

We are all mutants

First direct whole-genome measure of human mutation predicts 60 new mutations in each of us

Each one of us receives approximately 60 new mutations in our genome from our parents.

This striking value is reported in the first-ever direct measure of new mutations coming from mother and father in whole human genomes published today.

For the first time, researchers have been able to answer the questions: how many new mutations does a child have and did most of them come from mum or dad? The researchers measured directly the numbers of mutations in two families, using whole genome sequences from the 1000 Genomes Project. The results also reveal that human genomes, like all genomes, are changed by the forces of mutation: our DNA is altered by differences in its code from that of our parents. Mutations that occur in sperm or egg cells will be 'new' mutations not seen in our parents.

Although most of our variety comes from reshuffling of genes from our parents, new mutations are the ultimate source from which new variation is drawn. Finding new mutations is extremely technically challenging as, on average, only 1 in every 100 million letters of DNA is altered each generation.

Previous measures of the mutation rate in humans has either averaged across both sexes or measured over several generations. There has been no measure of the new mutations passed from a specific parent to a child among multiple individuals or families.

"We human geneticists have theorised that mutation rates might be different between the sexes or between people," explains Dr Matt Hurles, Senior Group Leader at the Wellcome Trust Sanger Institute, who co-led the study with scientists at Montreal and Boston, "We know now that, in some families, most mutations might arise from the mother, in others most will arise from the father. This is a surprise: many people expected that in all families most mutations would come from the father, due to the additional number of times that the genome needs to be copied to make a sperm, as opposed to an egg."

Professor Philip Awadalla, who also co-led the project and is at University of Montreal explained: "Today, we have been able to test previous theories through new developments in experimental technologies and our analytical algorithms. This has allowed us to find these new mutations, which are like very small needles in a very large haystack."

The unexpected findings came from a careful study of two families consisting of both parents and one child. The researchers looked for new mutations present in the DNA from the children that were absent from their parents' genomes. They looked at almost 6000 possible mutations in the genome sequences.

They sorted the mutations into those that occurred during the production of sperm or eggs of the parents and those that may have occurred during the life of the child: it is the mutation rate in sperm or eggs that is important in evolution. Remarkably, in one family 92 per cent of the mutations derived from the father, whereas in the other family only 36 per cent were from the father.

This fascinating result had not been anticipated, and it raises as many questions as it answers. In each case, the team looked at a single child and so cannot tell from this first study whether the variation in numbers of new mutations is the result of differences in mutation processes between parents, or differences between individual sperm and eggs within a parent.

Using the new techniques and algorithms, the team can look at more families to answer these new riddles, and address such issues as the impact of parental age and different environment exposures on rates of new mutations, which might concern any would-be parent.

Equally remarkably, the number of mutations passed on from a parent to a child varied between parents by as much as tenfold. A person with a high natural mutation rate might be at greater risk of misdiagnosis of a genetic disease because the samples used for diagnosis might contain mutations that are not present in other cells in their body: most of their cells would be unaffected.

Notes to Editors

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First 'living' laser made from kidney cell

* 18:00 12 June 2011 by Ferris Jabr

It's not quite Cyclops, the sci-fi superhero from the X-Men franchise whose eyes produce destructive blasts of light, but for the first time a laser has been created using a biological cell.

The human kidney cell that was used to make the laser survived the experience. In future such "living lasers" might be created inside live animals, which could potentially allow internal tissues to be imaged in unprecedented detail.

It's not the first unconventional laser. Other attempts include lasers made of Jell-O and powered by nuclear reactors (see box below). But how do you go about giving a living cell this bizarre ability?

Typically, a laser consists of two mirrors on either side of a gain medium – a material whose structural properties allow it to amplify light. A source of energy such as a flash tube or electrical discharge excites the atoms in the gain medium, releasing photons. Normally, these would shoot out in random directions, as in the broad beam of a flashlight, but a laser uses mirrors on either end of the gain medium to create a directed beam.

As photons bounce back and forth between the mirrors, repeatedly passing through the gain medium, they stimulate other atoms to release photons of exactly the same wavelength, phase and direction. Eventually, a concentrated single-frequency beam of light erupts through one of the mirrors as laser light.

Alive and well

Hundreds of different gain media have been used, including various dyes and gases. But no one has used living tissue. Mostly out of curiosity, Malte Gather and Seok-Hyun Yun of Harvard University decided to investigate with a single mammalian cell. They injected a human kidney cell with a loop of DNA that codes for an enhanced form of green fluorescent protein. Originally isolated from jellyfish, GFP glows green when exposed to blue light and has been invaluable as a biological beacon, tracking the path of molecules inside cells and lighting up when certain genes are expressed.

After placing the cell between two mirrors, the researchers bombarded it with pulses of blue light until it began to glow. As the green light bounced between the mirrors, certain wavelengths were preferentially amplified until they burst through the semi-transparent mirrors as laser light. Even after a few minutes of lasing, the cell was still alive and well.

Christopher Fang-Yen of the University of Pennsylvania, who has worked on single-atom lasers but was not involved in the recent study, says he finds the new research fascinating. "GFP is similar to dyes used to make commercial dye lasers, so it's not surprising that if you put it in a little bag like a cell and pump it optically you should be able to get a laser," he says. "But the fact that they show it really works is very cool."

Internal imaging?

Yun's main aim was simply to test whether a biological laser was even possible, but he has also been mulling over a few possible applications. "We would like to have a laser inside the body of the animal, to generate laser light directly within the animal's tissue," he says.

In a technique called laser optical tomography, laser beams are fired from outside the body at living tissues. The way the light is transmitted and scattered can reveal the tissues' size, volume and depth, and produce an image. Being able to image from within the body might give much more detailed images. Another technique, called fluorescence microscopy, relies on the glow from living cells doped with GFP to produce images. Yun's biological laser could improve its resolution with brighter laser light.

To turn cells inside a living animal into lasers, they would have to be engineered to express GFP so that they were able to glow. The mirrors in Yun's laser would have to be replaced with nanoscale-sized bits of metal that act as antennas to collect the light. "Previously the laser was considered an engineering material, and now we are showing the concept of the laser can be integrated into biological systems," says Yun.

You might also like to check out this gallery charting the evolution of the laser.

Journal reference: Nature Photonics, DOI: 10.1038/nphoton.2011.99

Meet the edible, nuclear and anti-lasers

The living laser is a first, but other strange lasers have been made in the half-century since Theodore Maiman made the first such device from a fingertip-sized ruby rod. On 16 May 1960, Maiman blasted the ruby with a brilliant burst of light from a photographic flash lamp, generating a bright red beam.

About a decade later, two future Nobel laureates created the first edible laser – well, almost. Theodor Hänsch and Arthur Schawlow tried 12 flavours of Jell-O dessert before settling on an "almost non-toxic" fluorescent dye. When added to unflavoured gelatin, this yielded a bright laser beam when illuminated with UV light. Schawlow, who had snacked on the failures, gave the successful one a miss.

Around the same time, NASA wanted much more powerful lasers for beaming power into space, and proposed powering these by exciting molecules with fragments from nuclear fission inside a small reactor. Pulses of up to 1 kilowatt were achieved before NASA abandoned the programme. The so-called Star Wars programme of the Reagan era later funded a project to develop reactor-powered laser weapons, but they never got off the ground.

Much more recently, in 2009, the world's smallest laser was demonstrated at the University of California, Berkeley. It generated green laser light in strands of cadmium sulphide only 50 nanometres across, 1/10th of the wavelength of the light it emitted.

And don't forget the anti-laser, from Hui Cao's lab at Yale University. Instead of emitting light, the anti-laser soaks it up. Strange as it sounds, it may have a practical use: converting optical signals into electrical form for future communication links.

http://www.eurekalert.org/pub_releases/2011-06/uoc--bsi060911.php

Brain scan identifies patterns of plaques and tangles in adults with Down syndrome

In one of the first studies of its kind, UCLA researchers used a unique brain scan to assess the levels of amyloid plaques and neurofibrillary tangles — the hallmarks of Alzheimer's disease — in adults with Down syndrome.

Published in the June edition of the Archives of Neurology, the finding may offer an additional clinical tool to help diagnose dementia in adults with Down syndrome, a genetic disorder caused by the presence of a complete or partial extra copy of chromosome 21.

Adults with this disorder develop Alzheimer's-like plaque and tangle deposits early, often before the age of 40. Previously, the only way to physically detect these abnormal proteins in this population was through an autopsy.

Over the last decade, methods for identifying and imaging the neuropathology of Alzheimer's disease in living patients have been developed. UCLA researchers have created a chemical marker called FDDNP that binds to both plaque and tangle deposits, which can then be viewed through a positron emission tomography (PET) brain scan, providing a "window into the brain." Using this method, researchers are able to pinpoint where in the brain these abnormal protein deposits are accumulating.

Due to individual variability and difficulty in obtaining baseline levels of cognitive function in adults with Down syndrome, such imaging may be useful in helping to diagnose dementia, say researchers.

"Neuroimaging may be a helpful tool in assessing and tracking plaque and tangle development over time in this population," said the study's senior author, Dr. Gary Small, a professor at the Semel Institute for Neuroscience and Human Behavior at UCLA who holds UCLA's Parlow-Solomon Chair on Aging. "Early detection can also lead to earlier interventions and treatments, often before symptoms begin."

For this study, researchers administered the FDDNP chemical marker intravenously and then performed PET brain scans on 19 non-demented adults with Down syndrome (average age 37), 10 healthy controls (average age 43) and 10 patients with Alzheimer's disease (average age 66).

Analysis found significantly higher binding levels of the chemical marker in participants with Down syndrome in all brain regions, when compared with healthy controls. Compared with Alzheimer's disease patients, subjects with Down syndrome showed significantly higher binding levels in the parietal and frontal regions — areas involved in memory, behavior and reasoning. "The higher level of plaques and tangles may be reflecting the early and extensive accumulation of these deposits seen in individuals with Down syndrome," Small said.

The researchers also discovered significant associations between increased age in those with Down syndrome and higher FDDNP binding values in the parietal, lateral temporal and frontal regions. "This is one of the first times we've been able to visualize the neuropathology occurring in the living brains of adults with Down syndrome," said study author Dr. Jorge R. Barrio, a professor of molecular and medical pharmacology at the David Geffen School of Medicine at UCLA who holds UCLA's Plott Chair in Gerontology. "The age-related patterns and regional distribution of the plaques and tangles were consistent with the types of deposits that could only be identified previously through an autopsy."

While the FDDNP brain scans didn't differentiate between the two types of abnormal proteins, the areas of accumulation were consistent with earlier autopsy study findings, which had shown that while plaque and tangle pathologies are the same in both Down syndrome and Alzheimer's disease, the deposit patterns are different.

Autopsy studies have also shown that all adults with Down syndrome eventually develop these accumulations of amyloid plaques and tau tangles. But rather than experiencing memory decline and other cognitive losses, as is common with Alzheimer's, aging Down syndrome patients tend to develop behavioral problems.

As part of the study, researchers performed cognitive and behavioral assessments of the Down syndrome subjects to see if FDDNP binding levels correlated with assessment results. They found several positive correlations with behavior abnormalities associated with these brain changes, including indifference and inappropriateness. "We found that the behavioral changes in the subjects with Down syndrome correlated with neurological changes in related areas of the brain consistent with the level of FDDNP binding levels to the abnormal proteins," Small said.

Small noted that cognitive skills in people with Down syndrome vary considerably and may not have been captured completely in the assessment, which primarily measured memory function. Larger future studies will compare other cognitive tests with FDDNP binding values, he said. In addition, researchers plan to determine the relative benefits of different forms of PET imaging using various chemical markers, including FDDNP.

This study was supported by the National Institutes of Health and the U.S. Department of Energy.

UCLA owns three U.S. patents on the FDDNP chemical marker. The Office of Intellectual Property at UCLA is actively seeking a commercial partner to bring this promising technology to market.

Small, Barrio and study author S.C. Huang are among the inventors. Disclosures are listed in the full study.

Additional UCLA study authors include Linda D. Nelson, Prabha Siddarth, Vladimir Kepe, S.C. Huang and Kevin E. Scheibel.

http://www.eurekalert.org/pub_releases/2011-06/aaos-ctb060511.php

Cooling the brain during sleep may be a natural and effective treatment for insomnia **Study finds that treatment with frontal cerebral thermal transfer can eliminate insomnia symptoms**

DARIEN, IL – People with primary insomnia may be able to find relief by wearing a cap that cools the brain during sleep, suggests a research abstract that will be presented Monday, June 13, in Minneapolis, Minn., at SLEEP 2011, the 25th Anniversary Meeting of the Associated Professional Sleep Societies LLC (APSS).

According to the authors, a reduction in metabolism in the brain's frontal cortex occurs while falling asleep and is associated with restorative sleep. However, insomnia is associated with increased metabolism in this same brain region. One way to reduce cerebral metabolic activity is to use frontal cerebral thermal transfer to cool the brain, a process known as "cerebral hypothermia."

Results show that there were linear effects of all-night thermal transfer intensities on sleep latency and sleep efficiency. The time that it took subjects with primary insomnia to fall asleep (13 minutes) and the percentage of time in bed that they slept (89 percent) during treatment at the maximal cooling intensity were similar to healthy controls (16 minutes and 89 percent).

"The most significant finding from this study is that we can have a beneficial impact on the sleep of insomnia patients via a safe, non-pharmaceutical mechanism that can be made widely available for home use by insomnia sufferers," said principal investigator and lead author Dr. Eric Nofzinger, professor and director of the Sleep Neuroimaging Research Program at the University of Pittsburgh School of Medicine. "The finding of a linear dose response effect of the treatment implies a direct beneficial impact on the neurobiology of insomnia that can improve the sleep of insomnia patients. We believe this has far-ranging implications for how insomnia can be managed in the future."

In this crossover study, Nofzinger and co-investigator Dr. Daniel Buysse screened 110 people, enrolling 12 people with primary insomnia and 12 healthy, age- and gender-matched controls. Participants with insomnia had an average age of about 45 years, and nine of the 12 subjects were women.

Participants received all-night frontal cerebral thermal transfer by wearing a soft plastic cap on their head. The cap contained tubes that were filled with circulating water. The effectiveness of varying thermal transfer intensities was investigated by implementing multiple conditions: no cooling cap, and cooling cap with either neutral, moderate or maximal cooling intensity.

According to Nofzinger, the simplicity and effectiveness of this natural treatment could be a long-awaited breakthrough for insomnia sufferers.

"The primary medical treatment for insomnia has long been the prescription of hypnotics, or sleeping pills, yet only about 25 percent of patients using these treatments are satisfied, citing concerns regarding side effects and the possibility of dependence on a pill to help them sleep at night," he said. "There exists a large gap between what patients with insomnia are looking for to help them and what is currently available. Patients have long sought a more natural, non-pharmaceutical means to help them with their sleep at night. The identification of a dose-dependent improvement by the device used in this study opens the door to a novel, safe and more natural way to achieve restorative sleep in insomnia care."

The American Academy of Sleep Medicine reports that chronic insomnia, or symptoms that last for at least a month, affects about 10 percent of adults. Most often insomnia is a "comorbid" disorder, occurring with another medical illness, mental disorder or sleep disorder, or associated with certain medications or substances. Fewer

people suffering from insomnia are considered to have primary insomnia, which is defined as a difficulty falling asleep or maintaining sleep in the absence of coexisting conditions.

In a study published in 2006 in the Journal of Clinical Sleep Medicine, Nofzinger and Buysse reported that increased relative metabolism in several brain regions during non-REM sleep in patients with insomnia is associated with increased wakefulness after sleep onset. They speculated that these effects may result from increased activity in arousal systems during sleep or heightened cognitive activity related to processes such as conflict, anxiety, and fear. *The SLEEP 2011 abstract supplement is available for download on the website of the journal SLEEP at <http://www.journalsleep.org/ViewAbstractSupplement.aspx>.*

http://www.eurekalert.org/pub_releases/2011-06/uab-ups061311.php

Under pressure, sodium, hydrogen could undergo a metamorphosis, emerging as superconductor

BUFFALO, N.Y. -- *In the search for superconductors, finding ways to compress hydrogen into a metal has been a point of focus ever since scientists predicted many years ago that electricity would flow, uninhibited, through such a material.*

Liquid metallic hydrogen is thought to exist in the high-gravity interiors of Jupiter and Saturn. But so far, on Earth, researchers have been unable to use static compression techniques to squeeze hydrogen under high enough pressures to convert it into a metal. Shock-wave methods have been successful, but as experiments with diamond anvil cells have shown, hydrogen remains an insulator even under pressures equivalent to those found in the Earth's core. The research, published June 10 in Physical Review Letters, details the findings of UB Assistant Professor Eva Zurek and UB postdoctoral associate Pio Baettig.

To circumvent the problem, a pair of University at Buffalo chemists has proposed an alternative solution for metallizing hydrogen: Add sodium to hydrogen, they say, and it just might be possible to convert the compound into a superconducting metal under significantly lower pressures.

Using an open-source computer program that UB PhD student David Lonie designed, Zurek and Baettig looked for sodium polyhydrides that, under pressure, would be viable superconductor candidates. The program, XtalOpt <<http://xtalopt.openmolecules.net>>, is an evolutionary algorithm that incorporates quantum mechanical calculations to determine the most stable geometries or crystal structures of solids.

In analyzing the results, Baettig and Zurek found that NaH₉, which contains one sodium atom for every nine hydrogen atoms, is predicted to become metallic at an experimentally achievable pressure of about 250 gigapascals -- about 2.5 million times the Earth's standard atmospheric pressure, but less than the pressure at the Earth's core (about 3.5 million atmospheres).

"It is very basic research," says Zurek, a theoretical chemist. "But if one could potentially metallize hydrogen using the addition of sodium, it could ultimately help us better understand superconductors and lead to new approaches to designing a room-temperature superconductor." By permitting electricity to travel freely, without resistance, such a superconductor could dramatically improve the efficiency of power transmission technologies.

Zurek, who joined UB in 2009, conducted research at Cornell University as a postdoctoral associate under Roald Hoffmann, a Nobel Prize-winning theoretical chemist whose research interests include the behavior of matter under high pressure. In October 2009, Zurek co-authored a paper with Hoffman and other colleagues in the Proceedings of the National Academy of Sciences predicting that LiH₆ - a compound containing one lithium atom for every six hydrogen atoms - could form as a stable metal at a pressure of around 1 million atmospheres. Neither LiH₆ and NaH₉ exists naturally as stable compounds on Earth, but under high pressures, their structure is predicted to be stable.

"One of the things that I always like to emphasize is that chemistry is very different under high pressures," Zurek says. "Our chemical intuition is based upon our experience at one atmosphere. Under pressure, elements that do not usually combine on the Earth's surface may mix, or mix in different proportions. The insulator iodine becomes a metal, and sodium becomes insulating. Our aim is to use the results of computational experiments in order to help develop a chemical intuition under pressure, and to predict new materials with unusual properties."

http://www.eurekalert.org/pub_releases/2011-06/nu-sea_1061311.php

Science explains ancient copper artifacts

Researchers reveal how prehistoric Native Americans of Cahokia made copper artifacts

EVANSTON, Ill. --- Northwestern University researchers ditched many of their high-tech tools and turned to large stones, fire and some old-fashioned elbow grease to recreate techniques used by Native American coppersmiths who lived more than 600 years ago.

This prehistoric approach to metalworking was part of a metallurgical analysis of copper artifacts left behind by the Mississippians of the Cahokia Mounds, who lived in southeastern Illinois from 700 until 1400 A.D. The study was published in the Journal of Archaeological Science in May.

The researchers were able to identify how the coppersmiths of Cahokia likely set up their workshop and the methods and tools used to work copper nuggets into sacred jewelry, headdresses, breastplates and other regalia.

"Metals store clues within their structure that can help explain how they were processed," said David Dunand, the James N. and Margie M. Krebs Professor of materials science and engineering at Northwestern's McCormick School of Engineering and Applied Science and co-author of the paper. "We were lucky enough to analyze small, discarded pieces of copper found on the ground of the excavated 'copper workshop house in Cahokia and determine how the metal was worked by the Cahokians."

Two materials science and engineering students conducted much of the research. Matt Chastain, a Northwestern undergraduate at the time of the study, worked alongside Alix Deymier-Black, a graduate student in the materials science and engineering department. Chastain, first author of the paper, undertook the metallurgical analysis of the samples, supplied from ongoing excavations at Mound 34 in Cahokia. Chastain followed up his analysis by volunteering at the excavation site.

"We cut through some samples of the copper pieces and polished them to look at the grain structures of the copper with a microscope," said Deymier-Black, second author of the paper. "From the size, shape and features of the grains inside the copper, we determined that the coppersmiths were likely hammering the copper, probably with a heavy rock, then putting the copper in the hot coals of a wood fire for five to 10 minutes to soften it and repeating the cycle until they had created a thin sheet of copper. "

After using basic metallurgical science to better understand the methods the Cahokians used to create copper sheets, Deymier-Black and Chastain recreated the metalworking process in the lab with natural copper nuggets, fire and a heavy stone ---pounding and heating the copper into thin sheets.

The researchers also tested theories that some archeologists had made about the coppersmiths' techniques. One idea was that they made large copper pieces, like ceremonial breastplates, by "laminating" sheets of copper together through a hammering technique. Deymier-Black said that the lamination could not be reproduced, even with much greater weights achievable with a modern press. The other hypothesis, that the Cahokians used copper knobs or copper rivets and other mechanical devices to secure sheets of copper together, seems more likely.

Another puzzle was how the Cahokians cut the hammered sheets of copper into regular shapes. The researchers cut replicated hammered sheets by four different methods: grinding an embossed ridge, shearing with scissors, hammering against a sharp corner, and bending the sheet back and forth. Only the bent edge looked similar to the edge of the historical artifacts, indicating that the Cahokians most likely used that method to cut copper.

Scientific insight into the process used to create the sacred copper artifacts of Cahokian people is helpful to James Brown, professor of anthropology at Northwestern Weinberg College of Arts and Sciences and John E. Kelly, professor of anthropology at Washington University in St. Louis. The two researchers, co-authors on the study, are credited with pinpointing the location of the copper workshop at Cahokia.

"I'm delighted that through the scientific process we were able to confirm some of the techniques and end some disputes about how the copper artifacts were made," said Brown, also an international expert on Native American archaeology. "This study gives some of the real details, so that an observer can imagine how it was done and could possibly hook onto other kinds of observations about the people of Cahokia."

This work was supported by the Office of the Provost of Northwestern University through an Undergraduate Research Grant and by a grant from the Sarah Boley Undergraduate Research Fund.

Archaeological fieldwork at Cahokia's Mound 34 is made possible by grants from the Cahokia Mounds Museum Society and the National Geographic Society (Grant No. 8464-08), and by field schools through Washington University and the University of Missouri at St. Louis.

<http://www.bbc.co.uk/news/uk-england-nottinghamshire-13752288>

Mother hopes to donate womb to her daughter

A 56-year-old says she hopes to become the first woman to have her womb transplanted into her daughter.

Eva Ottoson who lives in Nottinghamshire has agreed to take part in the medical procedure that would see her donate her uterus. Her 25-year-old daughter, Sara, who lives in Sweden, was born without reproductive organs.

If successful she could become pregnant and carry her child in the same womb that she herself was carried in.

Adoption discussed

The mother and daughter hope the procedure could happen in Sweden next spring. The pair have undergone tests to ascertain their suitability for the transplant operation. Sara Ottoson was born without a uterus because of the condition Mayer Rokitansky Kuster Hauser (MRKH) syndrome.

Her mother, who moved to England from Sweden three years ago, said: "From the start when we realised what her condition was she [Sara] has always been talking about adoption. "Then this opportunity came along last autumn. "So I think there are loads of young women out there, who for one reason or another, can't get their own babies and if this could be some way of doing it in the future, why not?"

"Both me and my daughter are rational about it. "It's just an organ like a kidney or whatever. She needs it, I have it. I don't need it anymore. "I can't see the ethical problems about it really."

The only previous womb transplant widely reported occurred in 2000, in Saudi Arabia. A womb from a 46-year-old was given to a 26-year-old but it had to be removed 99 days later because of complications.

<http://www.nytimes.com/2011/06/14/health/views/14vision.html>

A Defect That May Lead to a Masterpiece

By SANDRA BLAKESLEE

In learning to draw or paint, it helps to have a sense of composition, color and originality.

And depth perception? Maybe not so much, neuroscientists are now suggesting. Instead, so-called stereo blindness - in which the eyes are out of alignment so the brain cannot fuse the images from each one - may actually be an asset.

Looking at the world through one eye at a time automatically "flattens the scene," said Margaret S. Livingstone, an expert on vision and the brain at Harvard Medical School who helped carry out a study on stereo vision. That appears to give people with stereo blindness a natural advantage in translating the richly three-dimensional world onto a flat two-dimensional canvas, she said. They use monocular depth cues like motion, relative size, shadows and overlapping figures to stimulate a 3-D world.

For one experiment in the study, published in the journal *Psychological Science*, the researchers measured stereoscopic ability in 403 students from two art schools known for an emphasis on representational rendering and in 190 non-art majors at a university with similar tuition.

All students donned red and green glasses, the kind used to view 3-D movies, and stared at a background of colored dots that were manipulated by a computer to flicker randomly. Those with stereo vision were able to focus their eyes to see a square floating in front of or behind the computer screen, just as they might see the blade of a sword pop out of a 3-D screen. Those who were stereo blind just saw noise. The artists as a group performed more poorly than the controls.

In a second experiment, the researchers obtained portraits of 121 famous artists and 127 members of Congress from the National Gallery of Art and the photographic archives of the Smithsonian American Art Museum. The subjects' eyes were cropped from the photos and shown to observers who measured eye alignment using reflected light, not knowing anyone's identity.

The eyes of the established artists were more often misaligned, Dr. Livingstone said.

Dr. Livingstone and her colleagues first suspected a connection between artistic talent and stereo blindness when they examined 36 self-portraits by Rembrandt and found that his right eye was noticeably deviated in 35 of them. (That finding was published in *The New England Journal of Medicine* in 2004.) They wondered how widespread the phenomenon might be.

The idea that some artists have a fundamental visual defect seems counterintuitive, said a co-author of both studies, Bevil R. Conway, a stereo-blind artist who teaches neuroscience at Wellesley College. "But I always found it easy to draw," he said, "not because of dexterity, but because when I looked at a scene the relative size and spatial relationships of objects seemed obvious and related immediately to their representation on a flat sheet of paper."

An expert not involved in the new research, Susan R. Barry, a professor of neuroscience at Mount Holyoke College, said she thought the authors were "on to something." Dr. Barry is the author of "Fixing My Gaze" (Basic Books, 2009), an account of how she regained stereo vision at age 50 using vision therapy. "I have received hundreds of e-mails from people who are stereo blind, and it seems a disproportionate number are artists. Not being able to see in stereo might bias some people toward art."

Ten percent of people develop various degrees of stereo blindness in early childhood because of visual defects that do not allow both eyes to line up, Dr. Barry said. Some have weak stereo that comes and goes with fatigue, while others completely lack what she calls the "palpable volumes of space" that come with stereo. Stereo-blind people learn to navigate by using monocular cues and never know what they are missing.

Most artists' eyes are aligned, of course, so stereo blindness is not a condition for artistic success. And many people with no stereo vision show no artistic talent. "You can't make yourself a great artist by poking out one eye," Dr. Conway said.

But if you have normal stereo vision, he continued, you can appreciate the monocular cues used by artists if you sit perfectly still in front of a painting, close one eye and wait. "Stereo vision, which tells you the canvas is flat, will be suppressed," he said. "The image will pop out at you. It can be quite a surprise."

http://www.eurekalert.org/pub_releases/2011-06/aafc-lhd061411.php

Low-carbohydrate, high-protein diets may reduce both tumor growth rates and cancer risk

PHILADELPHIA — *Eating a low-carbohydrate, high-protein diet may reduce the risk of cancer and slow the growth of tumors already present, according to a study published in Cancer Research, a journal of the American Association for Cancer Research.*

The study was conducted in mice, but the scientists involved agree that the strong biological findings are definitive enough that an effect in humans can be considered.

"This shows that something as simple as a change in diet can have an impact on cancer risk," said lead researcher Gerald Krystal, Ph.D., a distinguished scientist at the British Columbia Cancer Research Centre.

Cancer Research editor-in-chief George Prendergast, Ph.D., CEO of the Lankenau Institute for Medical Research, agreed. "Many cancer patients are interested in making changes in areas that they can control, and this study definitely lends credence to the idea that a change in diet can be beneficial," said Prendergast, who was not involved with the study.

Krystal and his colleagues implanted various strains of mice with human tumor cells or with mouse tumor cells and assigned them to one of two diets. The first diet, a typical Western diet, contained about 55 percent carbohydrate, 23 percent protein and 22 percent fat. The second, which is somewhat like a South Beach diet but higher in protein, contained 15 percent carbohydrate, 58 percent protein and 26 percent fat. They found that the tumor cells grew consistently slower on the second diet.

As well, mice genetically predisposed to breast cancer were put on these two diets and almost half of them on the Western diet developed breast cancer within their first year of life while none on the low-carbohydrate, high-protein diet did. Interestingly, only one on the Western diet reached a normal life span (approximately 2 years), with 70 percent of them dying from cancer while only 30 percent of those on the low-carbohydrate diet developed cancer and more than half these mice reached or exceeded their normal life span.

Krystal and colleagues also tested the effect of an mTOR inhibitor, which inhibits cell growth, and a COX-2 inhibitor, which reduces inflammation, on tumor development, and found these agents had an additive effect in the mice fed the low-carbohydrate, high-protein diet.

When asked to speculate on the biological mechanism, Krystal said that tumor cells, unlike normal cells, need significantly more glucose to grow and thrive. Restricting carbohydrate intake can significantly limit blood glucose and insulin, a hormone that has been shown in many independent studies to promote tumor growth in both humans and mice.

Furthermore, a low-carbohydrate, high-protein diet has the potential to both boost the ability of the immune system to kill cancer cells and prevent obesity, which leads to chronic inflammation and cancer.

http://www.eurekalert.org/pub_releases/2011-06/ncsu-cfp061311.php

Copper folds protein into precursors of Parkinson's plaques

Researchers at North Carolina State University have figured out how copper induces misfolding in the protein associated with Parkinson's disease, leading to creation of the fibrillar plaques which characterize the disease.

This finding has implications for both the study of Parkinson's progression, as well as for future treatments.

The protein in question, alpha-synuclein, is the major component of fibrillar plaques found in Parkinson's patients. Researchers had already discovered that certain metals, including copper, could increase the rate of misfolding by binding with the protein, but were unsure of the mechanism by which this binding took place.

"We knew that the copper was interacting with a certain section of the protein, but we didn't have a model for what was happening on the atomic level," says Frisco Rose, Ph.D. candidate in physics and lead author of the paper describing the research. "Think of a huge swing set, with kids all swinging and holding hands – that's the protein. Copper is a kid who wants a swing. There are a number of ways that copper could grab a swing, or bind to the protein, and each of those ways would affect all of the other kids on the swing set differently. We wanted to find the specific binding process that leads to misfolding."

Their results appear in the June 14 edition of Nature Scientific Reports.

Rose and NC State colleagues Dr. Miroslav Hodak, research assistant professor of physics, and Dr. Jerzy Bernholc, Drexel Professor of Physics and Director of the Center for High Performance Simulation, developed a series of computer simulations designed to ferret out the most likely binding scenario.

According to Hodak, "We simulated the interactions of hundreds of thousands of atoms, which required multiple hundred thousand CPU-hour runs to study the onset of misfolding and the dynamics of the partially misfolded structures."

The number of calculations was so large that Hodak and Bernholc had to devise a new method to make it possible for a computer to process them. Only supercomputers like Jaguar, Oak Ridge National Laboratory's most powerful supercomputer – the most powerful in the United States, in fact – were up to the task. But the simulations finally revealed the binding configuration most likely to result in misfolding.

The researchers hope that their finding will advance our understanding of Parkinson's, one of the most common - and devastating - neurological diseases. "Understanding the molecular mechanism of Parkinson's disease should help researchers in developing drugs that treat the disease rather than merely alleviate symptoms," Bernholc says.

The research was funded by the Department of Energy and the National Science Foundation. The Department of Physics is part of NC State's College of Physical and Mathematical Sciences. Note to editors: An abstract of the paper follows.

"Mechanism of copper(II)-induced misfolding of Parkinson's disease protein"

Authors: Frisco Rose, Miroslav Hodak, Jerzy Bernholc, North Carolina State University

Published: June 14, 2011 in Nature Scientific Reports

Abstract: *α -synuclein (α S) is a natively unfolded pre-synaptic protein found in all Parkinson's disease patients as the major component of fibrillar plaques. Metal ions, and especially Cu(II), have been demonstrated to accelerate aggregation of α S into fibrillar plaques, the precursors to Lewy bodies. In this work, copper binding to α S is investigated by a combination of quantum and molecular mechanics simulations. Starting from the experimentally observed attachment site, several optimized structures of Cu-binding geometries are examined. The most energetically favorable attachment results in significant allosteric changes, making α S more susceptible to misfolding. Indeed, an inverse kinematics investigation of the configuration space uncovers a dynamically stable β -sheet conformation of Cu- α S that serves as a nucleation point for a second β -strand. Based on these findings, we propose an atomistic mechanism of copper-induced misfolding of α S as an initial event in the formation of Lewy bodies and thus in PD pathogenesis.*

<http://news.discovery.com/tech/hearts-with-no-beat-pulse-could-save-lives-110614.html>

Heart Without Beat or Pulse Could Save Lives

By Nic Halverson

For decades, the quest for the perfect artificial heart has been wrought with many technical challenges that have made it difficult to design a device that mimics the living, pumping organ.

But Drs. Billy Cohn and Bud Frazier of the Texas Heart Institute say that trying to copy the function of the living organ has been part of the problem. They've developed a non-beating, non-pumping machine that delivers blood through the body with the use of simple whirling rotors. Although such a device would leave a person without a pulse, it could work better than pumping devices, thereby prolonging the patient's life while also reducing the chance of infection or other complications.

Inside the institute's animal research laboratory resides an 8-month-old calf. The team has removed the calf's heart and replaced it with two centrifugal pumps that 'spin' blood throughout the animal's body. "If you listened to her chest with a stethoscope, you wouldn't hear a heartbeat," Cohn told NPR station KUHF in Houston. "If you examined her arteries, there's no pulse. If you hooked her up to an EKG, she'd be flat-lined."

After practicing on 38 calves, in March the team tried their device on a human patient, 55-year-old Craig Lewis. Lewis was dying from amyloidosis, a disease that causes buildup of abnormal proteins that clog the organs until they stop functioning. When his heart became damaged, doctors gave Lewis 12 hours to live, so he opted to try the artificial heart.

Cohn and Frazier took two medical implants known as ventricular assist devices and joined them together. A ventricular assist device has a screw-like rotor of blades that propels the blood forward in a continuous flow.

Thousands of people, including former Vice President Dick Cheney, have one of these implanted near their hearts. But by using two, the doctors replaced both the right and left ventricles -- essentially Lewis' entire heart.

Although Craig Lewis died a month later, due to the underlying disease attacking his kidneys and liver, doctors not only said the pumps performed flawlessly, but that continuous-flow pumps should last longer than other artificial hearts and cause fewer problems because each side has just one moving part: the constantly whirling rotor. "These pumps don't wear out," Frazier says. "We haven't pumped one to failure to date."

The doctors will have to decide on a final design before they can bring the pulse-less, continuous-flow artificial heart to the market. As well, they will need to find a manufacturer and get approval from the Food and Drug Administration. But the promise of a better artificial heart could give the thousands of people on organ donor waiting lists a ray of hope. [Via NPR] Credit: Courtesy of the Texas Heart Institute

Sleep position during pregnancy 'link to still-birth'

By Michelle Roberts Health reporter, BBC News

Pregnant woman sleeping Even among the women surveyed who lay on their right, the risk remained extremely small

Experts want urgent research to see if the position a woman chooses to sleep in during late pregnancy affects still-birth risk, as a study suggests a link. The University of Auckland compared 155 women who had late still-births with 310 who had healthy pregnancies.

Sleeping on the back or right side, rather than the left, doubled the risk - but only to almost four in 1,000. Left-side lying aids blood flow to the baby, as the mother's major blood vessels are unimpeded by a heavy womb. The New Zealand study, published in the British Medical Journal, called for larger studies to test the findings.

Ms Daghni Rajasingam of the Royal College of Obstetricians and Gynaecologists said: "There are many factors which are linked to still-birth including obesity, increasing maternal age, ethnicity, congenital anomalies and placental conditions. A significant number are unexplained.

"This small-scale study looks at another possible factor. However, more research is needed into sleep patterns before any firm conclusions over sleeping positions can be made. "In the meantime, women should speak to their midwives if they are concerned." The UK has one of the highest still-birth rates in the developed world. Every year here 4,000 babies are still-born. A third of still-births have no clear cause.

Janet Scott, of the still-birth and neonatal-death charity Sands, said: "We would like to see further research into sleep in pregnancy encouraged and funded as a matter of urgency.

"The study will require further validation before any widespread public health campaign could be justified.

"Mums want to know what they can do to reduce the chance of this happening to their baby. "A simple message which mums could follow, which would reduce their risk of still-birth, would be very welcome."

http://www.eurekalert.org/pub_releases/2011-06/du-ncf061511.php

Neutrinos change flavors while crossing Japan

DURHAM, NC – *By shooting a beam of neutrinos through a small slice of the Earth under Japan, physicists say they've caught the particles changing their stripes in new ways.*

These observations may one day help explain why the universe is made of matter rather than anti-matter.

The T2K experiment has been using the Japan Proton Accelerator Research Complex, or J-PARC, located on the east coast, to shoot a beam of muon neutrinos 185 miles, or 295 kilometers, underground toward the Super-Kamiokande, or Super-K, detector in Kamioka, near Japan's west coast.

The goal of the experiment, which is part of a new generation of neutrino-tracking facilities, is to observe the particles changing "flavors" from muon neutrinos to electron neutrinos on this brief journey.

Neutrinos are elementary particles that come in three flavors – muon, electron and tau. In past experiments, physicists have measured the change of muon neutrinos to tau neutrinos and electron neutrinos to muon neutrinos or tau neutrinos. "But no one had seen muon neutrinos turn into electron neutrinos," said Chris Walter, a physicist at Duke who is part of the T2K collaboration, along with Duke physicist Kate Scholberg.

The T2K collaboration, a team of physicists from around the world, began observing the neutrinos for their transformations in January 2010. The group measured the neutrinos, determining their flavor near the accelerator and then again at Super-K. So far, scientists caught 88 neutrinos with their detector. Six of these likely began their lives as muon neutrinos and turned into electron neutrinos on their way to Super-K.

"As it stands, this result is extremely interesting, but we are just getting started," Walter said. He explained that the T2K team has taken a little less than two percent of the planned neutrino measurements, partly due to the East Japan earthquake that struck on March 11, 2011 and forced the shutdown of T2K.

The preliminary findings were submitted to Physical Review Letters and announced at a press conference Wednesday in Japan. "We could see as many electron neutrino candidates as we saw by chance, something, like one out of every 150 times," Walter said. "This is why the title of our paper includes the word 'indications' as opposed to observation or measurement."

If the "indications" become "measurements," these T2K results will be the first to measure a muon-electron neutrino change. Scientists want this measurement to study a fundamental parameter of physics called theta-13, which controls the muon-electron neutrino switch. Walter said there is more than one way to measure theta-13 and that several experiments are currently competing to be the first. "It's good news that we have evidence of a relatively large theta-13, since there are even more interesting measurements that can be done if it is big enough," he said.

If theta-13 is large, it will allow scientists to measure the difference between oscillations of neutrinos and oscillation of anti-neutrinos. Walter explained that in the early universe, "something caused there to be slightly

more matter than anti-matter. When the matter and anti-matter annihilated each other, only that little bit of matter was left over. That matter is everything we see around us today. But no one understands how this happened. The difference between neutrino and anti-neutrino properties that we might measure in future experiments might give clues to how the excess matter was generated," Walter said.

Of course that all depends on how quickly T2K can come back online after being shut down from the earthquake. Currently, the experiment is slated to re-start at the end of 2011.

http://www.eurekalert.org/pub_releases/2011-06/miot-mrl061511.php

MIT research: Life after 'Snowball Earth'

New fossils suggest rapid recovery of life after global freeze

CAMBRIDGE, Mass. -- The first organisms to emerge after an ancient worldwide glaciation likely evolved hardy survival skills, arming themselves with tough exteriors to weather a frozen climate.

Researchers at MIT, Harvard University and Smith College have discovered hundreds of microscopic fossils in rocks dating back nearly 710 million years, around the time when the planet emerged from a global glaciation, or "Snowball Earth," event. The fossils are remnants of tiny, amoeba-like organisms that likely survived the harsh post-glacial environment by building armor and reaching out with microscopic "feet" to grab minerals from the environment, cobbling particles together to make protective shells.

The discovery is the earliest evidence of shell building, or agglutination, in the fossil record. The team found a diversity of fossils, suggesting life may have recovered relatively quickly following the first major Snowball Earth event. The researchers report their findings in an upcoming issue of *Earth and Planetary Science Letters*.

The widely held Snowball Earth theory maintains that massive ice sheets covered the planet from pole to pole hundreds of millions of years ago. Geologists have found evidence of two major snowball periods — at 710 and 635 million years ago — in glacial deposits that formed close to the modern equator. Fossil records illustrate an explosion of complex, multicellular life following the more recent ice age. However, not much is known about life between the two major glaciations — a period of about 75 million years that, until now, exhibited few signs of life.

"We know quite well what happened before the first Snowball, but we have no idea what happened in between," says Tanja Bosak, assistant professor of geobiology at MIT, and the paper's lead author. "Now we're really starting to realize there's a lot of unexpected life here."

Ice Age armor

Bosak's colleagues, Francis Macdonald of Harvard and Sara Pruss of Smith, trekked to northern Namibia and Mongolia to sample cap-carbonate rocks — the very first layers of sediment deposited after the first ice age. The team hauled the samples back to Cambridge, where Bosak dissolved the rocks in acid. She plated the residue on slides and looked for signs of fossilized life. "It's a little bit like looking at clouds, trying to pick out shapes and seeing if anything's consistent," Bosak says.

Peering at the sludge through a microscope, she discovered a sea of tiny dark ovals, each with a single notch at its edge. To get a closer look, Bosak used scanning electron microscopy to create high-resolution, three-dimensional images, revealing hollow, 10-micron-thick shells. Fossils from Namibia were mostly round; those from Mongolia, more tube-like. Most fossils contained a slit or neck at one end, from which the organism's pseudopodia, or feet, may have protruded.

Bosak analyzed the shells' composition using X-ray spectroscopy, finding a rough patchwork of silica, aluminum and potassium particles that the organism likely plucked from the environment and glued to its surface. Bosak says these single-celled microbes may have evolved the ability to build shells to protect against an extreme deep-ocean environment, as well as a potentially growing population of single-celled species, some of which may have preyed on other organisms.

A Snowball window

"We can now say there really were these robust organisms immediately after the first glaciation," Bosak says. "Having opened this kind of window, we're finding all kinds of organisms related to modern organisms."

The closest modern relative may be testate amoebae, single-celled microbes found in forests, lakes and peat bogs. These tiny organisms have been known to collect particles of silica, clay minerals, fungi and pollen, cementing them into a hard cloak or shell. Bosak says testate amoebae were extremely abundant before the first Snowball Earth, although there is no robust evidence that the plentiful protist evolved its shell-building mechanism until after that ice age.

Bosak's guess is that the post-glacial environment was a "brine" teeming with organisms and newly evolved traits. She says the group plans to return to Mongolia to sample more rocks from the same time period, and hopes other researchers will start to investigate rates of evolutionary change in similar rocks.

Dawn of agriculture took toll on health

Global review of research on stature and health during agriculture transition finds consistent trends, Emory University survey finds

When populations around the globe started turning to agriculture around 10,000 years ago, regardless of their locations and type of crops, a similar trend occurred: The height and health of the people declined.

"This broad and consistent pattern holds up when you look at standardized studies of whole skeletons in populations," says Amanda Mummert, an Emory University graduate student in anthropology.

Mummert led the first comprehensive, global review of the literature regarding stature and health during the agriculture transition, to be published by the journal *Economics and Human Biology*.

"Many people have this image of the rise of agriculture and the dawn of modern civilization, and they just assume that a more stable food source makes you healthier," Mummert says. "But early agriculturalists experienced nutritional deficiencies and had a harder time adapting to stress, probably because they became dependent on particular food crops, rather than having a more significantly diverse diet."

She adds that growth in population density spurred by agriculture settlements led to an increase in infectious diseases, likely exacerbated by problems of sanitation and the proximity to domesticated animals and other novel disease vectors.

Eventually, the trend toward shorter stature reversed, and average heights for most populations began increasing. The trend is especially notable in the developed world during the past 75 years, following the industrialization of food systems.

"Culturally, we're agricultural chauvinists. We tend to think that producing food is always beneficial, but the picture is much more complex than that," says Emory anthropologist George Armelagos, co-author of the review. "Humans paid a heavy biological cost for agriculture, especially when it came to the variety of nutrients. Even now, about 60 percent of our calories come from corn, rice and wheat."

In 1984, Armelagos and M. N. Cohen wrote a groundbreaking book, "Paleopathology at the Origins of Agriculture," which drew from more than 20 studies to describe an increase in declining health and nutritional diseases as societies shifted from foraging to agriculture.

The book was controversial at the time, but the link between the agricultural transition and declining health soon became widely accepted in what was then the emerging field of bioarcheology.

The current review was undertaken to compare data from more recent studies involving different world regions, crops and cultures. The studies included populations from areas of China, Southeast Asia, North and South America and Europe. All of the papers used standardized methods for assessing health at the individual level and examined how stressors were exhibited within the entire skeleton, rather than a concentration on a particular skeletal element or condition.

"Unless you're considering a complete skeleton, you're not getting a full picture of health," Mummert says. "You could have an individual with perfect teeth, for example, but serious markers of infection elsewhere. You could see pitting on the skull, likely related to anemia or nutritional stress, but no marks at all on the long bones."

Adult height, dental cavities and abscesses, bone density and healed fractures are some of the markers used to try to paint a more complete picture of an individual's health.

"Bones are constantly remodeling themselves," Mummert says. "Skeletons don't necessarily tell you what people died of, but they can almost always give you a glimpse into their ability to adapt and survive."

While the review further supports the link between early agricultural practices and declining stature and health, it's important to keep re-evaluating the data as more studies are completed, Mummert says.

One confounding factor is that agriculture was not adopted in an identical fashion and time span across the globe. In some ancient societies, such as those of the North American coasts, crops may have merely supplemented a seafood diet. "In these cases, a more sedentary lifestyle, and not necessarily agriculture, could have perpetuated decreased stature," Mummert says.

The way the human body adapted to changes we made in the environment 10,000 years ago could help us understand how our bodies are adapting now, she says.

Some economists and other scientists are using the rapid physiological increases in human stature during the 20th century as a key indicator of better health.

"I think it's important to consider what exactly 'good health' means," Mummert says. "The modernization and commercialization of food may be helping us by providing more calories, but those calories may not be good for us. You need calories to grow bones long, but you need rich nutrients to grow bones strong."

<http://www.sciencedaily.com/releases/2011/03/110330101036.htm>

Protein from Bones of 600,000-Year-Old Mammoth Extracted Successfully

ScienceDaily (June 4, 2011) — Researchers from the University of York and Manchester have successfully extracted protein from the bones of a 600,000-year-old mammoth, paving the way for the identification of ancient fossils.

Using an ultra-high resolution mass spectrometer, bio-archaeologists were able to produce a near complete collagen sequence for the West Runton Elephant, a Steppe Mammoth skeleton which was discovered in cliffs in Norfolk in 1990. The remarkable 85 per cent complete skeleton -- the most complete example of its species ever found in the world -- is preserved by Norfolk Museums and Archaeology Service in Norwich.



Artist's rendering of Steppe Mammoth (Mammuthus trogontherii). (Credit: Dmitry Bogdanov / Wikimedia Commons, Creative Commons Attribution 3.0 Unported license)

Bio-archaeologist Professor Matthew Collins, from the University of York's Department of Archaeology, said: "The time depth is absolutely remarkable. Until several years ago we did not believe we would find any collagen in a skeleton of this age, even if it was as well-preserved as the West Runton Elephant.

"We believe protein lasts in a useful form ten times as long as DNA which is normally only useful in discoveries of up to 100,000 years old in Northern Europe. The implications are that we can use collagen sequencing to look at very old extinct animals. It also means we can look through old sites and identify remains from tiny fragments of bone."

Dr Mike Buckley, from the Faculty of Life Sciences at the University of Manchester, said: "What is truly fascinating is that this fundamentally important protein, which is one of the most abundant proteins in most (vertebrate) animals, is an ideal target for obtaining long lost genetic information."

The collagen sequencing was carried out at the Centre for Excellence in Mass Spectrometry at the University of York and is arguably the oldest protein ever sequenced; short peptides (chains of amino acids) have controversially been reported from dinosaur fossils.

The research formed part of a study into the sequencing of mammoths and mastodons, which is published in the journal *Geochimica et Cosmochimica Acta*. The West Runton Elephant was compared with other mammoths, modern elephants and mastodons. Despite the age of the fossil, sufficient peptides were obtained to identify the West Runton skeleton as elephantid, and there was sufficient sequence variation to discriminate elephantid and mammutid collagen.

Nigel Larkin, co-author and Research Associate with Norfolk Museums and Archaeology Service, said: "The West Runton Elephant is unusual in that it is a nearly complete skeleton. At the time this animal was alive, before the Ice Ages, spotted hyenas much larger than those in Africa today were scavenging most carcasses and devouring the bones as well as meat. That means most fossils found from this time period are individual bones or fragments of bone, making them difficult to identify. In the future, collagen sequencing might help us to determine the species represented by even smallest scraps of bone.

"Therefore this research has important implications for bones and bone fragments in all archaeological and palaeontological collections in museums and archaeology units around the world, not just those of Norfolk Museums and Archaeology Service in Norwich."

<http://news.discovery.com/earth/tasty-mushrooms-from-dirty-diapers-110615.html>

Tasty Mushrooms From Dirty Diapers

By Tim Wall | Wed Jun 15, 2011 08:12 AM ET

Changing a dirty diaper isn't a fun job. Eating a diaper is even less fun, but luckily there is a fungi that can do just that.

Oyster mushrooms, *Pleurotus ostreatus*, can devour 90% of a disposable diaper within two months, observed Alethia Vázquez-Morillas of the Autonomous Metropolitan University in Mexico City in the journal *Waste Management*. What's more, the mushrooms grown on diapers are edible. Vázquez-Morillas has dined upon them herself. "They are cleaner than most of the vegetables you can find in the market, at least in Mexico," said Vázquez-Morillas in an interview with the *Economist*.

Disposable diapers normally take centuries to biodegrade in landfills. They are mostly made of cellulose, the tough material that plants use for structural support. In the airless netherworld of a landfill, cellulose can take 500 years to break down. But oyster mushrooms thrive on cellulose. They are already grown on cellulose-rich materials like barley straw, coffee grounds, and even the left-overs from making tequila.

Mexico alone throws away 5 billion diapers a year, noted Vázquez-Morillas. When you consider the billions of diapers thrown away around the world, a huge waste management problem could be turned into a cheap supply of mushroom food. But will people really eat mushrooms grown on Junior's diapers? Vázquez-Morillas asserts they are safe, since the diapers are sterilized before use.

The diapers are steam sterilized before being inoculated with mushroom mycelium, the network of white threads that make up much of the fungus' structure. Steaming kills the bacterias and other fungi that could out-compete the oyster mushrooms for living space on the diapers. It should also knock-out creatures that cause disease in humans.

Unfortunately, the cost of steam cleaning could make the process economically impractical as far as growing mushrooms for market. But the value of breaking down diapers goes beyond the sale price of oyster mushrooms.

Landfills are filling up fast, and getting more expensive to build. Reducing the intake of garbage extends the life of the landfills already in existence. And it looks like mushrooms can help.

<http://news.discovery.com/autos/spying-devices-found-on-thousands-hong-kong-cars-110616.html>

Spying Devices Found on Thousands of Hong Kong Cars

By Nic Halverson | Wed Jun 15, 2011 08:50 AM ET

Note to drivers and passengers travelling through Hong Kong: Mum's the word.

Chinese authorities have allegedly been spying on Hong Kong motorists after a device installed on thousands of vehicles was discovered to contain hardware suitable for eavesdropping.

According to a report in Hong Kong newspaper Apple Daily, recording devices were installed as "inspection and quarantine cards" in 2007. The devices -- about the size of a Blackberry and taped to vehicles' front windows -- were installed free of charge by the Shenzhen Inspection and Quarantine Bureau to streamline inspection status checks at border crossings.

However, when Apple Daily took the device to Zhang Dawei, a private investigator and Zehng Limin, associate professor of Electrical Engineering at City University of Hong Kong, both confirmed the device's potential for espionage.

Dawei told Apple Daily that much cheaper chips could be used to check inspection status for simple border crossings, "but this device uses chips commonly found in Bluetooth and voice recording devices, designed for receiving voice transmission."

Liming says the listening range is extensive. "The signal receiving range is up to 20km, which means if the device installer wants to, they can listen even when the vehicles are in Hong Kong."

Smugglers were the first to notice something odd about the devices. Sources told Apple Daily that after the cards were installed, mainland authorities demonstrated "unreal" accuracy at picking off cars smuggling illegal goods. Shenzhen Inspection and Quarantine Bureau staff flatly denied the allegations when an Apple Daily reporter confronted them with the accusations. *[Via The Epoch Times]*

http://www.eurekalert.org/pub_releases/2011-06/bc-a5y061511.php

After 55 years, surgery restores sight

After being hit in the eye by a stone, a detached retina left a man blind in his right eye.

Despite surgery to remove a cataract when the man was 23, which temporarily restored light perception, the patient was completely blind in that eye. Doctors at The New York Eye and Ear Infirmary have reported a case, published in BioMed Central's open access Journal of Medical Case Reports, describing how this patient had functional vision restored 55 years after the childhood accident which left him blind.

Whilst it is unusual for a retina to become detached, common causes include head injury, myopia or diabetes. If a retina remains detached for a prolonged period of time, degenerative changes mean that it is often impossible to restore sight even if the retina is reattached. When the patient arrived at the hospital, complaining of pain, he was found to have total hyphema, neovascular glaucoma, high intraocular pressure and a detached retina. Doctors first treated the pressure to relieve his pain.

Once his eye pressure had stabilized they treated the neovascular glaucoma using monoclonal antibody therapy and found that against all odds the patient regained light perception. Encouraged by these results the doctors decided to try and reattach the retina. After surgery the man recovered his eyesight to such an extent that he could count fingers at a distance of five meters.

A year later the patient required further retinal surgery because scars inside his eye were forcing parts of the retina to become detached again. However this second surgery was also successful. Dr Olusola Olawoye said, "To the best of our knowledge this is the first report of visual recovery in a patient with long-standing traumatic retinal detachment. This is not only a great result for our patient but has implications for restoring eyesight in

other patients, especially in the context of stem cell research into retinal progenitor cells which may be able to be transplanted into diseased retinas to restore vision."

Notes to Editors 1. Visual recovery in a patient with total hyphema, neovascular glaucoma, long-standing retinal detachment and no light perception vision: a case report *Olusola Olawoye, Christopher C Teng, Uri Shabto, Jeffrey M Liebmann, Francis A L'Esperance and Robert Ritch Journal of Medical Case Reports (in press)*

http://www.eurekalert.org/pub_releases/2011-06/e-pdl061611.php

Postnatal depression linked to depression in offspring until age 16

Washington, D.C. – Fortunately, postnatal depression often resolves itself in the weeks following childbirth.

But for mothers with more profound or prolonged postnatal depression the risk of subsequent development of depression in their children is strong. A recent study by Lynne Murray and colleagues published in the May 2011 issue of the Journal of the American Academy of Child and Adolescent Psychiatry (JAACAP) is the first to demonstrate that the effects of maternal depression on the likelihood of the child to develop depression may begin as early as infancy.

In the article titled "Maternal Postnatal Depression and the Development of Depression in Offspring Up to 16 Years of Age," Dr. Murray and her British colleagues report on 100 mothers (ranging from 18 to 42 years of age), 58 with postpartum depression, and the likelihood of their children to develop depression over a 16 year period.¹ The authors identified first time mothers with depression at 2 months postpartum, along with a group of non-depressed women, and evaluated the mothers and their children at 18 months, and 5, 8, 13, and 16 years of age.

Maternal depression was assessed using the SPI at recruitment, the Schedule for Affective Disorder and Schizophrenia, and the Structured Clinical Interview for DSM-IV. At each assessment, marital conflict was assessed using a combination of interview and questionnaire tools. At 18 months, infant attachment was assessed, using a standardized observational measure of infant responses to maternal separation and reunion in an unfamiliar environment, known as Ainsworth's Strange Situation Procedure. At 5 and 8 years, trained researchers rated the children on emotional and behavioural responses to assess their ego resilience. At 16 years, diagnostic interviews were conducted by a clinical researcher blind to maternal state using the Kiddie Schedule for Affective Disorders and Schizophrenia, Present and Lifetime Version (KSADs).

Murray and colleagues discovered that children of postnatally depressed mothers were at substantially increased risk for depression. In fact, offspring's rate of depression by age 16 was more than 40%, with the average age of first onset of depression at age 14. Interestingly, the researchers found that some years before the onset of depression, an associated impairment of the children's attachment to their mother during infancy. In addition, lower child ego resilience, measured at years 5 and 8, were associated with the increased risk of depression. Marital conflict and further maternal depression, extending beyond the postnatal period, were significantly associated with offspring lifetime depression.

In a related editorial in the same issue of the Journal, Dr. David Reiss observes, "The striking findings from Murray et al. emphasize the impact of maternal depression on the marital process and how important this process is in the evolution of the child's depression."²

The researchers conclude, "The substantially raised risk for depression among offspring of postnatally depressed mothers underlines the importance of screening for PND and of delivering early interventions." The study was supported by grants from the Medical Research Council (G9324094) and the Tedworth Charitable Trust (TED76). The study is published in the Journal of the American Academy of Child and Adolescent Psychiatry and online at www.jaacap.com.

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http://www.eurekalert.org/pub_releases/2011-06/cums-hmu061611.php

How many US deaths are caused by poverty, low levels of education and other social factors?

A new study finds that the numbers are in the same range as deaths from heart attacks and stroke

How researchers classify and quantify causes of death across a population has evolved in recent decades. In addition to long-recognized physiological causes such as heart attack and cancer, the role of behavioral factors—including smoking, dietary patterns and inactivity—began to be quantified in the 1990s. More recent research has begun to look at the contribution of social factors to U.S. mortality. In the first comprehensive analysis of such studies, researchers at Columbia University's Mailman School of Public Health found that poverty, low

levels of education, poor social support and other social factors contribute about as many deaths in the U.S. as such familiar causes as heart attacks, strokes and lung cancer.

The full study findings are published online ahead of print in the American Journal of Public Health.

The research team, led by Sandro Galea, MD, DrPH, chair of the Mailman School Department of Epidemiology, estimated the number of U.S. deaths attributable to social factors using a systematic review of the available literature combined with vital statistics data. They conducted a MEDLINE search for all English-language articles published between 1980 and 2007 with estimates of the relation between social factors and adult all-cause mortality. Ultimately they considered 47 studies for meta-analysis. After calculating for the relative risks of mortality from social factors, researchers obtained prevalence estimates for each social factor using primarily Census Bureau data. Individual social factors included education, poverty, health insurance status, employment status and job stress, social support, racism or discrimination, housing conditions and early childhood stressors. Area-level social factors included area-level poverty, income inequality, deteriorating built environment, racial segregation, crime and violence, social capital and availability of open or green spaces.

The investigators found that approximately 245,000 deaths in the United States in the year 2000 were attributable to low levels of education, 176,000 to racial segregation, 162,000 to low social support, 133,000 to individual-level poverty, 119,000 to income inequality, and 39,000 to area-level poverty.

Overall, 4.5% of U.S. deaths were found to be attributable to poverty—midway between previous estimates of 6% and 2.3%. However the risks associated with both poverty and low education were higher for individuals aged 25 to 64 than for those 65 or older.

"Social causes can be linked to death as readily as can pathophysiological and behavioral causes," points out Dr. Galea, who is also Gelman Professor of Epidemiology. For example, the number of deaths the researchers calculated as attributable to low education (245,000) is comparable to the number caused by heart attacks (192,898), which was the leading cause of U.S. deaths in 2000. The number of deaths attributable to racial segregation (176,000) is comparable to the number from cerebrovascular disease (167,661), the third leading cause of death in 2000, and the number attributable to low social support (162,000) compares to deaths from lung cancer (155,521).

"These findings argue for a broader public health conceptualization of the causes of mortality and an expansive policy approach that considers how social factors can be addressed to improve the health of populations," observed Dr. Galea. *This study was funded by the National Institutes of Health.*

<http://www.newscientist.com/article/mg21028174.000-breeding-with-neanderthals-helped-humans-go-global.html>

Breeding with Neanderthals helped humans go global

*** 16 June 2011 by Michael Marshall**

WHEN the first modern humans left Africa they were ill-equipped to cope with unfamiliar diseases. But by interbreeding with the local hominins, it seems they picked up genes that protected them and helped them eventually spread across the planet.

The publication of the Neanderthal genome last year offered proof that Homo sapiens bred with Neanderthals after leaving Africa. There is also evidence that suggests they enjoyed intimate relations with other hominins including the Denisovans, a species identified last year from a Siberian fossil.

But what wasn't known is whether the interbreeding made any difference to their evolution. To find out Peter Parham of Stanford University in California took a closer look at the genes they picked up along the way.

He focused on human leukocyte antigens (HLAs), a family of about 200 genes that is essential to our immune system. It also contains some of the most variable human genes: hundreds of versions - or alleles - exist of each gene in the population, allowing our bodies to react to a huge number of disease-causing agents and adapt to new ones.

The humans that left Africa probably carried only a limited number of HLA alleles as they likely travelled in small groups. Worse, their HLAs would have been adapted to African diseases. When Parham compared the HLA genes of people from different regions of the world with the Neanderthal and Denisovan HLAs, he found evidence that non-African humans picked up new alleles from the hominins they interbred with.

One allele, HLA-C*0702, is common in modern Europeans and Asians but never seen in Africans; Parham found it in the Neanderthal genome, suggesting it made its way into H. sapiens of non-African descent through interbreeding. HLA-A*11 had a similar story: it is mostly found in Asians and never in Africans, and Parham found it in the Denisovan genome, again suggesting its source was interbreeding outside of Africa.

Parham points out that because Neanderthals and Denisovans had lived outside Africa for over 200,000 years by the time they encountered H. sapiens, their HLAs would have been well suited to local diseases, helping to protect migrating H. sapiens too.

While only 6 per cent of the non-African modern human genome comes from other hominins, the share of HLAs acquired during interbreeding is much higher. Half of European HLA-A alleles come from other hominins, says Parham, and that figure rises to 72 per cent for people in China, and over 90 per cent for those in Papua New Guinea. This suggests they were increasingly selected for as *H. sapiens* moved east. That could be because humans migrating north would have faced fewer diseases than those heading towards the tropics of south-east Asia, says Chris Stringer of the Natural History Museum in London.

Parham presented his work at a Royal Society discussion meeting on human evolution in London last week. http://www.eurekalert.org/pub_releases/2011-06/dai-nhi061711.php

No healing in a vacuum

Negative-pressure wound therapy probably does not promote healing.

This is the conclusion of Frank Peinemann and Stefan Sauerland's meta-analysis in the current edition of *Deutsches Ärzteblatt International* (Dtsch Arztebl Int 2011; 108[22]: 381-9).

In negative-pressure wound therapy (NPWT), wounds are covered with an airtight film and an adjustable negative pressure is applied using an electronically controlled pump. The negative pressure drains wound exudate and is thought to promote healing. This procedure is used in particular for chronic persistent wounds and complicated wounds.

The research included a total of 21 randomized controlled trials that reported on commercially available NPWT systems and systems not commercially available. The proportion of patients with complete wound closure was reported in only five trials, and only two showed a statistically significant effect in favor of NPWT. The results on complete wound closure are not homogenous, and as yet it cannot be concluded that NPWT is superior to the control treatment. <http://www.aerzteblatt.de/v4/archiv/pdf.asp?id=92268>

http://www.eurekalert.org/pub_releases/2011-06/uosc-rmr061211.php

Restoring memory, repairing damaged brains

Biomedical engineers analyze -- and duplicate -- the neural mechanism of learning in rats

Scientists have developed a way to turn memories on and off - literally with the flip of a switch. Using an electronic system that duplicates the neural signals associated with memory, they managed to replicate the brain function in rats associated with long-term learned behavior, even when the rats had been drugged to forget.

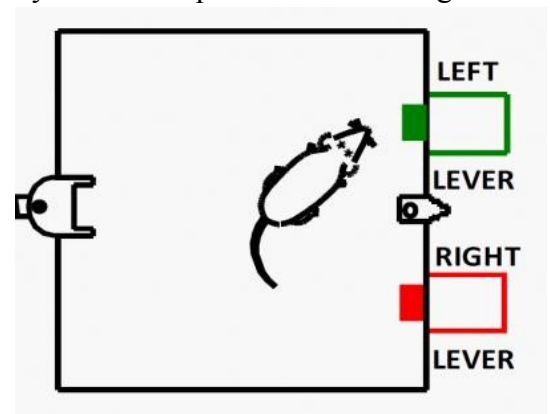
"Flip the switch on, and the rats remember. Flip it off, and the rats forget," said Theodore Berger of the USC Viterbi School of Engineering's Department of Biomedical Engineering.

Berger is the lead author of an article that will be published in the *Journal of Neural Engineering*. His team worked with scientists from Wake Forest University in the study, building on recent advances in our understanding of the brain area known as the hippocampus and its role in learning.

In the experiment, the researchers had rats learn a task, pressing one lever rather than another to receive a reward. Using embedded electrical probes, the experimental research team recorded changes in the rat's brain activity between the two major internal divisions of the hippocampus, known as subregions CA3 and CA1. The experimenters then blocked the normal neural interactions between the two areas using pharmacological agents. The previously trained rats then no longer displayed the long-term learned behavior. But long-term memory capability returned to the pharmacologically blocked rats when the team activated the electronic device programmed to duplicate the memory-encoding function. USC Viterbi School of Engineering

In the experiment, the researchers had rats learn a task, pressing one lever rather than another to receive a reward. Using embedded electrical probes, the experimental research team, led by Sam A. Deadwyler of the Wake Forest Department of Physiology and Pharmacology, recorded changes in the rat's brain activity between the two major internal divisions of the hippocampus, known as subregions CA3 and CA1. During the learning process, the hippocampus converts short-term memory into long-term memory, the researchers prior work has shown. "No hippocampus," says Berger, "no long-term memory, but still short-term memory." CA3 and CA1 interact to create long-term memory, prior research has shown.

In a dramatic demonstration, the experimenters blocked the normal neural interactions between the two areas using pharmacological agents. The previously trained rats then no longer displayed the long-term learned behavior. "The rats still showed that they knew 'when you press left first, then press right next time, and vice-versa,'" Berger said. "And they still knew in general to press levers for water, but they could only remember whether they had pressed left or right for 5-10 seconds."



Using a model created by the prosthetics research team led by Berger, the teams then went further and developed an artificial hippocampal system that could duplicate the pattern of interaction between CA3-CA1 interactions. Long-term memory capability returned to the pharmacologically blocked rats when the team activated the electronic device programmed to duplicate the memory-encoding function.

In addition, the researchers went on to show that if a prosthetic device and its associated electrodes were implanted in animals with a normal, functioning hippocampus, the device could actually strengthen the memory being generated internally in the brain and enhance the memory capability of normal rats.

"These integrated experimental modeling studies show for the first time that with sufficient information about the neural coding of memories, a neural prosthesis capable of real-time identification and manipulation of the encoding process can restore and even enhance cognitive mnemonic processes," says the paper.

Next steps, according to Berger and Deadwyler, will be attempts to duplicate the rat results in primates (monkeys), with the aim of eventually creating prostheses that might help the human victims of Alzheimer's disease, stroke or injury recover function.

The paper is entitled "A Cortical Neural Prosthesis for Restoring and Enhancing Memory." Besides Deadwyler and Berger, the other authors are, from USC, BME Professor Vasilis Z. Marmarelis and Research Assistant Professor Dong Song, and from Wake Forest, Associate Professor Robert E. Hampson and Post-Doctoral Fellow Anushka Goonawardena. Berger, who holds the David Packard Chair in Engineering, is the Director of the USC Center for Neural Engineering, Associate Director of the National Science Foundation Biomimetic MicroElectronic Systems Engineering Research Center, and a Fellow of the IEEE, the AAAS, and the AIMBE

"A Cortical Neural Prosthesis for Restoring and Enhancing Memory." (Berger et al 2011 J. Neural Eng. 8 046017)

http://www.nytimes.com/2011/06/17/science/space/17mercury.html?_r=1

Close Up, Mercury Is Looking Less Boring

By KENNETH CHANG

For years, many planetary scientists did not express much curiosity about Mercury, which looked gray and cratered — a slightly larger version of the Moon.

But data released Thursday from NASA's Mercury Messenger spacecraft, which entered orbit around Mercury in March, is painting a more vibrant picture of the solar system's innermost planet.

"Mercury ain't the Moon," Ralph L. McNutt Jr., the mission's project scientist, said at a NASA news conference on Thursday.

Among the new findings: Some of Mercury's topography is not seen anywhere else in the solar system - rimless pits, for instance - and its mineralogy is vastly different from the Moon's, whose rocks have much less potassium. Scientists already knew that Mercury has a magnetic field, while the Moon does not.

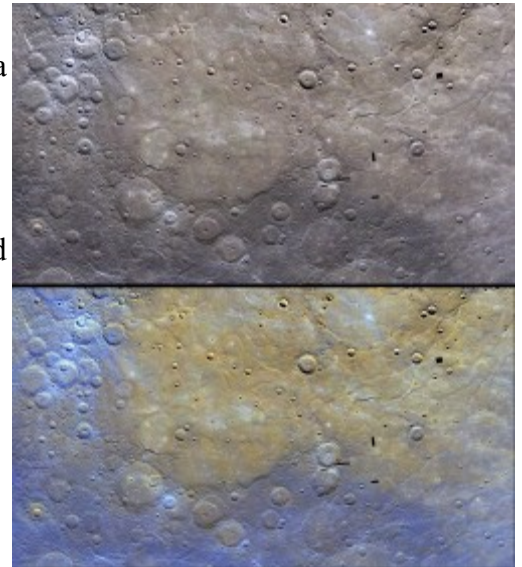
The latest batch of data includes the clearest pictures yet of Mercury's polar regions, plus readings of the elements in its crust, which have helped scientists rule out some theories about the planet's origins. Mercury Messenger has also discovered that the planet's magnetic field is stronger in its northern hemisphere than in its southern, which hints at something odd in the structure of its molten core.

Northern Plains in Color *The top image shows an example of MESSENGER's color base map imaging campaign, which will collect global images acquired through eight filters between wavelengths of 430 and 1000 nm at an average resolution of 1.2 km/pixel. In the bottom image, the same scene is shown after the application of a statistical method that highlights differences among the eight color filters, making variations in color and composition easier to discern.* NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

The new information could reveal how Mercury formed and changed over the 4.5-billion-year history of the solar system, which in turn could help astronomers understand the panoply of Earth-size planets around other stars and the possibility of conditions friendly for life on them. NASA's Kepler telescope has discovered dozens of possible Earth-size planets, but its observations can determine little beyond their size.

"We have in our solar system four experiments in how four Earthlike planets evolve once they form under slightly different conditions," said Sean C. Solomon, the principal investigator for Mercury Messenger, referring to Mercury, Venus, Earth and Mars, the four rocky planets of the inner solar system.

"What we're learning is that each of those experiments had an extraordinarily different outcome," Dr. Solomon said. "And one of those experiments we live on. So it really behooves us, in a very general way, to understand how Earthlike planets form and evolve and operate."



One of the mysteries is why the iron core of Mercury is unusually large, extending out three-quarters of the way to the surface. Earth's core, by contrast, extends a little more than halfway.

One idea was that Mercury was originally larger, and the young Sun was so intense that the radiation stripped away the outer layers, leaving behind the Mercury seen today. But that theory predicted low abundances of certain elements like potassium that would have easily evaporated in the intense heat. Mercury Messenger measured ample amounts of potassium. "We can rule out this kind of model," said Larry R. Nittler, a staff scientist at the Carnegie Institution of Washington and a member of the science team.

Another theory is that Mercury formed out of metal-rich meteorites. By and large, the observed composition of the surface rocks does not fit with that theory either, although a variation could still prove the correct explanation, Dr. Nittler said.

A third idea is that a giant impact early in Mercury's history knocked off a large fraction of the planet. "This is the model that is still in the running," Dr. Nittler said. "There are probably going to be many more models devised before we have an answer on this."

High-resolution images of craters revealed irregular pits, ranging in width from several hundred feet to a few miles. The pits do not have rims like craters produced by impacts, leading the scientists to speculate that they were etched by some unstable material that evaporated quickly when exposed at the surface.

Mercury Messenger's one-year mission around the planet is only one-quarter done, so more information about the planet will be forthcoming. Already, Dr. Solomon said, the orbiter has dispelled the misconception that Mercury is a boring place, and that what NASA's Mariner 10 spacecraft saw in 1974 and 1975 during three flybys was all that was to be seen.

"Some even in the planetary community, after the Mariner 10 mission, placed a low priority on returning a spacecraft to Mercury on the grounds that it was very much like the Moon, we'd been to the Moon," Dr. Solomon said. "It was an example, to use a phrase coined by a very famous space scientist, of 'one of the burnt-out cinders of the solar system.' And it is anything but that."

<http://www.newscientist.com/article/dn20584-chinese-medicine-offers-new-parkinsons-treatments.html>

Chinese medicine offers new Parkinson's treatments

*** 11:52 17 June 2011 by Wendy Zukerman**

A hooked herb, root extract and a dash of bark – it may sound like a witches' brew, but these compounds could provide treatments for diseases that have so far foiled western doctors, such as Parkinson's and irritable bowel syndrome.

For over 2000 years Chinese doctors have treated "the shakes" – now known as Parkinson's disease – with gou teng, a herb with hook-like branches.

Early this year, 115 people with Parkinson's were given a combination of traditional Chinese medical herbs, including gou teng, or a placebo for 13 weeks. At the end of the study, volunteers who had taken the herbs slept better and had more fluent speech than those taking the placebo.

Gou teng appears to stabilise symptoms, says Li Min, a traditional Chinese doctor at Hong Kong Baptist University. Now, Li and her colleagues have figured out how it might work.

Preserving dopamine

Parkinson's symptoms, such as muscle tremors, slowness of movement and rigidity, are caused by the progressive destruction of brain cells that produce dopamine. Previous work has suggested that an abundance of a protein called alpha-synuclein may be to blame. Current treatments aim to boost levels of dopamine, which only partly alleviates symptoms and does not affect the protein clusters.

It is thought that clumps of alpha-synuclein accumulate because brain cells cannot remove them through autophagy – a type of programmed cell death. Mice without the genes needed for autophagy quickly develop Parkinson's-like symptoms.

According to Li, autophagy is the only known process that gets rid of abnormal proteins within cells. "Enhancing this pathway may be key to treating Parkinson's," she says.

Li's team screened gou teng for its active compounds and tested which of these compounds increase the rate of autophagy and remove alpha-synuclein. To do this, the team added the compounds to human nerve cells and fruit flies that had been genetically modified to develop alpha-synuclein clusters.

Rapamycin connection

One of the compounds, an alkaloid called isorhynchamine, induced autophagy for alpha-synuclein at a similar rate to a drug called rapamycin. Rapamycin is normally used to suppress the immune system in transplant patients, but has recently been touted as a promising candidate for Parkinson's treatment because it prevents nerve cell death in flies with a Parkinson's-like disease. However, because rapamycin depresses the immune system, it would

have serious side effects for people with Parkinson's. Gou teng, meanwhile, has been taken for centuries with no apparent side effects.

Further testing found that isorhynchin activates autophagy through a different pathway to rapamycin, which may explain why it does not affect the immune system in the same way. Li, who recently presented her results at the Keystone Symposia on Molecular and Cellular Biology in Whistler, British Columbia, Canada, will begin trials of Isorhynchin in rodents later this year.

Herbs for the gut

Meanwhile, Zhaoxiang Bian, also at Hong Kong Baptist University, is developing a drug called JCM-16021 for irritable bowel syndrome (IBS) using seven herbal plants and based on a Chinese formulation called tong xie yao fang, used to treat IBS since the 1300s.

IBS affects up to 20 per cent of people, causing abdominal pain, constipation and diarrhoea. "They feel really rotten, and it's sufficiently severe for people to take time off work," says John Furness at the University of Melbourne, Australia. Stress management can help symptoms, but there is no effective medicine to treat it.

In 2007, Bian gave 80 people with IBS either JCM-16021 with Holopon – a drug that interrupts nerve impulses in the parasympathetic nervous system responsible for digestion – or Holopon alone. After eight weeks, 52 per cent of those given JCM-16021 with Holopon reported reduced IBS symptoms, compared with 32 per cent of those given Holopon alone.

IBS is partly caused by high levels of serotonin in the gut. Last year, Bian found that giving JCM-16021 to rats with IBS-like symptoms broke down serotonin in their bowel faster than normal, reducing their discomfort.

His team has since isolated several active compounds in JCM-16021 that block serotonin's activity in the rat gut, including magnolol, a herb taken from the bark of *Magnolia officinalis*.

Root of relief

This month, Keiko Lee at Juntendo University in Tokyo, Japan, found that paeoniflorin, a root extract used in JCM-16021, acts as an analgesic in rats, inhibiting adrenaline receptors in the spine.

Bian is now combining the active extracts of JCM-16021 to develop a new drug that attacks IBS from different angles. Unlike conventional approaches, which target only one aspect of the disease, he believes the combination drug will be more effective.

"I think it is a very rational way to go," says Furness, but warns that combination drugs usually take longer to gain approval because of the greater-than-usual possibility of unexpected side effects. But because these compounds have a long history of being safe for human consumption, it is hoped they will be approved faster, says Li.

"In the past the pharmaceutical industry didn't put much effort into traditional Chinese medicine," says Jing Kang, a biochemist at Harvard Medical School in Boston. "In the past few years this has been changing. More people are paying attention."

Journal references: gou teng and Parkinson's: Parkinson's Disease, DOI: 10.4061/2011/789506; rapamycin and Parkinson's: Nature Neuroscience, DOI: 10.1038/nn.2372; JCM-16021 and serotonin: World Journal of Gastroenterology, DOI: 10.3748/wjg.v16.i7.837; paeoniflorin and pain relief: European Journal of Pain DOI: 10.1016/j.ejpain.2011.04.011

<http://news.discovery.com/autos/honda-owner-nears-one-million-miles-110617.html>

Honda Owner Nears One Million Miles

A Maine man has been racking up the mileage since 1996.

content provided by Kurt Ernst, The Car Connection

The average American driver racks up 13,476 miles per year on their odometer. That makes "Million-Mile" Joe, of Norway, Maine, well above average; Joe has accumulated nearly one million miles on his 1990 Honda Accord over the last fifteen years. That works out to be nearly 4,700 miles of driving per month, meaning that Joe drives as much in a season as the average American drives in a year.

A former automotive service technician turned insurance claims adjuster, Joe is meticulous about his car's maintenance, and keeps detailed records of all services performed. He's got notebooks full of data, and Honda reports that he's taken nearly 700 pictures of his odometer to document the mileage. If nothing changes, Joe is on schedule to cross the one-million-mile mark this September, and Honda will be documenting his progress on their Facebook page.

Joe bought his Accord as a six-year-old used car in 1996 with 74,000 miles on it. His obsession with keeping records didn't start until he crossed the 300,000 mile mark, but it's safe to assume that Joe followed the car's maintenance schedule religiously even if he didn't document it. As remarkable as Joe's achievement is, it really highlights the fact that manufacturers publish recommended maintenance schedules for a reason; stick to them, and you may have a million mile car in your own garage.

<http://www.physorg.com/news/2011-06-ions-discovery-boosts-supercapacitor-energy.html>

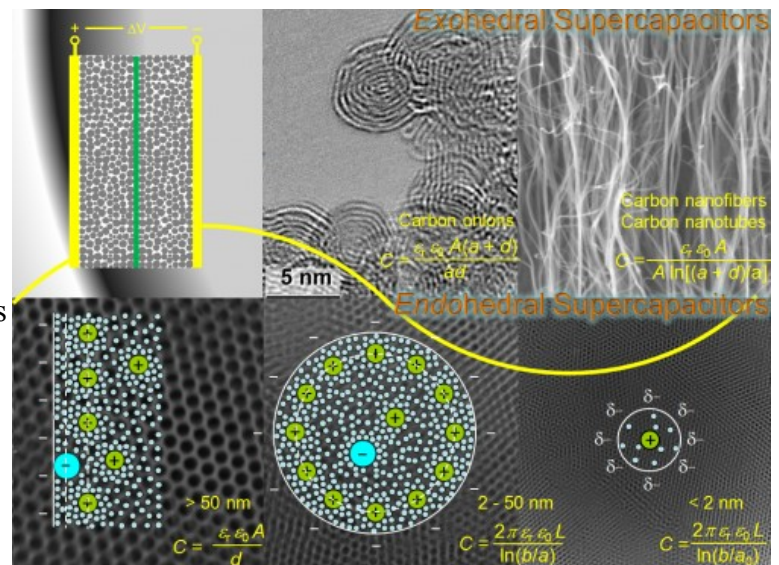
Packing the ions: Discovery boosts supercapacitor energy storage

June 17, 2011 By Leo Williams

Flat is in the eye of the beholder. When you're talking about nanomaterials, however, that eye is pretty much useless unless it's looking through an electron microscope or at a computer visualization.

Yet the pits and ridges on a seemingly flat surface -- so small they are invisible without such tools -- can give the material astonishing abilities. The trick for researchers interested in taking advantage of these abilities lies in understanding and, eventually, predicting how the microscopic topography of a surface can translate into transformative technologies.

Drexel University's Yury Gogotsi and colleagues recently needed an atom's-eye view of a promising supercapacitor material to sort out experimental results that were exciting but appeared illogical. That view was provided by a research team led by Oak Ridge National Laboratory (ORNL) computational chemists Bobby Sumpter and Jingsong Huang and computational physicist Vincent Meunier.



Computational modeling of carbon supercapacitors with the effects of surface curvature included. Jingsong Huang, ORNL

Gogotsi's team discovered you can increase the energy stored in a carbon supercapacitor dramatically by shrinking pores in the material to a seemingly impossible size—seemingly impossible because the pores were smaller than the solvent-covered electric charge-carriers that were supposed to fit within them. The team published its findings in the journal *Science*.

The mystery was not simply academic. Capacitors are an important technology that provides energy by holding an electrical charge. They have several advantages over traditional batteries—charging and discharging nearly instantaneously and recharging over and over again, almost indefinitely, without wearing out—but they also have drawbacks—most importantly, they hold far less energy.

An electric double-layer capacitor, or supercapacitor, represents an advance on the technology that allows for far greater energy density. While in traditional capacitors two metallic plates are separated by a nonconducting material known as a dielectric, in a supercapacitor an electrolyte is able to form an electric double layer with electrode materials that have very high surface areas.

As such, supercapacitors are able to achieve the same effect within a single material, as properties of the material divide it into separate layers with a very thin, nonconducting boundary. Because they can both forgo a bulky dielectric layer and make use of the carbon's nanoscale pores, supercapacitors are able to store far more energy than their traditional counterparts in a given volume. This technology could help increase the value of energy sources that are clean, but sporadic, metering out stored energy during downtimes such as night for a solar cell or calm days for a wind turbine.

So Gogotsi's discovery was potentially ground breaking. The energy was stored in the form of ions within an electrolyte, with the ions surrounded by shells of solvent molecules and packed on the surfaces of nanoporous carbons. The researchers were able to control the size of pores in the carbon material, making them 0.7 to 2.7 nanometers. What they found was that the energy stored in the material shot up dramatically as the pores became smaller than a nanometer, even though the ions in their solvation shells could not fit into spaces that small.

"It was a mystery," Sumpter said. "Many people questioned the result at the time. Yet the experimental data was showing an incredible increase in capacitance." Fortunately, it was a mystery that the ORNL team could unravel. "We thought this was a perfect case for computational modeling because we could certainly simulate nanometer-sized pores," Sumpter said. "We had electronic-structure capabilities that could treat it well, so it was a very good problem for us to explore."

Using ORNL's Jaguar and Eugene supercomputers, Sumpter and his team were able to take a nanoscale look at the interaction between ion and carbon surface. A computational technique known as density functional

theory allowed them to show that the phenomenon observed by Gogotsi was far from impossible. In fact, they found that the ion fairly easily pops out of its solvation shell and fits into the nanoscale pore.

"It goes in such a way that it desolvates in the bulk to get inside because there's electrostatic potential and van der Waals forces that pull it in," Sumpter explained. "There are a whole lot of different forces involved, but in fact it's very easy for it to get in." The ORNL team and colleagues at Clemson University, Drexel University, and Georgia Tech detailed their findings in a series of publications, including *Angewandte Chemie*, *Chemistry-A European Journal*, *ACS Nano*, *Journal of Chemical Physics C*, *Physical Chemistry Chemical Physics*, *Journal of Materials Research*, and *Nano Letters*.

"In addition," Sumpter noted, "the microscopic bumps and divots on a carbon plate make a dramatic difference in the amount of energy that can be stored on or in it.

"When you get to the nanoscale, the surface area is huge, and the curvature, both concave and convex, can be very large. This makes a large difference in the capacitance. We derived a model that explained all the experimental data. You can back out the pieces of the model from the electronic structure calculations, and from that model you can predict capacitance for different types of curved shapes and pore sizes."

For example, he said, the calculations showed that the charge-carrying ions are stored not only by slipping into pores but also attaching to mounds in the material. "It's a positive curvature instead of a negative curvature," Sumpter said, "and they can store and release energy even faster. So you can store ions inside a hole or you can store ions outside."

Using these and other insights gained through supercomputer simulation, the ORNL team partnered with colleagues at Rice University to develop a working supercapacitor that uses atom-thick sheets of carbon materials. "It uses graphene on a substrate and a polymer-gel electrolyte," Sumpter explained, "so that you produce a device that is fully transparent and flexible. You can wrap it around your finger, but it's still an energy storage device. So we've gone all the way from modeling electrons to making a functional device that you can hold in your hand." *Provided by Oak Ridge National Laboratory*

<http://www.scientificamerican.com/article.cfm?id=noaa-makes-2011-most-extreme-weather-year>

NOAA Makes It Official: 2011 Among Most Extreme Weather Years in History

Near the halfway point, 2011 has already seen eight weather-related disasters in the U.S. that caused more than \$1 billion in damages

By Lauren Morello and ClimateWire

The devastating string of tornadoes, droughts, wildfires and floods that hit the United States this spring marks 2011 as one of the most extreme years on record, according to a new federal analysis.

Just shy of the halfway mark, 2011 has seen eight \$1-billion-plus disasters, with total damages from wild weather at more than \$32 billion, according to the National Oceanic and Atmospheric Administration. Agency officials said that total could grow significantly, since they expect this year's North Atlantic hurricane season, which began June 1, will be an active one.

Overall, NOAA experts said extreme weather events have grown more frequent in the United States since 1980. Part of that shift is due to climate change, said Tom Karl, director of the agency's National Climatic Data Center. "Extremes of precipitation are generally increasing because the planet is actually warming and more water is evaporating from the oceans," he said. "This extra water vapor in the atmosphere then enables rain and snow events to become more extensive and intense than they might otherwise be."

But for some kinds of extreme weather, teasing out a contribution from climate change is more difficult.

The second half of April brought a swarm of tornadoes that leveled parts of the Midwest, including the twister that killed 151 people in Joplin, Mo. So far, 2011 has seen the sixth-highest number of tornado deaths on record, prompting many people to wonder whether climate change has played a role. So far, scientists say there's no good evidence for or against a climate change influence on tornado behavior.

Meanwhile, computer models predict that droughts -- like those that have scorched large swaths of Texas, New Mexico and Arizona this year -- will become stronger and more frequent as climate change continues. But because patterns of drought vary widely from decade to decade, that makes it "very difficult and unlikely that we're going to be able to discern a human fingerprint, if there is one, on the drought record in the foreseeable future," Karl said. "Sometimes Mother Nature just blasts us"

Katherine Hayhoe, a climate scientist at Texas Tech University, used a medical analogy to explain how climate change could affect extreme weather. "If you get a really bad bug, it could be that you were really run down," she said. "The bug is what is making you sick, but the background conditions -- being run down -- make you more susceptible to that virus. We have to acknowledge that we are changing the background conditions."

Warmer temperatures provide more energy and water in the atmosphere to feed storms, she said, noting evidence that heavy precipitation events are becoming more frequent in some parts of the globe.

But not everyone is convinced. Bill Patzert, a climate scientist at NASA's Jet Propulsion Laboratory, says he believes that climate change is real, but "it's too simple an answer to say there is more moisture in the atmosphere, so storms are more violent."

"Sometimes we have a quiet year, and sometimes Mother Nature just blasts us," he said.

More obvious influences on this year's wild weather, experts said, were La Niña and an unusual blast of cold Arctic air that reached as far south as the central United States last winter.

The droughts and associated wildfires seen across the southern United States this year, as well as increased rain and snow in the northern half of the country, are characteristic side effects of La Niña, a global weather pattern scientists recognize by the telltale pattern of cooling the equatorial Pacific Ocean. The most recent La Niña, which ended late last month, was a strong one, said Michelle L'Heureux, a climate scientist who leads the El Niño-La Niña forecasting team at NOAA's Climate Prediction Center.

"The dry seemed to be particularly dry, and the wet seemed to be particularly wet," she said.

But the unusually wet December in southern California and heavy snowpack in the northern United States are also signs of Arctic air that dipped south as another weather pattern, the North Atlantic Oscillation, hit a negative phase, experts said. That sent cold air and winter storms farther south than normal until the weather pattern started fading away in mid-January.

"The effects of La Niña were sort of muddled together with the effects of the North Atlantic Oscillation," said Ed O'Lenic, chief of the operations branch at NOAA's Climate Prediction Center. "It's very difficult to separate the two." Further muddling the picture, some research suggests that the unusual behavior of the North Atlantic Oscillation this year and during the winter of 2009-2010 may be a consequence of declining sea ice in the Arctic.

But it's not clear whether climate change has affected or will affect the behavior of La Niña and her counterpart, El Niño. "It's possible that [the El Niño cycle] impacts could be aided and abetted by climate," L'Heureux said, who said the ambiguity can be just as frustrating for climate scientists as it is for the public trying to make sense of unusual weather. "At this point, it's too difficult to make that real-time attribution," she said. "That's really what our field struggles at -- people want this information on demand. They want to know now what's causing this extreme rainfall event."

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http://www.nytimes.com/2011/06/14/health/policy/14vaccine.html?_r=1

\$4.3 Billion Pledged at Vaccine Fund-Raiser

By DONALD G. McNEIL Jr.

Public and private donors have pledged \$4.3 billion toward vaccinating children against a variety of diseases, according to the GAVI Alliance, which held its first fund-raising conference for vaccines in London on Monday.

That exceeds the \$3.7 billion that the alliance — created 11 years ago as the Global Alliance for Vaccines and Immunization to help poor countries pay for vaccines — had hoped to raise. Some is matching money contingent on other pledges. The target is to immunize more than 250 million children by 2015. Vaccines, medical experts say, save more lives than any public health measure other than clean water and sewage.

When GAVI was created, experts estimated that three million children a year were dying of vaccine-preventable diseases; that number has now dropped to two million.

Fifty countries have already applied for the funds, some of which will buy newer, more expensive vaccines against rotavirus, meningitis, pneumococcal disease, hepatitis B and yellow fever; the alliance also hopes to eventually add vaccines against cervical cancer, rubella, typhoid, Japanese encephalitis and other diseases.

Exactly how much the money will buy will be cannot be calculated because vaccine makers have been steadily lowering their prices as political pressure on them increases and as low-cost competitors, mostly from India, enter the field.

"Vaccines are absolutely brilliant value for money," Andrew Mitchell, Britain's secretary of state for international development, said at the news conference where the pledges were announced. "For the price of a cup of coffee, it's possible to vaccinate a child against five killer diseases."

Bill Gates, who helped create GAVI and whose foundation has given it more than \$1.5 billion, said the new money meant "we will be upping our sights" on how fast new vaccines can be made and how many children can be reached. "Eighty percent coverage is not nearly enough," he said, referring to how many of the world's children get the three most common vaccines, against diphtheria, whooping cough and tetanus.

The United States, which has given \$647 million in the past, pledged another \$450 million, pending Congressional approval. The British government, a sponsor of the pledging conference, gave \$1.3 billion over five years, roughly doubling its previous donation. Australia, Norway and Sweden also doubled theirs, Mr.

Mitchell said. Japan and Brazil pledged for the first time, as did some foundations and companies, like Anglo-American, the South African mining giant.

The financially strapped British government had recently re-examined all 43 agencies to which it donates foreign aid, Mr. Mitchell said. It froze or cut donations to some, but concluded that GAVI was one of the most cost-effective. *This article has been revised to reflect the following correction:*

Correction: June 18, 2011 An article on Tuesday about contributions to the GAVI Alliance, an international effort to vaccinate poor children, misstated the amount pledged by the British government. It is \$1.3 billion over five years, not \$266 million. The article also omitted a new pledge of \$1 billion by the Bill & Melinda Gates Foundation. (As it correctly noted, the foundation has already given \$1.5 billion.) And it misstated the amount of past contributions by the United States. The government has given \$647 million, not more than \$650 million.

http://www.eurekalert.org/pub_releases/2011-06/du-ash061711.php

Arctic snow harbors deadly assassin

Heavy and prolonged snowfall can bring about unexpected conditions that encourage fungal growth, leading to the death of plants in the Arctic, according to experts.

A new international study confirms that whilst snow has an insulating effect which helps plants to grow bigger, heavy and prolonged snow can, in certain circumstances, also encourage the rapid and extensive growth of killer fungal strains.

The research results, published in the journal Nature Climate Change, show for the first time the potential long term effects of unexpected fungal development on an arctic landscape. Extensive damage to a pervasive species under snowier conditions would leave gaps for another plant to take its place over time but could also alter the food-web for insects, voles, lemmings and their predators.

Co-author of the report, Dr. Robert Baxter, School of Biological and Biomedical Sciences, Durham University, said: "We were surprised to find that this extremely hardy tundra vegetation was killed off by fungal attack.

"In the first few years, as expected, the insulating effect of the snow helped the vegetation to grow, but after six years a tipping point was reached where the fungus spread with great speed and destroyed the plants.

"We need to look more carefully in the future at longer term vegetation and fungus life cycles to see if this is something that could recur and be more destructive over time."

The research team from Durham University, UK; Umeå University, the Swedish University of Agricultural Sciences, Uppsala, Sweden; and the Finnish Forest Research Institute, compared the effects of normal snowfall conditions and increased snow conditions on vegetation.

Researchers used snow fences to maintain increased snow conditions, and found that the fungus, *Arwidssonia empetri*, increased under heavier and prolonged snow cover killing the majority of the shoots of one of the dominant plant species in that area – the dwarf shrub *Empetrum hermaphroditum*. The team's unexpected finding followed a decision to keep the experiment running longer than was originally planned.

The researchers believe that the findings highlight unforeseen elements that should be factored into future modelling of the impacts of climate change and its effects on vegetation and food-web chains.

Co-author of the report, Johan Olofsson, Department of Ecology and Environmental Science, Umeå University, Sweden, said: "We set out to look at the effects of climate change and the potential of heavier precipitation and snowfall on plants and the processes that influence growth, decomposition and soil nutrients.

"Shrubs are an important part of the arctic vegetation and we did not expect to find a deadly species-to-species effect influenced by this manipulated snow accumulation."

Snow usually protects arctic plants through the long winter period as it maintains a warmer local environment around the overwintering plants and helps them to grow bigger and faster. During the seven year experiment, the researchers observed steady plant growth under the protection of the snow's insulating blanket. In year six, the fungus spread rapidly, killing the plant and changing the vegetation from a natural carbon sink to a net carbon source.

Co-author of the report, Lars Ericson, Department of Ecology and Environmental Science, Umeå University, Sweden, said: "We discovered some surprising interactions between plants and other organisms in an area that is very important for the world's climate. The results will enable us to have a better understanding of longer term climate change effects and extreme weather events, locally and regionally."

The study has been funded by The Natural Environment Research Council, UK; the Centre for Environmental research in Umeå, Sweden; and the Swedish Research Council for the Environment, Agricultural Sciences and Spatial Planning.

The Abisko Scientific Research Station provided accommodation, laboratory facilities and funding during the periods of field work. The research team is continuing the study to investigate the extent and duration of vegetation change under altered snow conditions.