"We can't say it's proof that Archaeopteryx was a flier. But what we can say is that in modern bird feathers, these melanosomes provide additional strength and resistance to abrasion from flight, which is why wing feathers and their tips are the most likely areas to be pigmented," Carney said. "With Archaeopteryx, as with birds today, the melanosomes we found would have provided similar structural advantages, regardless of whether the pigmentation initially evolved for another purpose."

*Contributing authors include Vinther, Shawkey, D'Alba, and Jörg Ackermann from Carl Zeiss.*

[http://www.eurekalert.org/pub\\_releases/2012-01/bmj-ffi012412.php](http://www.eurekalert.org/pub_releases/2012-01/bmj-ffi012412.php)

### **Food fried in olive or sunflower oil is not linked to heart disease**

#### ***Research: Consumption of fried foods and risk of coronary heart disease: Spanish cohort of the European Prospective Investigation into Cancer and Nutrition study***

Eating food fried in olive or sunflower oil is not linked to heart disease or premature death, finds a paper published on bmj.com today. The authors stress, however, that their study took place in Spain, a Mediterranean country where olive or sunflower oil is used for frying and their results would probably not be the same in another country where solid and re-used oils were used for frying.

In Western countries, frying is one of the most common methods of cooking. When food is fried it becomes more calorific because the food absorbs the fat of the oils.

While eating lots of fried food can increase some heart disease risk factors such as high blood pressure, high cholesterol and obesity, a link between fried food and heart disease has not been fully investigated.

So the authors, led by Professor Pilar Guallar-Castillón from Autonomous University of Madrid, surveyed the cooking methods of 40,757 adults aged 29 to 69 over an 11-year period. None of the participants had heart disease when the study began.

Trained interviewers asked participants about their diet and cooking methods. Fried food was defined as food for which frying was the only cooking method used. Questions were also asked about whether food was fried, battered, crumbed or sautéed. The participants' diet was divided into ranges of fried food consumption, the first quartile related to the lowest amount of fried food consumed and the fourth indicated the highest amount.

During the follow-up there were 606 events linked to heart disease and 1,134 deaths.

The authors conclude: "In a Mediterranean country where olive and sunflower oils are the most commonly used fats for frying, and where large amounts of fried foods are consumed both at and away from home, no association was observed between fried food consumption and the risk of coronary heart disease or death."

In an accompanying editorial, Professor Michael Leitzmann from the University of Regensburg in Germany, says the study explodes the myth that "frying food is generally bad for the heart" but stresses that this "does not mean that frequent meals of fish and chips will have no health consequences." He adds that specific aspects of frying food are relevant, such as the type of oil used.



<http://www.sciencedaily.com/releases/2012/01/120124092930.htm>

### **Scientists Discover New Clue to Chemical Origins of Life**

***Organic chemists at the University of York have made a significant advance towards establishing the origin of the carbohydrates (sugars) that form the building blocks of life.***

ScienceDaily - A team led by Dr Paul Clarke in the Department of Chemistry at York has re-created a process which could have occurred in the prebiotic world. Working with colleagues at the University of Nottingham, they have made the first step towards showing how simple sugars -- threose and erythrose -- developed. The research is published in *Organic & Biomolecular Chemistry*.

All biological molecules have an ability to exist as left-handed forms or right-handed forms. All sugars in biology are made up of the right-handed form of molecules and yet all the amino acids that make up the peptides and proteins are made up of the left-handed form. The researchers found using simple left-handed amino acids to catalyse the formation of sugars resulted in the production of predominately right-handed form of sugars. It could explain how carbohydrates originated and why the right-handed form dominates in nature.

Dr Clarke said: "There are a lot of fundamental questions about the origins of life and many people think they are questions about biology. But for life to have evolved, you have to have a moment when non-living things become living -- everything up to that point is chemistry.

"We are trying to understand the chemical origins of life. One of the interesting questions is where carbohydrates come from because they are the building blocks of DNA and RNA. What we have achieved is the first step on that pathway to show how simple sugars -- threose and erythrose -- originated. We generated these sugars from a very simple set of materials that most scientists believe were around at the time that life began."

<http://www.physorg.com/news/2012-01-neanderthals-contemporaries-stone-tools.html>

### **Neanderthals and their contemporaries engineered stone tools**

***New published research from anthropologists at the University of Kent has scientifically supported for the first time the long held theory that early human ancestors across Africa, Western Asia and Europe engineered their stone tools.***

PhysOrg.com - For over a century, anthropologists have debated the significance of a group of stone age artifacts manufactured by at least three prehistoric hominin species, including the Neanderthals (*Homo neanderthalensis*). These artifacts, collectively known as 'Levallois', were manufactured across Europe, Western Asia and Africa as early as 300,000 years ago.

Levallois artifacts are flaked stone tools described by archaeologists as 'prepared cores' i.e. the stone core is shaped in a deliberate manner such that only after such specialised preparation could a prehistoric flintknapper remove a distinctive 'Levallois flake'. Levallois flakes have long been suspected by researchers to be intentionally sought by prehistoric hominins for supposedly unique, standardised size and shape properties. However, such propositions were regarded as controversial by some, and in recent decades some researchers questioned whether Levallois tool production involved conscious, structured planning that resulted in predetermined, engineered products.



***Replica Levallois core (left) and flake (right) knapped by Dr Metin Eren***

Now, an experimental study – in which a modern-day flintknapper replicated hundreds of Levallois artifacts – supports the notion that Levallois flakes were indeed engineered by prehistoric hominins. By combining experimental archaeology with morphometrics (the study of form) and multivariate statistical analysis, the Kent researchers have proved for the first time that Levallois flakes removed from these types of prepared cores are significantly more standardised than the flakes produced incidentally during Levallois core shaping (called 'debitage flakes'). Importantly, they also identified the specific properties of Levallois flakes that would have made them preferable to past mobile hunter-gathering peoples.

Dr Metin Eren, Leverhulme Early Career Fellow at the University's School of Anthropology and Conservation and the flintknapper who crafted the tools, said: 'The more we learn about the stone tool-making of the Neanderthals and their contemporaries, the more elegant it becomes. The sophistication evident in their tool-making suggests cognitive abilities more similar to our own than not.'

Dr Stephen Lycett, Senior Lecturer in Human Evolution and the researcher who conducted the laboratory analysis of the tools, commented: 'Mobility is a factor in the lives of all hunter-gatherer populations, including Late Pleistocene hominins. Since mobile hunter-gatherers can only carry a fixed number of tools, it is

paramount that the potential usefulness of their tools is optimised relative to their weight. The new analyses indicated that Levallois flakes appear to optimise their utility in a variety of ways relative to other flakes. These flakes are on average thicker across their surface area than debitage flakes, and more uniformly thick. These properties would have optimised durability. However, relative to size, the maximum thickness of Levallois flakes is actually less than debitage flakes. This would have provided greater potential for use, resharpening, and re-use, time and again. The symmetry and evenly distributed thickness of Levallois flakes would also align the tool's centre of mass with the tool's motion during use, making them ergonomically desirable.'

Dr Lycett also explained that 'amongst a variety of choices these tools are 'superflakes'. They are not so thin that they are ineffective but they are not so thick that they could not be re-sharpened effectively or be unduly heavy to carry, which would have been important to hominins such as the Neanderthals'.

**More information:** 'Why Levallois? A morphometric comparison of experimental 'preferential' Levallois flakes versus debitage flakes' (Metin I. Eren and Stephen J. Lycett, University of Kent) is published in the journal PLoS ONE.

[dx.plos.org ... pone.0029273](http://dx.plos.org...pone.0029273) Provided by University of Kent

<http://medicalxpress.com/news/2012-01-black-tea-blood-pressure.html>

### **Black tea reduces blood pressure: study**

***Drinking a cup of black tea three times a day may significantly reduce your blood pressure.***

Medical Xpress - In a world first, scientists at The University of Western Australia and Unilever discovered that black tea lowers systolic and diastolic blood pressure.\* Their research is published this week in the Archives of Internal Medicine.

Lead author Research Professor Jonathan Hodgson of UWA's School of Medicine and Pharmacology said high blood pressure could significantly increase people's risk of heart disease.

"There is already mounting evidence that tea is good for your heart health, but this is an important discovery because it demonstrates a link between tea and a major risk factor for heart disease," he said.

In the study, 95 Australian participants aged between 35 and 75 were recruited to drink either three cups of black tea or a placebo with the same flavour and caffeine content, but not derived from tea.

After six months, the researchers found that compared with the placebo, participants who drank black tea had a lower 24-hour systolic and diastolic blood pressure of between 2 and 3 mmHg.

Professor Hodgson said more research is required to better understand how tea may reduce blood pressure, although earlier studies reported a link between tea drinking and the improved health of people's blood vessels.

Tea is the world's second-most consumed drink, after water.

\* **Blood pressure measurement consists of two numbers. The first is the systolic and measures blood pressure when the heart beats, or contracts to push blood through the body. The second number is the diastolic and measures the amount of pressure in between beats, when the heart is at rest.** Provided by University of Western Australia

<http://medicalxpress.com/news/2012-01-cdc-diabetes-amputations-falling.html>

### **CDC: Diabetes amputations falling dramatically**

***Foot and leg amputations were once a fairly common fate for diabetics, but new government research shows a dramatic decline in limbs lost to the disease, probably due to better treatments.***

The rate has fallen by more than half since the mid-1990s, according to what is being called the most comprehensive study of the trend. For older diabetics, amputations dropped from more than 11 to about 4 per 1,000 people, the Centers for Disease Control and Prevention reported Tuesday. Other diabetes studies have shown declines in lost toes, feet and legs, but not as dramatic. "What jumped out to me was the scale of the improvement," said Dr. John Buse, a University of North Carolina diabetes expert who was not involved in the new study. The study was released Tuesday by the medical journal Diabetes Care.

Diabetes is a disease in which sugar builds up in the blood. Roughly 1 in 10 U.S. adults has it, and it is the seventh leading cause of death, the CDC says. Complications include poor circulation and nerve damage in the lower limbs, resulting in numbness and slow healing of sores and infections. That's most common in elderly patients and those with diabetes for at least 10 years. While diabetes has been growing more common in the United States - driven by obesity-related Type 2 - researchers have noted recent declines in some of the other most dreaded complications, including blindness and kidney failure.

Buse recalled seeing such problems constantly when he first became director of UNC's Diabetes Care Center in the mid-1990s. "Pretty much every minute of every day in the waiting room, there would be somebody missing a limb, or with a seeing eye dog or white cane," he said.

But he hasn't seen a patient like that in his waiting room for a few years, he added.

In the CDC study, the researchers checked national hospital discharge records for 1988 through 2008, looking for patients aged 40 and older who had lost a toe, foot or leg to diabetes. They found that though the number of

people with the disease more than tripled over those two decades, foot and leg amputations fell after 1996. The researchers also looked at people who did not have diabetes, and found the rates of amputation were flat.

It's not clear what happened to start the drop among diabetics, said Nilka Rios Burrows, a CDC epidemiologist who co-authored the study. But experts note that was a decade in which studies clearly demonstrated the value of close monitoring and stepped-up patient education. It's also when Medicare began paying for blood sugar monitoring and for protective shoes and other medical devices for elderly diabetics.

CDC officials saw increases in the proportion of diabetics who got annual foot exams, and believe the enhanced care is the main reason for the decline in amputations. But another element may be that larger numbers of diabetics are being diagnosed earlier and with milder disease, Burrows said.

More information: *Diabetes Care*: <http://care.diabetesjournals.org/>

[http://www.eurekalert.org/pub\\_releases/2012-01/bmj-dfh012312.php](http://www.eurekalert.org/pub_releases/2012-01/bmj-dfh012312.php)

### **Deaths from heart attacks halved in last decade**

***The death rate from heart attack in England has halved in the last decade, claims a research paper published today on bmj.com.***

Compared with earlier years, the study found there were fewer heart attacks in the last decade and fewer of these were fatal. Several studies have already investigated changes in deaths from heart attack in many countries around the world, but reasons for the decline in deaths in England are still not known. Researchers from the University of Oxford set out to identify the possible causes of this reduction.

Using national hospital and mortality data, they looked at 840,175 men and women in England who had suffered from a total of 861,134 heart attacks between 2002 and 2010. Overall, the death rates for heart attacks fell by 50% in men and 53% in women.

The researchers investigated how much of the decline in death rates resulted from a decrease in the occurrence of new heart attacks, and how much was a result of improved survival after heart attack. They concluded that just over half of the decline in total death can be attributed to a decline in the number of new heart attacks, and just under half to a decline in the death rate after heart attack.

The substantial drop in the rate of occurrence of heart attacks reflects the impact of both primary and secondary prevention through beneficial changes in the health of the population with respect to cardiovascular risk factors, say the researchers, while the improvements in death rates following hospital admission are likely to reflect major improvements in NHS care over the recent years. 61% of the people who experienced heart attack were men, 36% of heart attack cases were fatal and 73% occurred in those aged 65 and over. Out of 311,419 fatal heart attacks, 70% were sudden deaths that occurred without an admission to hospital.

The factors behind the decrease in heart attack mortality differed by age, sex and geographic area. The greatest declines in heart attack event rate and mortality were seen among middle-aged individuals, whereas the smallest declines were seen for the younger and older age groups in both men and women. Rising rates of obesity and diabetes may help explain the lack of improvement in the occurrence of heart attacks among the youngest age group.

The authors say that further research is required to gain a clearer understanding of the specific elements of prevention and treatment that have contributed to the fall in death rates.

In an accompanying editorial, Hugh Tunstall-Pedoe from the Institute of Cardiovascular Research at the University of Dundee argues that death rates from heart attacks have only fallen in "rich nations" whereas they continue to rise in many others. He suggests that more data is needed from the other countries to reach a conclusion, but that resources to obtain data are scarce.

<http://www.sciencedaily.com/releases/2012/01/120125172321.htm>

### **Morgellons: Unexplained Skin Condition Is Non-Infectious, Not Linked to Environmental Cause: CDC Report**

***The US Centers for Disease Control and Prevention has completed a comprehensive study of an unexplained skin condition commonly referred to as Morgellons and found no infectious agent and no evidence to suggest an environmental link.***

ScienceDaily - The full results are reported in the Jan. 25 issue of the online journal PLoS ONE.

In this study, investigators took an in-depth look at a skin condition characterized by unexplained lesions that contain fibers, threads, or other foreign material, accompanied by sensations of crawling, biting, or stinging. The condition is not currently recognized as a distinct clinical disorder with established diagnostic criteria. However, increasing inquiries to the CDC in 2006-2009 regarding the condition prompted the study in Northern California, where many of the persons who reported these symptoms lived.

The researchers found and enrolled 109 persons with symptoms of this condition by searching through the electronic medical record database of a large HMO. They conducted extensive testing to rule out infectious causes, and found no indication that the condition was attributed an infection. The researchers also determined that the fibers associated with the lesions were apparently fragments of cloth or other debris. The investigators showed that the condition is uncommon, estimating that it results in fewer than four out of 100,000 people seeking medical attention. About half of the study participants had evidence of other medical, most commonly psychiatric, illnesses.

The CDC suggests that people suffering with symptoms similar to those reported in the study should see their health care provider for a complete physical to ensure proper diagnosis of all illnesses, including psychiatric, and follow the recommended treatments.

"We found no evidence that this condition is contagious, or that suggests the need for additional testing for an infectious disease as a potential cause," says Dr. Mark Eberhard, Director of CDC's Division of Parasitic Diseases and Malaria and a lead study investigator. "This alleviates concerns about the condition being contagious between family members and others."

<http://www.physorg.com/news/2012-01-role-quantum-effects-photosynthesis.html>

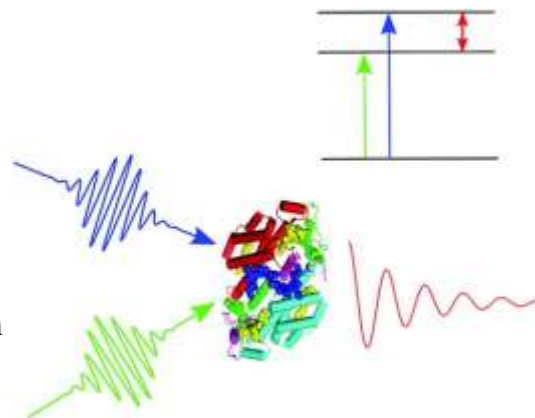
### **Study supports role of quantum effects in photosynthesis**

***Until a few years ago, photosynthesis seemed to be a straightforward and well-understood process in which plants and other organisms use sunlight to convert carbon dioxide and water into sugars, with oxygen as a waste product.***

PhysOrg.com - But recent research showing that the light energy entering these organisms' light-absorbing chromophore molecules may exist in two places at once – as a quantum superposition – has raised a new question: what role, if any, do quantum effects play in the vastly important and widespread process of photosynthesis?

So far, the subject has been one of great speculation. Other than the observations of coherent superpositions of light energy, researchers do not have any experimental evidence to show that such quantum effects play a functional role in photosynthesis.

Now in a new study, a team of researchers from the Swinburne University of Technology and the University of Melbourne, both in Victoria, Australia, and the University of New South Wales in Sydney, Australia, has offered some further support to the theoretical models that predict a quantum role in photosynthesis.



***Possible quantum effects in photosynthesis: Scientists have found experimental evidence for quantum mechanical interactions between electronic states and phonon modes in the light-harvesting complex of cryptophyte marine algae.***

Image credit: G. H. Richards, et al. ©2012 American Chemical Society

### **Quantum modeling**

"Quantum effects have been predicted to play a role in the very early stages of photosynthesis where efficient energy transfer between chromophores is required," Jeffrey Davis of the Swinburne University of Technology told PhysOrg.com. "The nature of quantum mechanics implies that energy can be reversibly transferred between states so long as everything remains coherent. As a result of this reversibility, quantum effects allow the initial excitation to explore different pathways for energy transfer."

In this way, quantum coherence enables light energy to simultaneously investigate multiple pathways, and then choose the shortest, most efficient path, thereby leading to efficient energy transfer. But Davis also explains that it's not as simple as it sounds, since complete coherence can actually do more harm than good.

"Interestingly, these models predict that a fully quantum mechanical system without decoherence would actually lead to a reduction in the energy transfer efficiency because the complete reversibility would mean that the energy doesn't stay where it needs to go," he explained. "As a result, some decoherence is required to ensure that once the energy gets where it needs to, it doesn't go back. The models predict that with the right combination of coherent quantum effects to reversibly explore different pathways and decoherence to ensure the energy stays where it is needed, an optimal efficiency for energy transfer can be obtained."

The observations made to date of the coherent superpositions of light energy in chromophores don't yet provide sufficient evidence to show that these theories are correct. As Davis explains, experimental evidence would require testing the light transfer efficiency under different conditions.



“Previous studies have revealed the presence of long-lived coherent superpositions, an intrinsically quantum mechanical effect, but this does not necessarily mean that they play an important part in photosynthesis, or more specifically, the energy transfer processes,” he said. “Experimental evidence that quantum effects play a role in photosynthesis would need to demonstrate coherent and reversible energy transfer between states following the excitation of a single electronic transition. To ascertain the importance of that role, some comparison between the transfer efficiency with and without quantum effects (or with different amounts of decoherence) would be required.”

### **Singling out pathways**

Although Davis and his coauthors have not detected such evidence in this study, they have provided further support for the argument that the long-lived quantum coherence observed previously is not merely a trivial phenomenon. To do this, the scientists used a new spectroscopy technique that, unlike previous techniques, allows them to investigate individual processes one at a time when they occur in the light-harvesting complexes of cryptophyte marine algae.

In contrast, the quantum coherence in the algae’s light-harvesting complexes was originally observed using 2D electronic spectroscopy, which uses short, broadband pulses to probe energy dynamics. The use of broadband pulses (i.e., pulses with a wide range of frequencies) excites many different pathways simultaneously. Although this technique can be useful, it also makes it difficult to isolate different processes since multiple excitations can interact and alter each other’s dynamics.

By using the newer, less common technique, called two-color photon echo spectroscopy, the researchers could excite only the pathway in which coherence occurs. Singling out this pathway revealed clear signatures for strong coupling between the electronic states and the vibrational modes of the protein matrix (phonons) in the algae’s light-harvesting complexes. As Davis explained, this type of interaction is not what is expected from the classical models that have traditionally been used to describe light harvesting and energy transfer in photosynthesis.

“Our observation of strong coupling between the electronic states and the phonon modes of the protein matrix provides strong experimental evidence that classical treatment of these interactions is not sufficient, and that models including the microscopic details of the coupling interactions are indeed required,” Davis said. “The quantum nature of these interactions increases the scope for quantum effects to have an impact and enhances the possibility of coherent energy transfer in photosynthesis.”

In the future, the researchers plan to further extend the technique to investigate these quantum mechanical interactions and the role they play in light harvesting and energy transfer.

“We are currently exploring the dependence of these coherent interactions on a number of experimental parameters, including temperature, wavelength and polarization,” Davis said. “These results will enable us to explore the nature of the excited states, their interactions with the phonon modes of the protein matrix and the role they play in energy transfer. We also plan to investigate whether such long-lived coherences also exist between other states in these systems and ultimately whether coherence transfer between states occurs and is relevant for photosynthesis.”

**More information:** G. H. Richards, et al. “Coherent Vibronic Coupling in Light-Harvesting Complexes from Photosynthetic Marine Algae.” *The Journal of Physical Chemistry Letters*, 2012, 3, 272-277. DOI: 10.1021/jz201600f

<http://www.physorg.com/news/2012-01-wings.html>

### **How wings really work**

**A 1-minute video released by the University of Cambridge sets the record straight on a much misunderstood concept – how wings lift.**

PhysOrg.com - It’s one of the most tenacious myths in physics and it frustrates aerodynamicists the world over. Now, University of Cambridge’s Professor Holger Babinsky has created a 1-minute video that he hopes will finally lay to rest a commonly used yet misleading explanation of how wings lift.

“A wing lifts when the air pressure above it is lowered. It’s often said that this happens because the airflow moving over the top, curved surface has a longer distance to travel and needs to go faster to have the same transit time as the air travelling along the lower, flat surface. But this is wrong,” he explained. “I don’t know when the explanation first surfaced but it’s been around for decades. You find it taught in textbooks, explained on television and even described in aircraft manuals for pilots. In the



worst case, it can lead to a fundamental misunderstanding of some of the most important principles of aerodynamics.”

To show that this common explanation is wrong, Babinsky filmed pulses of smoke flowing around an aerofoil (the shape of a wing in cross-section). When the video is paused, it’s clear that the transit times above and below the wing are not equal: the air moves faster over the top surface and has already gone past the end of the wing by the time the flow below the aerofoil reaches the end of the lower surface.

“What actually causes lift is introducing a shape into the airflow, which curves the streamlines and introduces pressure changes – lower pressure on the upper surface and higher pressure on the lower surface,” clarified Babinsky, from the Department of Engineering. “This is why a flat surface like a sail is able to cause lift – here the distance on each side is the same but it is slightly curved when it is rigged and so it acts as an aerofoil. In other words, it’s the curvature that creates lift, not the distance.”

Babinsky is quick to stress that he is far from the only aerodynamicist who is frustrated by the perpetuation of the myth: colleagues have in the past expressed their concerns in print and online. Where he hopes his video will help debunk the myth once and for all is by providing a quick and visual demonstration to show that the most commonly used explanation cannot possibly be correct. The original video, created by Babinsky a few years ago using a wind tunnel, has now been re-edited in high quality with a voice-over in which he explains the phenomenon as it happens.

Babinsky’s research focuses on the fundamental aspects of aerodynamics as they relate to aircraft wings, Formula I racing cars, articulated lorries and wind turbines. One of his visions is to design a wing that will enable aircraft to fly faster and more efficiently. Using a massive wind tunnel within the Department of Engineering, Babinsky and his team have been modelling the shockwaves that are created on aircraft wings and that restrict the plane’s top speed.

The newly released video will support lectures Babinsky will be giving as part of a series of University of Cambridge Subject Masterclasses aimed at Year 12 school children: “It’s important to put out this video because when I give this lecture to school kids I start by giving the wrong explanation and asking who has heard it and every time 95% of the audience puts their hand up. Only a handful will know that it is wrong.”

*Provided by University of Cambridge*

<http://www.scientificamerican.com/article.cfm?id=tame-theory-did-bonobos>

### **Tame Theory: Did Bonobos Domesticate Themselves?**

***A new hypothesis holds that the natural selection produced the chimpanzee's nicer cousin in much the same way that humans bred dogs from wolves***

**By Ed Yong | Wednesday, January 25, 2012 | 19**

Time and again humans have domesticated wild animals, producing tame individuals with softer appearances and more docile temperaments, such as dogs and guinea pigs. But a new study suggests that one of our primate cousins - the African ape known as the bonobo - did something similar without human involvement. It domesticated itself.

Anthropologist Brian Hare of Duke University's Institute for Brain Sciences noticed that the bonobo looks like a domestic version of its closest living relative, the chimpanzee. The bonobo is less aggressive than the chimp, with a smaller skull and shorter canine teeth. And it spends more time playing and having sex. These traits are very similar to those that separate domestic animals from their wild ancestors. They are all part of a constellation of characteristics known as the domestication syndrome.

The similarities between bonobos and domesticated species dawned on Hare during a large departmental dinner, where he listened to Harvard University anthropologist Richard Wrangham hold forth on bonobos. "He was talking about how bonobos are an evolutionary puzzle," Hare recalls. "They have all these weird traits relative to chimps and we have no idea how to explain them," Wrangham had noted. "I said, 'Oh that's like the silver foxes!' Richard turned around and said, 'What silver foxes?'"

The foxes that Hare mentioned were the legacy of Russian geneticist Dmitri Belyaev. In the 1950s Belyaev started raising wild silver foxes in captivity and breeding those that were least aggressive toward their human handlers. Within just 20 generations, he had created the fox equivalent of our domestic pooches. Instead of snarling when humans approached, they wagged their tails. At the same time, their ears became floppier, tails curlier and skulls smaller. Belyaev's experiments showed that if you select for nicer animals, the other parts of the domestication syndrome follow suit. Hare thinks that a similar process happened in bonobos, albeit without human intervention.

Rape, murder and warring neighbors are all regular aspects of chimp life. Bonobo societies, however, are far more peaceful. Hare thinks that the chimplike ancestors of bonobos found themselves in an environment where

aggressive individuals fared poorly. By selecting for the most cooperative ones, evolution forged a "self-domesticated" ape, just as Belyaev produced domestic foxes by picking the most docile ones.

Hare has now laid out his ideas in a new paper, written with Wrangham and Harvard colleague Victoria Wobber, and published online January 20 in *Animal Behaviour*.

Bonobos and chimpanzees diverged from a common ancestor between one million and two million years ago, after the formation of the Congo River separated one population of apes into two. Considering that neither species can swim, the two populations "might as well have been on different planets," Hare says.

Both groups faced very different environments. Hare thinks that the northern population, which would eventually become chimps, had more competition from gorillas for their food. They were forced to compete fiercely with one another for whatever was left. Females got a particularly short shrift, and were easily overpowered by males for both sex and resources.

"In bonobo-land in the south, the story was different," Hare explains. "The river would have protected the ancestors of bonobos from gorillas." With more food to go around, females could gather in larger groups, form tight social bonds, and better resist the advances of males. In this land of plenty, the least aggressive males, who opted for alliances rather than brute force, were most likely to mate. South of the river, the nicer apes thrived.

As a result, Hare thinks that they started maturing more slowly. Many domestic animals evolved to become less aggressive by slowing the pace of development, so adults retained juvenile traits. For example, as Belyaev's foxes became tamer, their minds and bodies became more like those of puppies than wild adults.

The same thing probably happened as domestic dogs and bonobos evolved from their respective ancestors. Their physiques changed—faces became shorter, skulls shrank, sex differences narrowed, teeth shortened and sections of their fur lost coloration. Their bodies responded to stress in a more muted way. They behaved differently, playing, grooming and mating more often. The tamer generations also became more sensitive to social cues. Simply by maturing more slowly, they all evolved the same set of domesticated traits.

"People have been thinking about domestication as a human-centered thing: purposeful, directed, something we do to animals," says Greger Larson of Durham University in England, who was not involved in this study. "But what Brian says is that this process, which we imbue with all this human-centric meaning, is something that takes place in nature. That's super cool."

Not everyone is convinced by Hare's idea. "I'm not buying it," says bonobo expert Frans de Waal of Emory University. He notes that it is not clear if bonobos evolved from a chimplike ancestor or vice versa. If the latter is true, then the question is why chimps became so aggressive, rather than why bonobos evolved to be nicer. Hare admits the problem. "It's a real challenge, especially since we don't have a single fossil for either species," he says.

De Waal also wonders if other female-dominated species, such as spotted hyenas or ring-tailed lemurs, would also show signs of self-domestication. Hare agrees. "To really test the hypothesis," he remarks, "you need to have a dozen species that you believe are self-domesticated to understand what it is about the ecology that might explain these changes." Ultimately Hare hopes that more research on bonobo genetics, behavior and ecology will demonstrate whether his idea is right or wrong.

<http://nyti.ms/wOUf0Z>

### **Survival's Ick Factor**

***Disgust is the Cinderella of emotions. While fear, sadness and anger, its nasty, flashy sisters, have drawn the rapt attention of psychologists, poor disgust has been hidden away in a corner, left to muck around in the ashes.***

**By JAMES GORMAN**

No longer. Disgust is having its moment in the light as researchers find that it does more than cause that sick feeling in the stomach. It protects human beings from disease and parasites, and affects almost every aspect of human relations, from romance to politics. In several new books and a steady stream of research papers, scientists are exploring the evolution of disgust and its role in attitudes toward food, sexuality and other people.

Paul Rozin, a psychologist who is an emeritus professor at the University of Pennsylvania and a pioneer of modern disgust research, began researching it with a few collaborators in the 1980s, when disgust was far from the mainstream. "It was always the other emotion," he said. "Now it's hot."

It still won't wear glass slippers, which may be just as well, given the stuff it has to walk through. Nonetheless, its reach takes disgust beyond the realms of rot and excrement.

Speaking last week from a conference on disgust in Germany, Valerie Curtis, a self-described "disgustologist" from the London School of Hygiene and Tropical Medicine, described her favorite emotion as "incredibly important."

She continued: “It’s in our everyday life. It determines our hygiene behaviors. It determines how close we get to people. It determines who we’re going to kiss, who we’re going to mate with, who we’re going to sit next to. It determines the people that we shun, and that is something that we do a lot of.”

It begins early, she said: “Kids in the playground accuse other kids of having cooties. And it works, and people feel shame when disgust is turned on them.”

Some studies have suggested that political conservatives are more prone to disgust than liberals are. And it is clear that what people find disgusting they often find immoral, too.

It adds to the popularity of disgust as a subject of basic research that it is easier to elicit in an ethical manner than anger or fear. You don’t have to insult someone or make anyone afraid for his or her life — a bad smell will do the trick. And disgust has been relatively easy to locate in the brain, where it frequents the insula, the amygdala and other regions.

“It is becoming a model emotion,” said Jonathan Haidt of the University of Virginia, a disgust pioneer with Dr. Rozin. And the research may have practical benefits, including clues to obsessive compulsive disorder, some aspects of which — like excessive hand washing — look like disgust gone wild.

Conversely, some researchers are trying to inspire more disgust at dirt and germs to promote hand washing and improve public health. Dr. Curtis is involved in efforts in Africa, India and England to explore what she calls “the power of trying to gross people out.” One slogan that appeared to be effective in England in getting people to wash their hands before leaving a bathroom was “Don’t bring the toilet with you.”

Disgust was not completely ignored in the past. Charles Darwin tackled the subject in “The Expression of the Emotions in Man and Animals.” He described the face of disgust, documented by Guillaume-Benjamin Duchenne in his classic study of facial expressions in 1862, as if one were expelling some horrible-tasting substance from the mouth. “I never saw disgust more plainly expressed,” Darwin wrote, “than on the face of one of my infants at five months, when, for the first time, some cold water, and again a month afterwards, when a piece of ripe cherry was put into his mouth.” His book did not contain an image of the infant, but fortunately YouTube has numerous videos of babies tasting lemons.

Human beings are complex, of course, as evidenced by the behavior of parents who give their babies lemons and record their distress on video, and the lemon face is not exactly that of adult disgust.

It is, however, generally accepted that disgust evolved partly to avoid putting bad things in the mouth, an idea already put forth when Dr. Rozin tackled disgust. He and his colleagues developed the idea that disgust was then elaborated by cultural evolution to include other forms, one of them based in a dislike for reminders of the animal nature of humans. Sex, death, feces and bad food all smacked of animality.

There are many variations in how scientists now view disgust, but one new approach by evolutionary psychologists was captured in a December special issue of *The Philosophical Transactions of the Royal Society B*, “Disease Avoidance: From Animals to Culture,” and in a conference on “The Evolution of Disgust” this month in Bielefeld, Germany, where many of the same scientists appeared.

Dr. Curtis contributed to the issue and the conference, and emphasized above all disgust as an adaptation to avoid disease-causing microbes and parasites that involves not only taste and smell but also sight and touch.

“To me the story is quite simple,” she said. The animal origins of disgust involve all sorts of ways that diseases are spread, including fleas, so there are a variety of signs of disease and types of disgust.

“It’s not all oral,” Dr. Curtis said.

Under that evolutionary umbrella, however, there is still the question of what kinds of disgust there are. Dr. Haidt, Dr. Rozin and Clark McCauley of Bryn Mawr College claim nine different domains of disgust for North Americans. Dr. Curtis proposes seven categories. Joshua Tybur of VU University in Amsterdam proposed three domains of disgust, three separate psychological programs, for disease avoidance, mate choice and moral judgment.

“People who are sensitive to one type of disgust are not necessarily sensitive to another,” he said. For example, he said, earlier claims that political conservatives (self-identified) were more sensitive than liberals to disgust were overly general. Research that he and his colleagues did suggested that conservatives were more disgusted by sexual topics, but were similar to liberals in the domains of disease avoidance and moral judgment.

Still, it’s not always easy to say in which domain a form of disgust fits, and there is no reason that more than one can’t operate at the same time, given the right stimulus. Jeffrey Dahmer killed and ate people he had had sex with — a disgust trifecta if there ever was one.

Researchers have also been trying to pin down details about the mechanisms and evolutionary value of disgust. Daniel Fessler, an anthropologist at the Center for Behavior, Evolution and Culture at the University of California, Los Angeles, investigated with his colleagues why pregnant women were more sensitive to disgust.



What they found was that as progesterone levels went up, so did sensitivity to disgust. That was true in the first trimester of pregnancy, when derailing fetal development would have the most dire effects. In very recent work, Dr. Fessler said, the researchers found that even in women who weren't pregnant and were not suffering nausea, disgust increased with the levels of progesterone.

An important function of progesterone, Dr. Fessler said, is that it dials down an early-warning part of the immune system, inflammation, which might prevent the embryo, or conceptus, from implanting itself in the placenta. The eight-cell embryo "actually destroys tissue as it burrows in," Dr. Fessler said. "Left to its own, the maternal immune system would destroy the conceptus." So, he and his colleagues reason, while the body turns down the dial on one kind of protection, it turns it up on disgust, another kind of defense.

Whatever the fine points of disgust, its power to affect behavior is unquestioned, and that power ought to be put to good use, Dr. Curtis said. So, in one of her projects, she has worked with an Indian public relations agency to come up with a disgust-based campaign to encourage hand washing among mothers in small villages, which could save countless children's lives lost to diarrhea and other diseases.

The result, now being tested, is a skit involving two characters, one a supermom and the other a disgusting, dirty man. The man makes sweets using mud and worms, stops in the middle of the performance to rush off because he has diarrhea, never washes his hands and does everything possible to be revolting. Supermom is scrupulously clean. Her children don't get sick, the skit makes clear. In fact, her baby grows up to be a doctor. She washes her hands all the time.

The prominence of diarrhea in the skit is no accident. One thing about studying disgust, Dr. Curtis said, is that it makes you realize how important it is to talk about the very things that disgust us, because they often present dangers to public health.

Exhibit 1 is excrement. "We need to talk about" excrement, she said, using a punchier single-syllable word for maximum effect — a word she is unapologetic about using, as befits a disgustologist.

"Which is worse?" Dr. Curtis asked. To talk about it, "or to make kids die?"

*This article has been revised to reflect the following correction:*

**Correction: January 23, 2012**

*An earlier version of this article misstated the name of the institution where Valerie Curtis works. It's the London School of Hygiene and Tropical Medicine.*

<http://www.scientificamerican.com/podcast/episode.cfm?id=brown-fat-furnishes-physiological-f-12-01-25>

### **Brown Fat Furnishes Physiological Furnace**

***Men with more brown fat burn more calories in the cold to keep warm. Katherine Harmon reports*** [Download MP3](#)

When it comes to the battle of the bulge, putting on more muscle will burn extra calories even when you're resting. But recent research suggests that there might be a particular type of fat that also uses up more energy than the typical off-white stuff that tends to congregate around American midsections: brown fat.

This tissue turns food energy directly into heat. It was thought to exist only in babies, to help them keep warm. But it's recently been found—in small quantities—in adults, too. Mostly distributed in our necks and shoulders. And a new study finds that when adult men are chilly, those with more brown fat burn through more calories keeping warm. The results are in the Journal of Clinical Investigation. [[Veronique Ouellet, et al., "Brown Adipose Tissue Oxidative Metabolism Contributes to Energy Expenditure During Acute Cold Exposure In Humans"](#)]

The researchers found that those subjects with the most brown fat saw the biggest boost in their metabolism when they were subjected to cold for three hours.

Although scientists are interested in brown fat's obesity-battling possibilities, don't count on a calorie-crunching injection in a meat locker anytime soon. For now, we have to burn calories the old fashioned way - or avoid them in the first place. - Katherine Harmon [*The above text is a transcript of this podcast.*]

[http://www.eurekalert.org/pub\\_releases/2012-01/uom-sgs012612.php](http://www.eurekalert.org/pub_releases/2012-01/uom-sgs012612.php)

### **Supermaterial goes superpermeable**

***Graphene is one of the wonders of the science world, with the potential to create foldaway mobile phones, wallpaper-thin lighting panels and the next generation of aircraft.***

The new finding at the University of Manchester gives graphene's potential a most surprising dimension — graphene can also be used for distilling alcohol.

In a report published in Science, a team led by Professor Sir Andre Geim shows that graphene-based membranes are impermeable to all gases and liquids (vacuum-tight). However, water evaporates through them as quickly as if the membranes were not there at all. This newly-found property can now be added to the

already long list of superlatives describing graphene. It is the thinnest known material in the universe and the strongest ever measured. It conducts electricity and heat better than any other material. It is the stiffest one too and, at the same time, it is the most ductile. Demonstrating its remarkable properties won University of Manchester academics the Nobel Prize in Physics in 2010.

Now the University of Manchester scientists have studied membranes from a chemical derivative of graphene called graphene oxide. Graphene oxide is the same graphene sheet but it is randomly covered with other molecules such as hydroxyl groups OH-. Graphene oxide sheets stack on top of each other and form a laminate. The researchers prepared such laminates that were hundreds times thinner than a human hair but remained strong, flexible and were easy to handle. When a metal container was sealed with such a film, even the most sensitive equipment was unable to detect air or any other gas, including helium, to leak through.

It came as a complete surprise that, when the researchers tried the same with ordinary water, they found that it evaporates without noticing the graphene seal. Water molecules diffused through the graphene-oxide membranes with such a great speed that the evaporation rate was the same independently whether the container was sealed or completely open.

Dr Rahul Nair, who was leading the experimental work, offers the following explanation: "Graphene oxide sheets arrange in such a way that between them there is room for exactly one layer of water molecules. They arrange themselves in one molecule thick sheets of ice which slide along the graphene surface with practically no friction.

"If another atom or molecule tries the same trick, it finds that graphene capillaries either shrink in low humidity or get clogged with water molecules." "Helium gas is hard to stop. It slowly leaks even through a millimetre -thick window glass but our ultra-thin films completely block it. At the same time, water evaporates through them unimpeded. Materials cannot behave any stranger," comments Professor Geim. "You cannot help wondering what else graphene has in store for us".

"This unique property can be used in situations where one needs to remove water from a mixture or a container, while keeping in all the other ingredients", says Dr Irina Grigorieva who also participated in the research.

"Just for a laugh, we sealed a bottle of vodka with our membranes and found that the distilled solution became stronger and stronger with time. Neither of us drinks vodka but it was great fun to do the experiment", adds Dr Nair.

The Manchester researchers report this experiment in their Science paper, too, but they say they do not envisage use of graphene in distilleries, nor offer any immediate ideas for applications.

However, Professor Geim adds 'The properties are so unusual that it is hard to imagine that they cannot find some use in the design of filtration, separation or barrier membranes and for selective removal of water'.

[http://www.eurekalert.org/pub\\_releases/2012-01/uop-pac011912.php](http://www.eurekalert.org/pub_releases/2012-01/uop-pac011912.php)

**Penn anthropologists clarify link between Asians and early Native-Americans**  
***A tiny mountainous region in southern Siberia may have been the genetic source of the earliest Native Americans, according to new research by a University of Pennsylvania-led team of anthropologists.***

PHILADELPHIA - Lying at the intersection of what is today Russia, Mongolia, China and Kazakhstan, the region known as the Altai "is a key area because it's a place that people have been coming and going for thousands and thousands of years," said Theodore Schurr, an associate professor in Penn's Department of Anthropology. Schurr, together with doctoral student Matthew Dulik and a team of graduate students and postdoctoral researchers, collaborated on the work with Ludmila Osipova of the Institute of Cytology and Genetics in Novosibirsk, Russia.

Among the people who may have emerged from the Altai region are the predecessors of the first Native Americans. Roughly 20-25,000 years ago, these prehistoric humans carried their Asian genetic lineages up into the far reaches of Siberia and eventually across the then-exposed Bering land mass into the Americas.

"Our goal in working in this area was to better define what those founding lineages or sister lineages are to Native American populations," Schurr said.

The team's study, published in the American Journal of Human Genetics, analyzed the genetics of individuals living in Russia's Altai Republic to identify markers that might link them to Native Americans. Prior ethnographic studies had found distinctions between tribes in the northern and southern Altai, with the northern tribes apparently linked linguistically and culturally to ethnic groups farther to the north, such as the Uralic or Samoyedic populations, and the southern groups showing a stronger connection to Mongols, Uighurs and Buryats.

Schurr and colleagues assessed the Altai samples for markers in mitochondrial DNA, which is maternally inherited, and in Y chromosome DNA, which is passed from fathers to sons. They also compared the samples to ones previously collected from individuals in southern Siberia, Central Asia, Mongolia, East Asia and a variety of American indigenous groups. Because of the large number of gene markers examined, the findings have a high degree of precision.

"At this level of resolution we can see the connections more clearly," Schurr said.

Looking at the Y chromosome DNA, the researchers found a unique mutation shared by Native Americans and southern Altaians in the lineage known as Q.

"This is also true from the mitochondrial side," Schurr said. "We find forms of haplogroups C and D in southern Altaians and D in northern Altaians that look like some of the founder types that arose in North America, although the northern Altaians appeared more distantly related to Native Americans."

Calculating how long the mutations they noted took to arise, Schurr's team estimated that the southern Altaian lineage diverged genetically from the Native American lineage 13,000 to 14,000 years ago, a timing scenario that aligns with the idea of people moving into the Americas from Siberia between 15,000 and 20,000 years ago. Though it's possible, even likely, that more than one wave of people crossed the land bridge, Schurr said that other researchers have not yet been able to identify a similar geographic focal point from which Native Americans can trace their heritage. "It may change with more data from other groups, but, so far, even with intensive work in Mongolia, they're not seeing the same things that we are," he said.

In addition to elucidating the Asia-America connection, the study confirms that the modern cultural divide between southern and northern Altaians has ancient genetic roots. Southern Altaians appeared to have had greater genetic contact with Mongolians than they did with northern Altaians, who were more genetically similar to groups farther to the north.

However, when looking at the Altaians' mitochondrial DNA in isolation, the researchers did observe greater connections between northern and southern Altaians, suggesting that perhaps females were more likely to bridge the genetic divide between the two populations. "Subtle differences here both reflect the Altaians themselves - the differentiation among those groups - and allow us to try to point to an area where some of these precursors of American Indian lineages may have arisen," Schurr said.

Moving forward, Schurr and his team hope to continue to use molecular genetic techniques to trace the movement of peoples within Asia and into and through the Americas. They may also attempt to identify links between genetic variations and adaptive physiological responses, links that could inform biomedical research.

For example, Schurr noted that both Siberian and Native American populations "seem to be susceptible to Westernization of diet and moving away from traditional diets, but their responses in terms of blood pressure and fat metabolism and so forth actually differ." Using genomic approaches along with traditional physical anthropology may lend insight into the factors that govern these differences.

*In addition to Schurr and Dulik, the research was conducted by Sergey Zhadanov, Ayken Askapuli, Lydia Gau, Omer Gokcumen and Samara Rubinstein of Penn's Department of Anthropology.*

*The study was supported by the University of Pennsylvania, the National Science Foundation, the Social Sciences and Humanities Research Council of Canada and the Russian Basic Fund for Research. The National Geographic Society also provided infrastructural support to the Schurr lab.*

<http://www.physorg.com/news/2012-01-scientists-reveal-females-sperm-decades.html>

### **Scientists reveal how females store sperm for decades**

***Scientists have discovered that all sorts of females – from birds to reptiles to insects – have a nifty trick to prolong the lifespan of sperm, letting them store it for weeks, months or even years on end.***

PhysOrg.com - They found that females do this by lowering the metabolic rate of sperm, so it can survive in their bodies almost indefinitely. In one extreme example, biologists have shown that queen ants fertilise their eggs with sperm they've stored for up to 30 years. Normally, once it's outside the male's body, it doesn't survive for long. The findings could explain why, in reproductive medicine, sperm samples aren't necessarily the best way to predict if someone can father children or not.

"Infertility tests on sperm are notoriously unreliable, and this could be one reason why," says Dr. Klaus Reinhardt from the University of Sheffield, who led the study, published in Proceedings of the Royal Society B.

It seems that females lower sperm's metabolic rate and stop sperm generating excessive amounts of highly damaging, reactive oxygen molecules – called free radicals. Having a slower metabolism in turn means sperm age much more slowly than usual.

At the moment, Reinhardt and his colleagues have no idea how females manage this.

"All cells produce these molecules, but sperm tend to produce more, probably because they have such fast metabolisms. What's more, reactive oxygen molecules are thought to accelerate aging in all cells. So it follows that getting rid of free radicals might extend the lifespan of sperm," says Reinhardt.

The idea that free radicals contribute to aging isn't new. Nutritionists have long promoted the idea of eating foods like fruit and vegetables, because evidence suggests they contain antioxidants which mop up free radicals.

While some had suggested that females prevent sperm producing free radicals by lowering their metabolic rate, no-one had shown this, until now. "Females could be manipulating sperm in such a way that they produce much fewer radicals in the first place," explains Reinhardt. So Reinhardt and his colleague Anne-Cécile Ribou from the University of Perpignan in France decided to borrow a technique from the field of cancer research to investigate.

They used a technique called fluorescence-lifetime measurement to analyse sperm taken from the female crickets' reproductive tracts. The technique let them monitor both the metabolic rate of male crickets' sperm cells and how many oxidative free radicals they produce at the same time.

They found that the metabolic rate of sperm stored in the female Mediterranean field cricket for anything from an hour to 26 days went down by a massive 37 per cent compared with un-stored sperm. This tied in with the finding that a low metabolic rate corresponded with low free radical production.

But they also discovered that in sperm taken from the male the processes are entirely different: sperm that metabolise more quickly don't necessarily create more reactive oxygen molecules. "So in this case the current view in ageing research that a higher metabolism equals faster ageing doesn't hold," says Reinhardt.

Another thing the team noticed is that the metabolic rate in un-stored sperm doesn't predict its metabolic rate once it's stored in the female. "This is pretty much why fertility predictions may not work so well. One reason that females don't let sperm keep going like hell once inside their reproductive tracts is probably that it is cheaper for them to shut down sperm than to support their energy requirements." "This is something we'd like to investigate in the future," Reinhardt says.

*More information: Anne-Cécile Ribou and Klaus Reinhardt, Reduced metabolic rate and oxygen radicals production in stored insect sperm, Proceedings of the Royal Society B, published 25 January 2012, doi:10.1098/rspb.2011.2422 Provided by PlanetEarth Online*

<http://healthland.time.com/2012/01/25/exposure-to-common-chemicals-may-weaken-vaccine-response/>

## **Exposure to Common Chemicals May Weaken Vaccine Response**

***A study finds disturbing evidence that chemicals found in furniture, fast-food packaging and microwave popcorn bags may compromise children's immune systems.***

**By Alice Park | @aliceparkny | January 25, 2012 | 15**

Researchers report that exposure to ubiquitous household chemicals may lower children's responses to vaccines.

The study, published in the Journal of the American Medical Association, suggests that perfluorinated compounds (PFCs), which are commonly used in Teflon coatings in pots and pans as well as in furniture, stain-resistant carpeting, rain gear and microwave popcorn bags, may hinder children's ability to mount proper immune responses after they are vaccinated. The findings suggest that important gains made by immunization programs in the past century may be eroded by the emergence of these environmental chemicals.

In the report, Dr. Philippe Grandjean, chair of environmental medicine at the University of Southern Denmark, and his colleagues studied a group of 587 children born between 1999 to 2001 in the Faroe Islands. The researchers chose that population, located in the north Atlantic, since most residents rely on the sea to survive, and recent studies have recorded increasing amounts of PFCs in the drinking water and fish there. All of the children received the diphtheria, tetanus and pertussis (DTaP) vaccine at 3 months, and a booster at 5. The scientists tested the children's antibodies to diphtheria and tetanus at age 5, just before they received their booster shot, and again when they were 7. In addition, the team also drew the children's blood to test for PFCs.

When the researchers compared the participants' antibody levels to the levels of PFCs in their blood, they were surprised to find that higher levels of PFCs were linked with a lower immune response. In fact, kids whose PFC levels were twice as high had half the amount of antibodies to diphtheria and tetanus, compared with children who tested lower for PFCs. At age 7, kids with a twofold increase in PFC levels were also two to four times more likely to show an immune response that was so low that it was no longer clinically protective.

"We were kind of shocked when we saw those numbers," says Grandjean, who is also an adjunct professor at the Harvard School of Public Health. "This is the first study to say that by [exposing children to these chemicals], we are screwing up a major aspect of disease prevention in our society. I've been in the field for quite a while, and this is a very strong signal."



Grandjean acknowledges that the study involved an isolated island population and needs to be confirmed, but he notes that he and his team took care to address many factors that could potentially confound the results, including the children's birthweight, the time since their last vaccination, their age, sex and other parameters. Even after adjusting for these contributors, he says, the association remained strong. "We haven't been able to explain it away," he says.

Other studies have found similar effects on the immune system associated with environmental toxins such as PCBs and dioxin, but the PFC effect on immunity seems to be stronger, says Grandjean. That's a particular concern since PFCs have a half-life in the body of at least four years, meaning that it takes four years to reduce by half the amount of PFCs absorbed at any given time.

The scientists also looked at how prenatal exposure to the chemicals might influence infants' immunity, and found that a twofold increase of PFCs in an expectant mother's blood was linked to a 39% lower concentration of antibodies in 5-year-olds (before their booster), compared with those whose moms had lower levels of PFCs.

The researchers had expected PFC levels in the study participants to be higher than in kids elsewhere, because of their high fish consumption. But, in fact, their levels of PFCs were similar to those seen in American kids, who are exposed to PFCs through common household dust. In certain parts of the U.S., including West Virginia and Ohio, water pollution from decades of industrial waste has also led to unhealthy levels of PFCs in drinking water, meaning that residents may still be harboring the chemical from earlier exposures.

Avoiding the chemicals can be difficult, if not impossible. The Environmental Protection Agency (EPA) currently does not require companies to test for PFCs in industrial waste, noting that "to date, significant adverse effects have not been found in the general human population." However, under the Toxic Substances Control Act (TCSA) the agency in 2002 limited the future manufacture and import of certain types of PFCs known as perfluoroalkyl sulfonates (PFAs), citing concerns that "these chemical substances may be hazardous to human health and the environment."

For children who may have been exposed to enough PFCs to affect their immune system, Grandjean says there is a simple solution — get re-vaccinated. That's what the scientists did for the children in the study whose antibodies levels fell below protective amounts from diphtheria and tetanus. But, he says "that can only put a Band-Aid on the wound. The problem is that those drops may not be the only deficit." Grandjean and his colleagues are now analyzing children's responses to other vaccines, to see if PFC exposure affects antibody levels for other childhood immunizations as well.

If they do, then the problem becomes a much bigger one. If the exposure to environmental chemicals is negating the effect of childhood immunizations, then the major public health gains made by vaccines in the past century in preventing infectious diseases may start to erode. And if the immune system is compromised enough to respond more sluggishly to vaccines, then what does that mean for its ability to fend off other pathogens, like the common cold virus and influenza? Further, is it possible that exposure to environmental chemicals plays a role in autoimmune diseases or conditions like type I diabetes and cancer that may in part be due to dysfunction of the immune system?

There's not much that we can do currently to cleanse ourselves of these compounds, says Grandjean. But if we're aware of how potentially harmful they can be to our health, we might be more vocal about how we want our regulatory agencies to handle them. "When we see results like this, it's clear we haven't done our job well enough," he says. "I think the next generation deserves better from us."

*Alice Park is a writer at TIME. Find her on Twitter at @aliceparkny. You can also continue the discussion on TIME's Facebook page and on Twitter at @TIME.*

<http://medicalxpress.com/news/2012-01-muscling-multiple-sclerosis.html>

### **Muscling in on multiple sclerosis**

***Multiple sclerosis (MS), a neurodegenerative disease, causes periodic attacks of neurologic symptoms such as limb weakness and mobility defects.***

And while MS patients' walking abilities and muscle strength are examined on a regular basis, doctors have yet to determine when the lower limb muscles begin to deteriorate. That's important because with earlier identification of mobility problems, doctors would be able to implement early intervention programs that could make all the difference for those with MS.

Now, Dr. Alon Kalron and his fellow researchers from Tel Aviv University's Sackler Faculty of Medicine and the Multiple Sclerosis Centre in Sheba Medical Center, Tel-Hashomer, have discovered that specific laboratory tests for leg muscle endurance and gait — the pattern of movement while walking or running — are highly effective in identifying mobility deficits at the initial stage of MS. These deficits are difficult to discover during standard neurological testing.

According to Dr. Kalron, who was supervised by Profs. Anat Achiron and Zeevi Dvir, patients in the early stages of MS had 40 percent less muscle endurance compared to their healthy counterparts. Additionally, distinct abnormalities were observed in their walking patterns. The study, which was published in the Journal of Neurologic Physiotherapy, could help researchers understand the mechanisms underlying the evolution of MS, and improve the management of patients afflicted with the disease.

### **One step at a time**

Reduced muscle endurance may be one of the earliest signs of MS and is a common complaint among patients, but it is hard to detect, says Dr. Kalron. In order to quantify muscle fatigue, the researchers conducted a study that included 52 patients in the early stage of MS, and a control group of 28 healthy subjects.

Participants were examined using an isokinetic dynamometer, a special instrument for measuring lower limb muscle strength and endurance. They were asked to attempt to bend or straighten a knee exerting maximum effort, and maintain this position for 30 seconds. Muscle fatigue was calculated by measuring the decline in muscle strength during that period. On average, those in the early stages of MS were not able to maintain their strength — they demonstrated 40 percent less endurance compared to the healthy control group.

In addition, patients' gait was observed for factors such as how far a patient spreads his legs while walking, the length of their steps, and symmetry of movement. By examining walking patterns, the researchers discovered specific abnormalities in the MS group. Patients in the early stages of MS "tend to walk with a wider base, because walking with your legs further apart helps to improve stability. It's probably a compensation strategy due to the lower muscle endurance," explains Dr. Kalron. The participants in the MS group also walked more slowly, in an asymmetrical pattern with shorter steps.

### **Giving physical therapy a head start**

Clinicians should be more aware of possible gait and lower limb muscle deficits very early in the disease process, especially because minor impairments are difficult to detect with regular neurological examinations. "The downside of detecting such deficits using advanced instruments is offset by the positive potential of early intervention programs," suggests Dr. Kalron. "If we find the abnormalities earlier, then we can start intervention programs when they have a chance to benefit the most." Programs based around physical therapy and fitness can help MS patients maintain higher levels of muscle endurance and improve balance, holding off the fatigue that typically accompanies the disease. *Provided by Tel Aviv University*

<http://www.scientificamerican.com/article.cfm?id=lunar-dynamo-apollo>

## **Primitive Attraction: Magnetized Moon Rock Points to Lunar Core's Active Past** ***A lunar sample collected by Apollo astronauts suggests that other-Earthly geophysics drove the moon's churning interior***

**By John Matson | Thursday, January 26, 2012 | 12**

The moon of today is a static orb with little to no internal activity; for all intents and purposes it appears to be a dead, dusty pebble of a world. But billions of years ago the moon may have been a place of far more dynamism - literally.

A new study of a lunar rock scooped up by Neil Armstrong and Buzz Aldrin during their Apollo 11 mission indicates that the ancient moon long sustained a dynamo - a convecting fluid core, much like Earth's, that produces a global magnetic field. The age of the rock implies that the lunar dynamo was still going some 3.7 billion years ago, about 800 million years after the moon's formation.



***CHIP OFF THE OLD ROCK: A piece of lunar sample 10020, a rock that appears to carry the signature of a past magnetic field on the moon. Image: NASA***

That is longer than would be expected if the lunar dynamo were powered primarily by the natural churning of a cooling molten interior, as is the case on Earth. The moon's small core should have cooled off rather quickly and put an end to any dynamo-generated magnetic field within a few hundred million years. So researchers may have to explore alternate explanations for how a dynamo could be sustained—explanations that depart from thinking of the lunar interior in terms of Earthly geophysics.

A standard-issue, Earth-like dynamo "would have died out on the moon much, much before 3.7 billion years ago," says Erin Shea, a graduate student in geology at the Massachusetts Institute of Technology and lead author on a study in the January 27 issue of Science. "We have to start thinking outside the box about what generates a lunar dynamo."

The first clues that the moon had a dynamo came from a number of lunar samples that appear to record the presence of a magnetic field at the time of their formation. Specifically, the magnetic field is locked in metallic particles in similar orientations. But some of that magnetism could be explained by short-lived magnetic fields rather than by a dynamo. A meteor impact, for instance, can shock a magnetic signature into nearby rocks.

So researchers investigating whether the moon had a more long-lived magnetic field look for evidence of lunar paleomagnetism encoded in rocks that formed slowly in the presence of that field. Such slow-cooling rocks would remain largely unaffected by transient magnetic fields that came and went during solidification. Shea and her colleagues based their study on a rock collected July 20, 1969, the day that humankind took its first "giant leap" onto the lunar surface. The sample is a basalt from volcanic flows early in lunar geologic history, and it would have taken about two weeks to cool—roughly 10 times as long as a short-lived magnetic field from an impact would be expected to persist.

Using a high-resolution magnetometer, the researchers found that the lunar sample indeed formed in the presence of a magnetic field, perhaps even one as strong as Earth's magnetic field today. "What this sample tells us is that at some point the moon did have a dynamo," Shea says. "This magnetic field lasted much longer than we had considered before."

A similar paleomagnetic study in 2009 by some of Shea's co-authors demonstrated the presence of a lunar dynamo some 4.2 billion years ago. That is just at the cusp of what would be possible with an Earth-like dynamo driven by a cooling interior alone. "Even then it's not trivial," says Ian Garrick-Bethell, a planetary scientist at the University of California, Santa Cruz (U.C.S.C.), who was the lead author of the 2009 study.

"It's nice because this sample is also very pristine, like the previous sample that I studied," Garrick-Bethell says. He notes that the new sample not only cooled slowly but also shows no evidence of having been shocked and reheated since its initial formation. "It's a high-quality recorder of magnetic fields," Garrick-Bethell says. "If this sample does have any remnant [magnetization] in it, combined with the pristine nature of the sample, it suggests that there really was a dynamo."

The evidence in favor of a dynamo has made enough believers that researchers are investigating what could drive a churning lunar interior over such long timescales. "It seems to me almost inescapable that there was a long-lived lunar dynamo," says U.C.S.C. planetary scientist Francis Nimmo.

He and his colleagues published a study in *Nature* late last year arguing that the gravitational pull of Earth could have tweaked the moon's spin axis enough to cause the solid outer layer and the fluid core to rotate differently. That could have stirred up the lunar interior to keep a dynamo churning until about 2.7 billion years ago. Another paper in the same journal noted that large impacts could also upset the moon's rotation enough to energize a dynamo. If that were the case, Nimmo notes, the dynamo's operation would have been somewhat intermittent. (*Scientific American* is part of Nature Publishing Group.)

The new study seems to imply that some such mechanism existed. "There is certainly a difficulty driving a conventional dynamo at 3.7 billion years ago," Nimmo says. "Some more exotic explanation—like orbital forcing or impacts—appears to be required."

[http://www.sciencenews.org/view/generic/id/337970/title/Prions\\_more\\_mobile\\_than\\_thought](http://www.sciencenews.org/view/generic/id/337970/title/Prions_more_mobile_than_thought)

### **Prions more mobile than thought**

#### ***Disease agents can jump from one species to another***

**By Rebecca Cheung**

The protein-based pathogens known as prions may pass between different species more easily than has been thought, a team of French researchers reports in the Jan. 27 *Science*. By infecting engineered mice with prions from cows and goats, scientists also have shown that the invaders readily target tissues other than the brain.

"We may underestimate the threat posed by some of these diseases by focusing only on the brain," says Pierluigi Gambetti, a prion researcher at Case Western Reserve University in Cleveland. "It adds a new element to the equation." The research also raises the possibility that new prion strains recently identified in cattle and small rodents might be able to jump to other species, including humans.

"We should, in the future, be more exhaustive when looking at the possibility of prions being passed from one species to another," says Hubert Laude, a professor at the French National Institute for Agricultural Research in Jouy-en-Josas and a coauthor of the study.

Prions closely resemble normal proteins made by a host. When prions invade a host, they propagate by forcing these normal host proteins, actually called prion proteins, to assemble improperly. When these malformed proteins accumulate in the brain, they cause mind-wasting conditions such as Creutzfeldt-Jakob disease in people and scrapie in sheep.

For the most part, intrinsic biological differences between species prevent these pathogens from jumping hosts. But some prions are known to be transmitted between species, including Creutzfeldt-Jakob disease, which humans contract after being exposed to mad cow disease in cattle. "This barrier can be very, very strong or easily broken," Laude says. "It depends on the species, the donor, host and also the strain of prion."

To measure the strength of this barrier, Laude's team used genetically engineered mice that expressed the normal human prion proteins. The scientists injected the mice with prions known to target similar proteins from cows or goats.

Laude's team found misassembled proteins in the spleens of over half the mice, suggesting that this tissue might be more susceptible to infection. Malformed proteins were also detected in some of the animals' brains, though the mice all lived out a normal life span and didn't exhibit any signs of disease.

Taken together, these findings suggest that prions once believed to be limited to only one species can jump the barrier and affect other species.

<http://www.physorg.com/news/2012-01-kepler-planetary-hosting-planets.html>

### **Kepler announces 11 planetary systems hosting 26 planets**

#### ***NASA's Kepler mission has discovered 11 new planetary systems hosting 26 confirmed planets.***

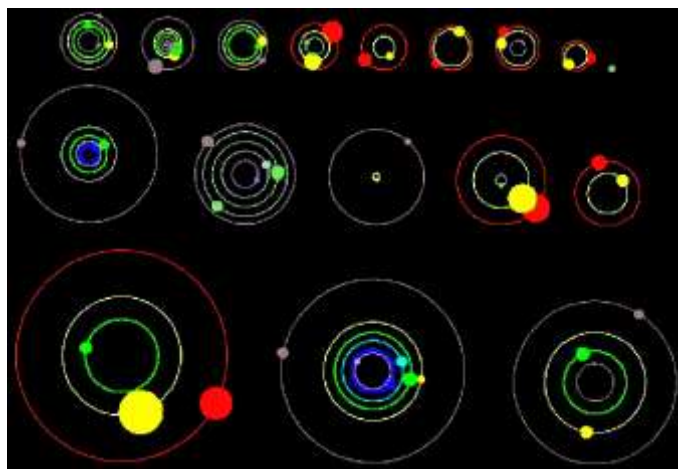
PhysOrg.com - These discoveries nearly double the number of verified Kepler planets and triple the number of stars known to have more than one planet that transits, or passes in front of, its host star. Such systems will help astronomers better understand how planets form.

The planets orbit close to their host stars and range in size from 1.5 times the radius of Earth to larger than Jupiter. Fifteen of them are between Earth and Neptune in size, and further observations will be required to determine which are rocky like Earth and which have thick gaseous atmospheres like Neptune. The planets orbit their host star once every six to 143 days. All are closer to their host star than Venus is to our sun.

"Prior to the Kepler mission, we knew of perhaps 500 exoplanets across the whole sky," said Doug Hudgins, Kepler program scientist at NASA Headquarters in Washington. "Now, in just two years staring at a patch of sky not much bigger than your fist, Kepler has discovered more than 60 planets and more than 2,300 planet candidates. This tells us that our galaxy is positively loaded with planets of all sizes and orbits."

Kepler identifies planet candidates by repeatedly measuring the change in brightness of more than 150,000 stars to detect when a planet passes in front of the star. That passage casts a small shadow toward Earth and the Kepler spacecraft.

"Confirming that the small decrease in the star's brightness is due to a planet requires additional observations and time-consuming analysis," said Eric Ford, associate professor of astronomy at the University of Florida and lead author of the paper confirming Kepler-23 and Kepler-24. "We verified these planets using new techniques that dramatically accelerated their discovery."



*The image shows an overhead view of orbital positions of the planets in systems with multiple transiting planets discovered by NASA's Kepler mission. Credit: NASA Ames/Dan Fabrycky, UC Santa Cruz*

Each of the new confirmed planetary systems contains two to five closely spaced transiting planets. In tightly packed planetary systems, the gravitational pull of the planets among themselves causes one planet to accelerate and another planet to decelerate along its orbit. The acceleration causes the orbital period of each planet to change. Kepler detects this effect by measuring the changes, or so-called Transit Timing Variations (TTVs).

Planetary systems with TTVs can be verified without requiring extensive ground-based observations, accelerating confirmation of planet candidates. The TTV detection technique also increases Kepler's ability to confirm planetary systems around fainter and more distant stars. "By precisely timing when each planet transits its star, Kepler detected the gravitational tug of the planets on each other, clinching the case for ten of the newly announced planetary systems," said Dan Fabrycky, Hubble Fellow at the University of California, Santa Cruz and lead author for a paper confirming Kepler-29, 30, 31 and 32."

Five of the systems (Kepler-25, Kepler-27, Kepler-30, Kepler-31 and Kepler-33) contain a pair of planets where the inner planet orbits the star twice during each orbit of the outer planet. Four of the systems (Kepler-23, Kepler-24, Kepler-28 and Kepler-32) contain a pairing where the outer planet circles the star twice for every three times the inner planet orbits its star.



“These configurations help to amplify the gravitational interactions between the planets, similar to how my sons kick their legs on a swing at the right time to go higher,” said Jason Steffen, the Brinson postdoctoral fellow at Fermilab Center for Particle Astrophysics in Batavia, Ill., and lead author of a paper confirming Kepler-25, 26, 27 and 28.

The system with the most planets among these discoveries is Kepler-33, a star that is older and more massive than our sun. Kepler-33 hosts five planets, ranging in size from 1.5 to 5 times that of Earth and all located closer to their star than any planet is to the sun.

The properties of a star provide clues for planet detection. The decrease in the star's brightness and duration of a planet transit combined with the properties of its host star present a recognizable signature. When astronomers detect planet candidates that exhibit similar signatures around the same star the likelihood of any of these planet candidates being a false positive is very low. “The approach that was used to verify the Kepler-33 planets shows that the overall reliability of Kepler's candidate multiple transiting systems is quite high,” said Jack Lissauer, planetary scientist at NASA Ames Research Center at Moffett Field, Calif., and lead author of the paper confirming Kepler-33. “This is a validation by multiplicity.”

**More information:** *These discoveries are published in the Astrophysical Journal and the Monthly Notices of the Royal Astronomical Society and can be viewed at:*

*J Lissauer et al - Almost All of Kepler's Multiple Planet Candidates are Planets, and Kepler-33 5-planet system*

*E Ford et al - Transit Timing Observations from Kepler: II. Confirmation of Two Multiplanet Systems via a Non-parametric Correlation Analysis. Confirms KOI-168=Kepler-23 and KOI 1102=Kepler-24*

*J Steffen et al - Transit Timing Observations from Kepler: III. Confirmation of 4 Multiple Planet Systems by a Fourier-Domain Study of Anti-correlated Transit Timing Variations*

*D Fabrycky et al - Transit Timing Observations From Kepler: IV. Confirmation Of 4 Multiple Planet Systems By Simple Physical Models Provided by JPL/NASA*

<http://www.physorg.com/news/2012-01-visual-nudge-accuracy-mammogram.html>

### **Visual nudge improves accuracy of mammogram readings**

***In 2011 - to the consternation of women everywhere -- a systematic review of randomized clinical trials showed that routine mammography was of little value to younger women at average or low risk of breast cancer.***

The review showed, for example, that for every 50-year-old woman whose life is prolonged by mammography, dozens are treated unnecessarily - some with harmful consequences - or treated without benefit. Hundreds are told they have breast cancer when they do not.

Cindy M. Grimm, PhD, associate professor of computer science and engineering in the School of Engineering & Applied Science at Washington University in St. Louis, was not surprised by the review, a prestigious Cochrane review of the scientific evidence for a medical treatment.

"It's not just the mammogram that's the problem," she says, "it's accurately interpreting the mammogram.

"People aren't good at it. Even expert radiologists aren't good at it. Results vary widely from person to person, even when people have gone through the same training."

But Grimm thought a perceptual trick she and colleagues had invented, called subtle gaze direction, might be used to improve training. An experiment showed that a novice could be subtly guided to follow an expert's scanpath across a mammogram and that this subtle nudging improved the novice's accuracy. The experimental results will be presented at the Eye Tracking Research & Application Symposium this March.

Grimm and her colleagues say the technique, should it prove durable, is widely applicable to visual search tasks. Not only might it improve the reading of mammograms and other types of medical images, such as MRIs and PET scans, but it might also be used to improve the accuracy of airport screening and learning in virtual environments.

#### **Directing the gaze**

Grimm invented subtle gaze direction together with colleagues Reynold Bailey, PhD, then her graduate student, and Ann McNamara, PhD, then of Saint Louis University, a conference acquaintance.

"I had double-majored in art and computer science as an undergraduate at the University of California, Berkeley," Grimm says. "So I was aware that artists have all sorts of tricks for guiding viewers to look at particular areas in a painting, sometimes, in the case of narrative art, in a particular sequence.

"They might make an area brighter than the background, increase the contrast or have strong edges (borders) that attract the eye.

"Movie producers do the same thing in post processing," Grimm says. "For example, when one actor is talking and others are listening, the audience tends to watch the talker. But the producer can direct attention to a listener's reaction instead by changing the color or brightness of that part of the image."

Subtle gaze direction is a high-tech version of this time-honored craft. It works, says Grimm, by exploiting the difference between peripheral and central (foveal) vision. "We use a small area in the central part of our retina called the fovea to see detail," she says. "But foveal vision doesn't actually cover much of our field of view. "If you hold out your thumb, your foveal vision - the part of your surroundings you're actually seeing in detail - covers about the same area as your thumbnail.

"We use our foveal vision to read or drive or for other detail-oriented tasks. At the same time, we are monitoring the rest of our environment with our peripheral vision, which has lower resolution but responds faster than our foveal vision. "When our peripheral vision picks up a stimulus, our eyes move to focus our foveal vision on it so that we can see it clearly.

"During those quick eye movements, called saccades, vision is suppressed, or masked, so that the motion of the eye, the motion blur of the image and the gap in visual perception are not noticeable to the viewer. We lose an astonishing 40 minutes of vision a day to saccadic masking."

To direct the gaze, Grimm and her colleagues changed the brightness or "warmth" of an area in the peripheral field of view to draw the novice's focus to this area. The stimulus remained subtle, however, because the viewer's gaze is monitored in real-time by an eye-tracking device and the modulations to the peripheral vision are terminated before the eye fixates on them. The idea," says Grimm "is to get someone to look in a particular direction while altering their experience of viewing the image as little as possible."

"In the case of mammograms," for example, "you want to get a learner to look at the tumor region but you don't want to do anything that makes the tumor region look different than it does on the mammogram itself."

### **The mammography study**

Reading mammograms is a good target for computer assistance because training is time-consuming and expensive, typically requiring a four-year residency and a two-year fellowship.

Despite advances in technology, novices are still trained by working as an apprentice to an expert.

The mammography study, led by Bailey, now an assistant professor of computer science at the Rochester Institute of Technology, brought together the same group of scientists as the subtle gaze direction experiment. McNamara is now assistant professor of visualization at Texas A&M University.

For the study, Grimm and her colleagues used a database of images provided by the Mammographic Image Analysis Society that includes both images and text files that contains coordinates of abnormalities and their size.

"Expert diagnostic radiologists have a particular search pattern that is not the same as that of a novice," Grimm says. "We don't know exactly what they're doing, but they tend to do a fairly broad scan and then fixate on parts of the image that have a tumor-like texture. A novice might instead attend to brighter spots in the image or fail to scan all of it."

Bailey hired an expert radiologist at the Rochester Institute of Technology to view and mark 65 images from the database. The expert's scanpath was recorded during this process by an eye-tracking system.

During the experiment, subtle gaze direction was used to guide a group of novices along the expert scanpath. A control group viewed the mammograms without gaze manipulation. Novices who were guided were significantly more accurate than the control group or a third group guided along a random path. Moreover, even though the training session was brief, the effect lingered even after gaze manipulation was disabled.

Grimm says more work must be done to show that more extensive training will stick long-term. In the meantime, she can think of many ways gaze manipulation could be used to improve performance on visual search tasks. "One simple use of the technology would be to make sure readers look at every part of the image. If you're using eye tracking," she says, "you know where people are looking, so you can make sure they don't skip part of the image."

Gaze manipulation might also be used to assist tumor-recognition software. "Suppose you had a software program that was reasonably good at spotting possible tumor areas but, erring on the side of caution, flagged too many areas as suspicious. "Such software might be paired with gaze direction to ensure the radiologist looked at all of the flagged areas," she says. "That wouldn't necessarily be a training application; it could be a routine element of reading mammograms."

The mammogram study is widely applicable, Grimm says, because there are so many visual search tasks. She mentions airport scanners, but they are just at the top of a long list. "I work with someone who identifies pollen species," she says. "Apparently, it takes a novice a year to learn, and they spend hours and hours looking through a microscope at these pollen grains. Again, some people are good at it and others struggle for competence. "Perhaps in that case, as well, gaze direction could be used to train novice pollen identifiers."

*Provided by Washington University in St. Louis*

**Brain Receptor in Eyes May Link Epilepsy, Cataracts and Antidepressants**  
***Researchers have discovered that the most common receptor for the major neurotransmitter in the brain is also present in the lens of the eye***

ScienceDaily - Researchers from the University of Medicine and Dentistry of New Jersey (UMDNJ) and Columbia University have discovered that the most common receptor for the major neurotransmitter in the brain is also present in the lens of the eye, a finding that may help explain links between cataracts, epilepsy and use of a number of widely prescribed antiepileptic and antidepressant drugs. The research appears online in Biochemical and Biophysical Research Communications.

"Recent studies identified associations between increased cataracts and epilepsy, and showed increased cataract prevalence with use of antiepileptic drugs as well as some common antidepressants," explained corresponding author Peter Frederikse, PhD, of the UMDNJ-New Jersey Medical School. "One common theme linking these observations is that our research showed the most prevalent receptor for the major neurotransmitter in the brain is also present in the lens."

The research team, which included Norman Kleiman, PhD, of the Mailman School of Public Health at Columbia University, with Mohammed Farooq of the New Jersey Medical School and Rajesh Kaswala, DDS, and Chinnaswamy Kasinathan, PhD, from the New Jersey Dental School, found these glutamate receptor proteins, and specifically a pivotal GluA2 subunit, are expressed in the lens and appear to be regulated in a surprisingly similar manner to the way they are in the brain. In the nervous system, glutamate and GluA receptor proteins underlie memory formation and mood regulation along with being an important factor in epilepsy, considered a primary disorder of the brain. Consistent with this, these receptor proteins are also targets for a number of antiepileptic drugs and antidepressant medications.

"The presence of these glutamate receptors in the lens suggests they contribute to links between brain disease and cataract, as well as providing unintended secondary 'targets' of current drugs," Frederikse said. "Our goal now is to use this information to parse out the potential effects of antiepileptics and antidepressants on these 'off-target' sites in the lens, and to determine the role glutamate receptors have in lens biology and pathology." *This research was supported by a grant from the National Eye Institute of the National Institutes of Health.*

<http://wapo.st/zTjgxs>

**Traditional Chinese medicine technique uses heated glass cups to heal ills**  
***Though cupping, a form of acupuncture, has become something of a fad in Hollywood, it is only slowly catching on among the general public in the West.***

**By Debra Bruno, Published: January 24**

BEIJING — Not long after I moved to China, I learned I had a case of blocked qi. A practitioner of traditional Chinese medicine squeezed the top of my ear and informed me that the obstruction of my qi, or life force, was caused in part by my tendency to overthink. She also said I had some liver stagnation and a weak heart. Until that moment, I had thought I was just fine.

The practitioner suggested I try a remedy called cupping. I'd never heard of it before I moved to Beijing, though I had seen markings of it on others here: bright red circles across bare shoulders and backs that look like painful tattoos or hickeys. (Several years ago Gwyneth Paltrow caused a stir when the cut of her evening gown revealed a row of cupping marks all across her back.)

Though cupping, a form of acupuncture, has become something of a fad in Hollywood, it is only slowly catching on among the general public in the West. The aversion is understandable: Cupping involves the suctioning of flesh using warm cups that typically have been heated using a flaming stick. The heat inside the cup creates a vacuum that pulls the skin up a good inch or so in an effort to stimulate circulation, draw out toxins and stimulate the lymphatic system. The procedure is generally done on the back but can also be performed on the neck, legs and hips.

Some clinics opt for plastic cups, and some use oil to move the hot cups up and down the skin. There's also "wet cupping," or bleeding, in which a needle is inserted into the flesh before a cup is used to suction out blood from the spot that was pricked. A dozen or more cups can be used, and the patient rests between five and 20 minutes while the skin inside the cups reddens. The redder the skin, the more proof that harmful toxins needed to be released, say practitioners. The marks disappear in a few days.

**An alternative to needles**

Cupping is a relatively benign process, although a singer in Taiwan was reportedly burned last year when a therapist accidentally spilled alcohol on his body and the alcohol was ignited by a flaming stick intended to warm a cup.

In the United States, there is no requirement for licensing of cupping therapists, and cupping products are available on Amazon.com. In Asia, patients use it both as a home remedy and as part of traditional Chinese medicine treatment in clinics. In the United States, an hour-long session with a therapist costs about \$55, according to Jesse Mac-Lean, director of education for the International Cupping Therapy Association, which is based outside Seattle. (A traditional acupuncture session generally ranges from \$70 to \$120.)

Lixing Lao, director of the Traditional Chinese Medicine Research Program at the University of Maryland School of Medicine's Center for Integrative Medicine in Baltimore, said that once his patients learn about cupping, they prefer it to the needles of traditional acupuncture. MacLean said that while it's difficult to track cupping's popularity in the United States, her group has seen a "sizable increase in the last few years" of inquiries from both health-care practitioners and consumers wanting to learn more about the procedure.

### **Many uses, little science**

Lao says he has seen many patients who have "improved or recovered after cupping treatment." The technique, he says, is especially "useful for muscular-skeletal pain" affecting the back, neck, shoulders and hips. "It can be also used for internal disorders, such as stomachache, vomiting, diarrhea, asthma or cough," he says.

Indeed, cupping has been said to help with an array of ailments from infertility, pain and colds to constipation, insomnia and drug addiction. Some practitioners also claim that it prevents disease.

Still, there is little if any solid evidence showing the health effects of cupping. A 2010 study funded by the National Basic Research Program of China and the National Institutes of Health's National Center for Complementary and Alternative Medicine, looked at 550 clinical studies between 1959 and 2008, mainly in China. This review found that although cupping showed "potential benefits" for pain, herpes zoster (shingles) and other diseases, more and better studies were needed. On its Web site, the American Cancer Society says there is no "available scientific evidence" for the health benefits of cupping, and that reports of success with cupping "are mainly anecdotal."

### **'They love it'**

For Westerners coming to China, traditional healing techniques such as cupping have become something of a tourist attraction. Some tours mix standard stops at the Forbidden City and the Great Wall with morning lectures on traditional Chinese medicine and visits to clinics. David Zhang, general manager of the Joyful Bliss Massage Center in Beijing, said that once he explains cupping to Westerners, they are less apprehensive. "Then they experience it," he said, "and they love it."

Could I be one of those people? I decided to find out at the Beijing Traditional Chinese Medicine Health Preservation Research Center, an institution that looks more spalike than medical. I began with a tuina massage, which is more of a pressing and a pressure-point kneading than an oily, clothes-off process. And yet it ended up feeling pretty good. It lasted an hour, and I nearly fell asleep.

Afterward, I lay on my stomach and bared my back. Before I had a chance to get nervous, I felt a gentle pressure along my back, one after the other. Then the nurse put a warm blanket over the cups, and I half-dozed on the couch. Even though my skin had a tight feeling from being pulled up into the cups, it didn't hurt.

After about 10 minutes, she pulled the cups off. I had 14 pink and red circles all over my back. I felt comfortable and relaxed, but I don't know if that was from the massage or the cupping. By the end of the day, though, I felt dizzy, and my back felt lightly sunburned. A few days later, the marks had become more faint, and my skin a little itchy.

As for the effects, well, I haven't lost the problem of overthinking. Whether my treatment prevented any future disease is something I may never know. *Bruno is a freelance writer in Beijing.*

<http://www.physorg.com/news/2012-01-rare-combination-electric-magnetic-properties.html>

## **Researchers demonstrate rare combination of electric and magnetic properties in strontium barium manganite** ***Making better memories***

An electric field can displace the cloud of electrons surrounding each atom of a solid. In an effect known as polarization, the cloud centers move away slightly from the positively charged nuclei, which radically changes the optical properties of the solid. Materials that can maintain this polarization, even when the external electric field is removed, are known as ferroelectrics and they could provide a novel route to higher-density memory devices.

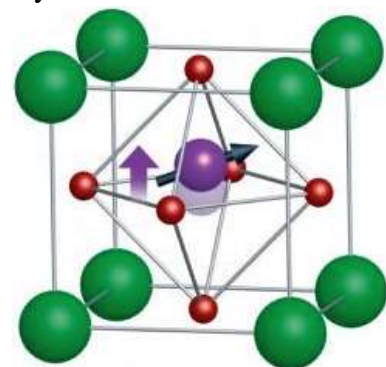
"The function of ferroelectric materials is much expanded if they are also magnetic, and if there is a strong coupling between polarization and magnetization," explains Yasujiro Taguchi from the RIKEN Advanced Science Institute in Wako, Japan. Taguchi and his colleagues from RIKEN, and several other Japanese research



institutes, recently demonstrated experimentally that the material strontium barium manganite ((Sr,Ba)MnO<sub>3</sub>) has this rare combination of properties.

Previous experimental studies on (Sr,Ba)MnO<sub>3</sub> did not identify any signs of the ferroelectricity promised by theoretical simulations. The problem was an insufficient ratio of barium to strontium atoms: conventional crystal growth techniques had produced material with only a maximum ratio of 1:4. Taguchi and his colleagues therefore developed a new two-stage growth technique that enabled them to increase the barium content to 50%. By comparing the properties of crystals with different levels of barium content, they identified a transition to a ferroelectric state at a content ratio of between 40 and 45%.

Strontium barium manganite has a so-called perovskite crystal arrangement, which is characterized by a repeating cubic structure (Fig. 1). Manganese atoms are located at the center of the crystal and oxygen atoms are situated in the middle of each of the six sides. Either a strontium or a barium atom sits on each corner of the cube. The spin, or rotation, of an electron in the manganese ions makes the crystal magnetic. Ferroelectricity arises because the manganese ions are displaced slightly from the center of the cube. "Therefore the manganese ions are responsible for both polarization and magnetism and thus a strong coupling between the two emerges," explains Taguchi.



**Figure 1: Strontium barium manganite's properties come from its manganese atoms (purple sphere). Spin (black arrow) endows the material with its magnetic properties, while the displacement of the ion from the center of the cubic lattice (purple arrow) makes it ferroelectric. Oxygen atoms are shown as red spheres and strontium or barium atoms are green. Credit: 2012 Yasujiro Taguchi**

Materials that are both ferroelectric and have magnetic properties are called multiferroics. The multiferroic materials identified so far have either strong coupling between electricity and magnetism but small polarization, or large polarization with weak coupling. "We have now discovered a multiferroic material that has both [strong coupling and large polarization]," says Taguchi. "These properties are necessary requirements if multiferroic materials are to be applied to devices. One possible example is low-power-consumption memory devices."

More information: Sakai, H., et al. Displacement-type ferroelectricity with off-center magnetic ions in perovskite Sr<sub>1-x</sub>BaxMnO<sub>3</sub>. *Physical Review Letters* 107, 137601 (2011). Provided by RIKEN

<http://www.bbc.co.uk/news/science-environment-16756457>

### **Anti-matter atoms to address anti-gravity question**

***The question of whether normal matter's shadowy counterpart anti-matter exerts a kind of "anti-gravity" is set to be answered, according to a new report.***

Normal matter attracts all other matter in the Universe, but it remains unclear if anti-matter attracts or repels it.

A team reporting in *Physics Review Letters* says it has prepared stable pairs of electrons and their anti-matter particles, positrons. A beam of these pairs can be used to finally solve the anti-gravity puzzle.

#### **Falling up**

For every particle in physics, there is an associated anti-particle, identical in every respect that scientists have yet measured, except that it holds an opposite electric charge.

Current theory holds that, at the birth of the Universe, matter and anti-matter were created in equal amounts. When they meet, however, they destroy each other in energetic flashes of light.

The question has remained, then, why did any Universe come into being at all, and why is the one we see overwhelmingly made of normal matter? One of the characteristics that may differentiate anti-matter is its gravitational behaviour. Most scientists believe that anti-matter will be attracted to normal matter. Others are not so sure; anti-matter may repel - it may "fall up".

That has implications for the question of why the Universe didn't disappear into a grand flash of light just as soon as it formed. It also might help explain why the Universe is expanding ever more quickly.

It has simply been impossible to test the idea, but researchers at the University of California Riverside are getting closer to addressing the question once and for all.

They have created electron-positron pairs that are in stable orbits around one another - the result is called positronium. The pairs are kept from bumping into and destroying each other by carefully dumping energy into them to create what are known as "Rydberg states".

Like the lanes of an automotive test track, particles can move into different orbits around one another if they reach higher energies, and these Rydberg positronium atoms are spun up to high energies, lasting for a comparatively long three billionths of a second.

The team hopes to extend the method, up to a few thousandths of a second, preparing a beam of the artificial atoms and seeing just which way they fall.

<http://medicalxpress.com/news/2012-01-memories-prion-like-protein-key-role.html>

## **Making memories last: Prion-like protein plays key role in storing long-term memories** ***Memories in our brains are maintained by connections between neurons called "synapses".***

But how do these synapses stay strong and keep memories alive for decades? Neuroscientists at the Stowers Institute for Medical Research have discovered a major clue from a study in fruit flies: Hardy, self-copying clusters or oligomers of a synapse protein are an essential ingredient for the formation of long-term memory.

The finding supports a surprising new theory about memory, and may have a profound impact on explaining other oligomer-linked functions and diseases in the brain, including Alzheimer's disease and prion diseases.

"Self-sustaining populations of oligomers located at synapses may be the key to the long-term synaptic changes that underlie memory; in fact, our finding hints that oligomers play a wider role in the brain than has been thought," says Kausik Si, Ph.D., an associate investigator at the Stowers Institute, and senior author of the new study, which is published in the January 27, 2012 online issue of the journal *Cell*.

Si's investigations in this area began nearly a decade ago during his doctoral research in the Columbia University laboratory of Nobel-winning neuroscientist Eric Kandel. He found that in the sea slug *Aplysia californica*, which has long been favored by neuroscientists for memory experiments because of its large, easily-studied neurons, a synapse-maintenance protein known as CPEB (Cytoplasmic Polyadenylation Element Binding protein) has an unexpected property.

A portion of the structure is self-complementary and - much like empty egg cartons - can easily stack up with other copies of itself. CPEB thus exists in neurons partly in the form of oligomers, which increase in number when neuronal synapses strengthen. These oligomers have a hardy resistance to ordinary solvents, and within neurons may be much more stable than single-copy "monomers" of CPEB. They also seem to actively sustain their population by serving as templates for the formation of new oligomers from free monomers in the vicinity.

CPEB-like proteins exist in all animals, and in brain cells they play a key role in maintaining the production of other synapse-strengthening proteins. Studies by Si and others in the past few years have hinted that CPEB's tendency to oligomerize is not merely incidental, but is indeed essential to its ability to stabilize longer-term memory. "What we've lacked till now are experiments showing this conclusively," Si says.

In the new study, Si and his colleagues examined a *Drosophila* fruit fly CPEB protein known as Orb2. Like its counterpart in *Aplysia*, it forms oligomers within neurons. "We found that these Orb2 oligomers become more numerous in neurons whose synapses are stimulated, and that this increase in oligomers happens near synapses," says lead author Amitabha Majumdar, Ph.D., a postdoctoral researcher in Si's lab.

The key was to show that the disruption of Orb2 oligomerization on its own impairs Orb2's function in stabilizing memory. Majumdar was able to do this by generating an Orb2 mutant that lacks the normal ability to oligomerize yet maintains a near-normal concentration in neurons. Fruit flies carrying this mutant form of Orb2 lost their ability to form long-term memories. "For the first 24 hours after a memory-forming stimulus, the memory was there, but by 48 hours it was gone, whereas in flies with normal Orb2 the memory persisted," Majumdar says.

Si and his team are now following up with experiments to determine for how long Orb2 oligomers are needed to keep a memory alive. "We suspect that they need to be continuously present, because they are self-sustaining in a way that Orb2 monomers are not," says Si.

The team's research also suggests some intriguing possibilities for other areas of neuroscience. This study revealed that Orb2 proteins in the *Drosophila* nervous system come in a rare, highly oligomerization-prone form (Orb2A) and a much more common, much less oligomerization-prone form (Orb2B). "The rare form seems to be the one that is regulated, and it seems to act like a seed for the initial oligomerization, which pulls in copies of the more abundant form," Si says. "This may turn out to be a basic pattern for functional oligomers."

The findings may help scientists understand disease-causing oligomers too. Alzheimer's, Parkinson's and Huntington's disease, as well as prion diseases such as Creutzfeldt-Jakob disease, all involve the spread in the brain of apparently toxic oligomers of various proteins. One such protein, strongly implicated in Alzheimer's disease, is amyloid beta; like Orb2 it comes in two forms, the highly oligomerizing amyloid-beta-42 and the relatively inert amyloid-beta-40. Si's work hints at the possibility that oligomer-linked diseases are relatively common in the brain because the brain evolved to be relatively hospitable to CPEB proteins and other functional oligomers, and thus has fewer mechanisms for keeping rogue oligomers under control.

*Provided by Stowers Institute for Medical Research*

## **Brain Likely Encodes the World in Two Dimensions**

*Our internal representation of the world is flat*

By Morgen Peck | Sunday, January 29, 2012 | 1

When we drive somewhere new, we navigate by referring to a two-dimensional map that accounts for distances only on a horizontal plane. According to research published online in August in *Nature Neuroscience*, the mammalian brain seems to do the same, collapsing the world into a flat plane even as the animal skitters up trees and slips deep into burrows.

“Our subjective sense that our map is three-dimensional is illusory,” says Kathryn Jeffery, a behavioral neuroscientist at University College London who led the research. Jeffery studies a collection of neurons in and around the rat hippocampus that build an internal representation of space. As the animal travels, these neurons, called grid cells and place cells, respond uniquely to distance, turning on and off in a way that measures how far the animal has moved in a particular direction.

Past research has focused on how these cartographic cells encode two-dimensional space. Jeffery and her colleagues decided to look at how they respond to changes in altitude. To do this, they enticed rats to climb up a spiral staircase while the scientists collected electrical recordings from single cells. The firing pattern encoded very little information about height.

The finding adds evidence for the hypothesis that the brain keeps track of our location on a flat plane, which is defined by the way the body is oriented. If a squirrel, say, is running along the ground, then scampers straight up a tree, its internal two-dimensional map simply shifts from the horizontal plane to the vertical. Astronauts are some of the few humans to describe this experience: when they move in space to “stand” on a ceiling, they report a moment of disorientation before their mental map flips so they feel right side up again.

Researchers do not know yet whether other areas of the brain encode altitude or whether mammals simply do not need that information to survive. “Maybe an animal has a mosaic of maps, each fragment of which is flat but which can be oriented in the way that’s appropriate,” Jeffery speculates. Or maybe in our head, the world is simply flat.

[http://www.eurekalert.org/pub\\_releases/2012-01/tpco-tbp012712.php](http://www.eurekalert.org/pub_releases/2012-01/tpco-tbp012712.php)

## **2-arm blood pressure check indicator for risk from heart disease or death**

*A review and meta-analysis found that differences in systolic blood pressure between arms could be a useful indicator of the likelihood of vascular risk and death.*

A systematic review and meta-analysis carried out by researchers at the University of Exeter Peninsula College of Medicine and Dentistry (PCMD) has found that differences in systolic blood pressure between arms could be a useful indicator of the likelihood of vascular risk and death.

The findings add support to the calls for both-arm blood pressure checks to be performed as standard.

The review is published in *The Lancet* online today (30th January) and the study is supported by the Royal College of General Practitioners, the South West GP Trust and the National Institute for Health Research Peninsula Collaboration for Leadership in Applied Health Research and Care.

The study reviewed 28 papers covering difference in systolic blood pressure between arms. It found significant evidence to suggest that a difference of 15mm Hg or more was associated with increased risk of: peripheral vascular disease (the narrowing and hardening of the arteries that supply blood to the legs and feet); pre-existing cerebrovascular disease (affecting the blood supply to the brain and often associated with cognitive issues such as dementia); and mortality, both as a result of cardiovascular problems and generally.

The risk of peripheral vascular disease was also increased at a difference of 10mm Hg or more.

The findings further support the need for both-arm blood pressure checks to be the norm – not least because most cases are ‘clinically silent’ and such checks would better identify those at risk.

Dr. Christopher Clark, Clinical Academic Fellow at PCMD and a GP in Witheridge, Devon, led the study. He said: “We set out to investigate whether there was an association between differences in systolic blood pressure between arms and vascular disease and mortality. Our findings indicate a strong association, and that differences of 10mm Hg or 15mm Hg or more might help to identify patients who are at risk and who need further vascular assessment. More research is required in order to transfer our findings to clinical practice, but in the meanwhile we will be flagging the results of our review to the UK Vascular Check programme.”