You're born a copy but die an original

The older we get, the more different we become. This is the conclusion of a study that followed people from their 70th to their 90th year of life.

Old people are usually thought of as a rather homogenous group – they are considered to be ill, lonely and unable to take care of themselves. But the truth is that the differences among people grow with age,' says Bo G Eriksson, University of Gothenburg.

As part of his doctoral thesis, Eriksson studied participants of the extensive and unique so-called H-70 study, which is based on a group of randomly selected individuals born in 1901 and 1902 who were followed closely over their entire lifetimes. Eriksson's study focuses on the period from their 70th to their 90th year of life. It turns out that people become more and more different as they age.

'The perception of old people having similar interests, values and lifestyles can lead to age discrimination. However, I found that, as people age, these stereotypes become more and more untrue,' says Eriksson.

Eriksson also studied differences in causes of death with increasing age, and again found indications of possible age discrimination.

Eriksson explored how social conditions can affect longevity, and found four mechanisms at work. The first two relate to creation of social facts. Examples of social facts include promises and agreements that strengthen the identities of individuals. The third mechanism relates to how a person builds and maintains self esteem by successfully responding to challenges. The fourth mechanism consists of everyday conversations, which decrease anxiety and offer support in everyday decision making, improves attention and gives the brain and the memory a healthy workout. 'Taken together, these mechanisms also contribute to increased everyday activity, which has some beneficial physical effects,' says Eriksson.

Moreover, Eriksson applied two different methods to predict people's lifespan: one that researchers commonly use when calculating probability and one that is based on artificial neural networks (ANN), which is common in research on artificial intelligence. It turned out that the ANN method was more effective in complex situations where traditional methods do not work. ANN may therefore be appropriate in evaluations of results produced with traditional research methods.

About the H70 study: The H70 study, started in 1971, is a unique population-based study on ageing among 70-year-olds. It includes both medical and cognitive dimensions. Five different groups of 70-year-olds have so far been assessed, and a number of trends in mental and physical health have been identified. In addition, some groups have been followed longitudinally over three decades. The H70 study is coordinated by several research groups at the University of Gothenburg.

Digging into Fuji's religious side / Archaeologists searching for clues to history of worship on mountain

Ichiro Sumi Yomiuri Shimbun Staff Writer

An excavation project is under way on Mt. Fuji, searching for the roots of religious faith involving this national symbol. A three-year enterprise begun in fiscal 2009 by Yamanashi Prefecture's Archaeological Cultural Properties Center, the project is seeking to find out when Mt. Fuji became a place of worship for laypeople as well as priests.

Climbing Mt. Fuji to perform religious devotions is known to have become popular among laypeople living near the capital during the Edo period (1603-1867). However, items recently unearthed on the mountain suggest such "climber-worshippers" may have established a base there much earlier.

Excavation began last year at Fuji Omuro Sengen Jinja shrine in Fuji Kawaguchikomachi, Yamanashi Prefecture, located at the second station from the Fuji Yoshida entrance to Mt. Fuji. Legend has it that contributions to build the shrine began to be solicited in 699, making it the oldest shrine near the mountain.

The property was refurbished in the Keicho era (1596-1615), and little is known about the shrine and how it was used before that period.

Last year, the excavation team worked around the altar and at the back of the shrine grounds. Near the altar, archaeologists found kanei tsuho, coins used in the Edo period, and within the grounds they found about 40 toraisen, foreign coins used before the Edo period. They did not find a cornerstone or nails in the back of the shrine grounds, or traces of a building, indicating no large structure was built. However, their research discovered that land was prepared to construct something in an area along an old thoroughfare.

"Some sort of religious facility--a small building like a hokora (small-scale shrine)--might have been there," said Kazuhiro Hosaka, an official at the center. "We shouldn't make a conclusion based just on toraisen, but it's highly likely it was built in the medieval era or earlier," Hosaka said.

The earliest document in existence that refers to a religious facility at Mt. Fuji's second station is a 1475 land deed for the area. A 1500 entry in the chronicle Katsuyamaki says that in addition to monks undergoing religious training on the mountain, laypeople had begun climbing it to worship.

"It's hard to believe monks carried money when they went on the mountain. Whether it was for donations or something else, laypeople must have brought the coins," said Hidekazu Sakazume, an archaeologist and professor emeritus at Rissho University.

An expert in ancient coins, Sakazume hailed the findings. "[The coins] are evidence the second station may have served as a religious base for laypeople in the medieval era," he said.

In the Edo period, a religious group called Fujiko became popular among laypeople. People gathered to climb Mt. Fuji to worship, led by priests called oshi.

Fujiko extended its influence in the late Edo period by linking its ideology to the belief that the Emperor should rule the nation. The bakufu government repeatedly banned the group.

Advocates are aiming to have Mt. Fuji registered as a World Heritage Site in fiscal 2012 or later. A member of the International Council on Monuments and Sites at an international conference has advised them to focus on the religious and artistic aspects of the mountain when seeking registration.

The latest findings are certain to reinforce the religious connection between the Japanese people and Mt. Fuji. The center plans to continue its research this year, and hopes are high its research will solve a number of mysteries.

Archaeopteryx may have hunted at night

LIKE a modern owl, Archaeopteryx may have come alive at night. The shapes of eye sockets differ predictably in birds that feed during the day, night or twilight, according to a study that promises to spill the beans on the dino-bird's lifestyle.

When Lars Schmitz at the University of California, Davis, studied 77 bird species, he found he could predict the foraging lifestyle of any species simply by measuring the bones that their eyes are set in. Each bird pupil is surrounded by a ring of bony segments called the scleral ring. Schmitz found that the outer and inner diameter of this ring, combined with the depth of eye sockets, could closely predict when a bird forages (Vision Research, DOI: 10.1016/j.visres.2010.03.009). This opens up the tantalising possibility of discovering whether extinct birds were nocturnal.

Current depictions of Archaeopteryx may have to change **(Image: DEA Picture Library)**

Schmitz is currently making detailed measurements, but a quick look at Archaeopteryx fossils reveals that it had wide scleral rings and deep eye sockets, says Derek Yalden at the University of Manchester. According to Schmitz's findings, this would make the dino-bird nocturnal.

"I don't think it had occurred to anyone to suggest this," says Yalden. If he is right, all drawings of Archaeopteryx flying through the daytime skies of early Earth will need to be revisited.

Scientists identify how a novel class of antibodies inhibits HIV infection

DURHAM, N.C. – Scientists at Duke University Medical Center have identified a set of naturally occurring antibodies that can block one of the key ways the AIDS virus gains entry into certain blood cells. They say the discovery, published online in the Journal of Experimental Medicine, expands traditional notions about how the immune system fights HIV and offers a potential new strategy for HIV vaccine design.

Researchers have been puzzled and frustrated for years by antibody responses to HIV. In most infections, antibodies that fight off invading pathogens show up quickly and get right to work. But with HIV, the most powerful antibodies typically don't materialize until weeks or even months after initial infection – way too late to be effective.

"The beauty of this newly identified set of antibodies – called polyreactive anti-phospholipid antibodies – is that they are so potent against the type of virus that establishes infection during mucosal transmission," says Anthony Moody, M.D., a member of the Center for HIV/AIDS Vaccine Immunology (CHAVI) at Duke and lead author of the study appearing in the Journal of Experimental Medicine. "Our research suggests we may be able to harness them and enhance their anti-viral activity with a vaccine to fight HIV directly," Moody says.

Moody says the antibodies, PGN632, P1, IS4 and CL1, do not appear to have any pathogenic features, even though other members of the class do. Earlier studies by others have demonstrated that anti-phospholipid antibodies have anti-viral effects, but "what we have done in this paper is to show how they do that," Moody says.

Through a series of laboratory tests on blood taken from HIV-infected patients as well as healthy volunteers, Moody discovered that when these antibodies bind to white blood cells (monocytes), it causes them to secrete substances called chemokines that block HIV from docking with its favorite entry point into a blood cell, the CCR5 receptor. "In other words, they don't go after individual viral particles directly, but instead, indirectly, by creating a chemical roadblock at one of the virus' most commonly used portals."

That doesn't happen all the time, however. The study showed antiviral activity in only 85 percent of the blood they tested – and only in the presence of monocytes.

Investigators believe the finding has particular strategic importance because most of the HIV strains use the CCR5 receptor to gain entry into a cell. Since it is one of the earliest events in the process of infection, being able to potentially intervene at that juncture could be meaningful.

While the findings still have to be tested clinically, they do suggest a new way the immune system might be manipulated to thwart HIV, said Barton Haynes, M.D., director of CHAVI and the Duke Human Vaccine Institute and senior author of the study. "There are two parts of the immune system - the innate and adaptive components - and this study shows a vaccine that could elicit these polyreactive antibodies could recruit both components to fight HIV."

"We have long assumed that a successful vaccine would probably need to attack HIV on multiple fronts," Haynes says. "These findings have given us one more potential way to use the immune system to fight HIV."

The study was supported by a Collaboration for AIDS Vaccine Discovery grant from the Bill and Melinda Gates Foundation, a Veterans Affairs Merit Review Award, an NIAID NIH grant, the Center for HIV/AIDS Vaccine Immunology as well as resources from the University of Alabama and the Birmingham Center for AIDS Research.

Colleagues from Duke who contributed to the study include David Montefiori, Hua-Xin Liao, S. Munir Alam, Richard Seacre, M. Kelly Plonk, Daniel Koznik, Mark Drinker, Shi-Mao Xia, Laura Sutherland, Georgia Tomaras, Thomas Denny and Kwan-Ki Hwang. Others who contributed include Ian Giles, University College, London; John Kappes, Christina Ochsenbauer-Jambor and Tara Edmonds, University of Alabama; Melina Soares, Gustavo Barbero and Philip Thorpe, University of Texas Southwestern Medical Center; Donald Forthal and Gary Landucci, University of California Irvine; Connie Chang and Steven King, Peregrine Pharmaceuticals; and Pojen Chen, UCLA.

New arrhythmia drug provides only modest efficacy and no clear safety benefits say researchers

Cedars-Sinai Heart Institute researchers review dronedarone

LOS ANGELES – In a rigorous new review of the antiarrhythmic drug dronedarone (Multaq), researchers at the Cedars-Sinai Heart Institute conclude that the controversial drug is only modestly effective and has no clear safety benefits.

The review, to be published in the April 23 issue of the Journal of the American College of Cardiology, assessed data on dronedarone submitted during the drug's FDA approval process and determined that dronedarone is 50 percent less effective than amiodarone (Cordarone), a frequently used treatment for atrial fibrillation, a common type of heart rhythm disorder. Despite initial hopes that dronedarone would cause fewer side effects than amiodarone, the studies submitted to the FDA do not confirm that, the researchers conclude.

"We believe that dronedarone should only be used as a second-line or third-line agent in individuals that are not able to tolerate amiodarone or other first-line agents recommended by the guidelines," says the study's senior author, Dr. Sanjay Kaul, director of the Vascular Physiology and Thrombosis Research Laboratory at the Cedars-Sinai Heart Institute.

Atrial fibrillation and atrial flutter are disruptions of the heart's natural rhythm. Atrial fibrillation occurs when the heart's upper chambers (called atria) quiver, instead of beating properly, and this disruption may allow blood to pool or clot, raising the risk of stroke. Atrial flutter is a type of rapid heartbeat related to atrial fibrillation. Nearly 2.3 million Americans are affected by atrial fibrillation and atrial flutter and these conditions account for nearly 71,000 deaths each year.

Although amiodarone is an effective treatment for atrial fibrillation and atrial flutter, it can cause serious side effects, such as thyroid and lung toxicity. Dronedarone is chemically similar to amiodarone and was specifically designed to avoid amiodarone's side effects. However, the studies submitted to the FDA failed to confirm that dronedarone was significantly safer or more effective than amiodarone, says Kaul. While it's possible that dronedarone might provoke fewer side effects than amiodarone, the studies done so far have been too small and of insufficient duration to confirm this, he says.

Dronedarone has received widespread attention recently due to a controversial lecture sponsored by the drug's maker, Sanofi-Aventis, that touted dronedarone's off-label use. When the drug received a green light from the FDA in 2009, its approval was for reducing the risk of cardiovascular hospitalization in patients with nonpermanent atrial fibrillation or atrial flutter, rather than as a drug indicated for suppression of arrhythmia, says Kaul.

"Dronedarone has, at best, modest effectiveness as an antiarrhythmic agent, and it has not been proven to be any safer than amiodarone," says Kaul. "Amiodarone does have the potential for toxicity that can adversely impact quality of life, but it's also very effective and we can manage side effects or avoid them by lowering the dose. The argument that dronedarone is potentially safer than amiodarone is weakened by the fact that it's also

half as effective. However, patient preference is an important consideration in treatment decisions. There are some patients who might consider improved short-term tolerability over reduced efficacy an acceptable tradeoff."

Based on the current studies, physicians should be very cautious about using dronedarone for off-label indications such as ventricular arrhythmia, and should avoid using it in high-risk patients such as those with advanced heart failure or those with recently decompensated heart failure requiring hospitalization or special attention, says Kaul. "Dronedarone has very modest efficacy as an antiarrhythmic agent, and based on the current evidence its use for the treatment of nonpermanent atrial fibrillation or atrial flutter can only be supported as a second- or third-line agent after guideline-recommended first-line agents have failed."

Researchers show some cells in pancreas can spontaneously change into insulin-producing cells

NEW YORK – Alpha cells in the pancreas, which do not produce insulin, can convert into insulin-producing beta cells, advancing the prospect of regenerating beta cells as a cure for type 1 diabetes. The findings come from a study at the University of Geneva, co-funded by the Juvenile Diabetes Research Foundation, that is published today in the online edition of the scientific journal Nature.

The researchers, led by Dr. Pedro L. Herrera, demonstrated that beta cells will spontaneously regenerate after near-total beta cell destruction in mice and the majority of the regenerated beta cells are derived from alpha cells that had been reprogrammed, or converted, into beta cells. Using a unique model of diabetes in mice, in which nearly all of the beta cells are rapidly destroyed, the researchers found that if the mice were maintained on insulin therapy, beta cells were slowly and spontaneously restored, eventually eliminating the need for insulin replacement. Alpha cells normally reside alongside beta cells in the pancreas and secrete a hormone called glucagon, which works opposite to insulin to regulate the levels of sugar in the blood. Alpha cells are not attacked by the autoimmune processes that destroy beta cells and causes type 1 diabetes.

Type 1 diabetes is a chronic, autoimmune disease that affects children, adolescents and adults, in which the immune system attacks the beta cells in the pancreas that produce insulin, a hormone that enables people to convert food into energy. People with type 1 diabetes are dependent on insulin treatment for the rest of their life.

Dr. Herrera's results are the first to show that beta cell reprogramming can occur spontaneously, without genetic alterations. Previous efforts to reprogram non-beta cells into beta cells relied on genetic manipulations – processes that can not be easily translated into therapies.

According to Dr. Andrew Rakeman, JDRF Program Manager in Beta Cell Therapies, the breakthrough in Dr. Herrera's work is the demonstration that alpha- to-beta-cell reprogramming can be a natural, spontaneous process., "If we can understand the signals that are triggering this conversion, it will open a whole new potential strategy for regenerating beta cells in people with type 1 diabetes," he said. "It appears that the body can restore beta cell function either through reprogramming alpha cells to become beta cells or, as previously shown by others, by increasing growth of existing beta cells. This path may be particularly useful in individuals who have had the disease for a long time and have no, or very few, remaining beta cells."

Role of Removing Beta Cells

Dr. Herrera's team genetically engineered the animals to be susceptible to a toxin that would destroy only their beta cells. When the mice were exposed to the toxin, the beta cells were rapidly and efficiently destroyed – greater than 99% just 15 days after treatment. Then, to track the source of newly regenerated beta cells, Dr. Herrera's team used another genetic manipulation to permanently label mature alpha cells and all their descendents with a fluorescent protein. This "genetic lineage tracing" approach allowed the scientists to track the fate of the alpha cells and their progeny; the presence of fluorescently labeled beta cells in the recovered animals gave conclusive evidence that alpha cells had reprogrammed into beta cells.

The Geneva researchers pointed out that the critical factor in sparking the alpha-to- beta-cell reprogramming was removing (or ablating) nearly all the original insulin-producing cells in the mice. In mice where the loss of beta cells was more modest, the researchers either found no evidence of beta cell regeneration (when only half the cells were destroyed) or less alpha cell reprogramming (when less than 95% of cells were destroyed).

"The amount of beta-cell destruction thus appears to determine whether regeneration occurs. Moreover, it influences the degree of cell plasticity and regenerative resources of the pancreas in adult organisms," said Dr. Herrera.

Regeneration Research

In type 1 diabetes, the immune system attacks beta cells, stopping a person's pancreas from producing insulin, the hormone that enables people to get energy from sugar. JDRF has been at the forefront of diabetes

research looking to develop therapeutics to drive the regeneration of insulin-producing cells within a person's body (as an alternative to transplanting insulin-producing cells from other sources). Beta cell regeneration involves triggering the body to grow its own new insulin producing cells, either by copying existing ones – some are usually still active, even in people who have had diabetes for decades – or causing the pancreas to create new ones.

This study is another step forward for JDRF's research focus on Regeneration as a potential pathway to restore insulin production – and normal blood sugar in people with type 1 diabetes. JDRF has become a leader in this new and exciting research field, funding a wide range of research projects, including studies like Dr. Herrera's, and an innovative diabetes drug discovery and development partnership with the Genomics Institute of the Novartis Foundation (GNF), focused on regeneration approaches.

In addition to regenerating or replacing insulin producing cells, a cure for type 1 diabetes will also require stopping the autoimmune attack that causes diabetes, and reestablishing excellent glucose control.

New study on carbon nanotubes gives hope for medical applications

A team of Swedish and American scientists has shown for the first time that carbon nanotubes can be broken down by an enzyme - myeloperoxidase (MPO) - found in white blood cells. Their discoveries are presented in Nature Nanotechnology and contradict what was previously believed, that carbon nanotubes are not broken down in the body or in nature. The scientists hope that this new understanding of how MPO converts carbon nanotubes into water and carbon dioxide can be of significance to medicine.

"Previous studies have shown that carbon nanotubes could be used for introducing drugs or other substances into human cells," says Bengt Fadeel, associate professor at the Swedish medical university Karolinska Institutet. "The problem has been not knowing how to control the breakdown of the nanotubes, which can caused unwanted toxicity and tissue damage. Our study now shows how they can be broken down biologically into harmless components."

Carbon nanotubes are a material consisting of a single layer of carbon atoms rolled into a tube with a diameter of only a couple of nanometres (1 nanometer = 1 billionth of a metre) and a length that can range from tens of nanometres up to several micrometers. Carbon nanotubes are lighter and stronger than steel, and have exceptional heat-conductive and electrical properties. They are manufactured on an industrial scale, mainly for engineering purposes but also for some consumer products.

Carbon nanotubes were once considered biopersistent in that they did not break down in body tissue or in nature. In recent years, research has shown that laboratory animals exposed to carbon nanotubes via inhalation or through injection into the abdominal cavity develop severe inflammation. This and the tissue changes (fibrosis) that exposure causes lead to impaired lung function and perhaps even to cancer. For example, a year or two ago, alarming reports by other scientists suggested that carbon nanotubes are very similar to asbestos fibres, which are themselves biopersistent and which can cause lung cancer (mesothelioma) in humans a considerable time after exposure.

This current study thus represents a breakthrough in nanotechnology and nanotoxicology, since it clearly shows that endogenous MPO can break down carbon nanotubes. This enzyme is expressed in certain types of white blood cell (neutrophils), which use it to neutralise harmful bacteria. Now, however, the researchers have found that the enzyme also works on carbon nanotubes, breaking them down into water and carbon dioxide. The researchers also showed that carbon nanotubes that have been broken down by MPO no longer give rise to inflammation in mice.

"This means that there might be a way to render carbon nanotubes harmless, for example in the event of an accident at a production plant," says Dr Fadeel. "But the findings are also relevant to the future use of carbon nanotubes for medical purposes."

The study was led by researchers at Karolinska Institutet, the University of Pittsburgh and the National Institute for Occupational Safety and Health (NIOSH), and was financed in part through grants from the National Institutes of Health (NIH) and the Seventh Framework Programme of the European Commission. The work was conducted as part of the NANOMMUNE project, which is coordinated by associate professor Bengt Fadeel of the Institute of Environmental Medicine, Karolinska Institutet, and which comprises a total of thirteen research groups in Europe and the USA.

Publication: *Valerian E. Kagan, Nagarjun V. Konduru, Weihong Feng, Brett L. Allen, Jennifer Conroy, Yuri Volkov, Irina I. Vlasova, Natalia A. Belikova, Naveena Yanamala, Alexander Kapralov, Yulia Y. Tyurina, Jingwen Shi, Elena R. Kisin, Ashley R. Murray, Jonathan Franks, Donna Stolz, Pingping Gou, Judith Klein-Seetharaman, Bengt Fadeel, Alexander Star, Anna Shvedova*

Carbon nanotubes degraded by neutrophil myeloperoxidase induce less pulmonary inflammation
Nature Nanotechnology, in press, 4 April 2010, DOI: 10.1038/NNANO.2010.44

New investigation supports correlation between XMRV and prostate cancer

Novel XMRV retrovirus diagnostic test developed

Philadelphia, PA – The recently discovered retrovirus, xenotropic murine leukemia virus-related virus (XMRV), has been identified in some prostate cancer patients. In light of conflicting data concerning XMRV, standardized diagnostic testing is important to identify patients in which XMRV is present and to determine whether it plays a role in the incidence of prostate cancer. An article published in the April issue of Urology® is a step in this direction as researchers from Emory University report the successful development of an experimental clinical test for XMRV.

"We cannot as a scientific community begin to answer the basic questions of XMRV transmission, frequency in the population, association with disease, etc. until we can effectively test for infection," according to lead investigator John A. Petros, MD, Associate Professor of Urology, Emory University School of Medicine and Veterans Administration Hospital.

Dr. Petros and co-investigators adapted technology developed in the HIV arena (neutralizing antibody assay) and have developed a serum test that can identify patients who have previously been infected with the virus. This assay has been rigorously confirmed by two independent labs and two independent technologies (PCR and FISH), thus confidence in the accuracy of the test is high.

The mode of transmission of the virus is unknown. No method is available to screen either blood or tissue donors for infection and no data are available regarding whether the virus can be transmitted by blood transfusion or tissue transplantation. Dr. Petros comments, "The public deserves to know if the next blood transfusion or organ donation will give them XMRV retrovirus, an infection which lasts for life, and could possibly be related to prostate cancer. The failure to develop accurate tests for this virus is a serious public health oversight."

Although the assay used in the present report involved the inhibition of infection of target cells by viral-like particles with the XMRV envelope protein expressed on their surface, results also suggest that more standard serologic tests for antibodies against specific viral antigens can be developed in the future.

The authors conclude that "our report adds to the growing body of evidence that XMRV is indeed a novel gamma-retrovirus capable of infecting humans and that at least some patients with prostate cancer have been infected with XMRV. We have reported serologic evidence of infection and that the serology correlated with tissue-based assays. The concordance of 3 independent methods of detecting infection added confidence to the assertion that this recently discovered virus is real and possibly related to human disease. Robust clinical assays are needed to detect XMRV infection, and much work remains to be done in determining whether XMRV is indeed an oncogenic virus or simply an associated epiphenomenon."

The article is "XMRV Infection in Patients With Prostate Cancer: Novel Serologic Assay and Correlation With PCR and FISH" by Rebecca S. Arnold, Natalia V. Makarova, Adeboye O. Osunkoya, Suganthi Suppiah, Takara A. Scott, Nicole A. Johnson, Sushma M. Bhosle, Dennis Liotta, Eric Hunter, Fray F. Marshall, Hinh Ly, Ross J. Molinaro, Jerry L. Blackwell, and John A. Petros. It appears in Urology, Volume 75, Issue 4 (April 2010) published by Elsevier.

African Fossil Changes Ideas of Ant Origins

By SINDYA N. BHANOO

An ant trapped in Ethiopian amber. **Alexander Schmidt**

The first fossil ant from Africa, found in amber dating back 95 million years, challenges a previously held theory that ants originated in North America or East Asia. The finding is part of a larger study published in the Proceedings of the National Academy of Sciences identifying 28 fossilized insects, one spider and one mite, as well as a variety of flora all trapped in amber from Ethiopia. The insects, the oldest that have been identified in Africa, are from the Cretaceous.There are also numerous fungi, ferns and spores that were previously unknown to paleontologists.

Until now, paleontologists had assumed that ants originated in North America or South Asia, because the only known fossils were from these regions, said Alexander Schmidt, the paper's lead author and a biologist at the University of Göttingen in Germany.

He and his colleagues are convinced that further analysis will reveal more about the evolution of the ants and how the Ethiopian ant is biologically related to Cretaceous ants of the Northern Hemisphere.

The paper is a culmination of five years of study by 20 researchers from seven countries, including specialists in dating the amber, and experts in different insects and flora. "This was a really interdisciplinary project and it was our intent to produce a holistic study," he said. The samples are primarily housed in Berlin and Vienna, though some are also in the American Museum of Natural History in New York.

This is your brain on Cryptococcus: Pathogenic fungus loves your brain sugar

DURHAM, N.C. -- Highly dangerous Cryptococcus fungi love sugar and will consume it anywhere because it helps them reproduce. In particular, they thrive on a sugar called inositol which is abundant in the human brain and spinal cord.

To borrow inositol from a person's brain, the fungi have an expanded set of genes that encode for sugar transporter molecules. While a typical fungus has just two such genes, Cryptococcus have almost a dozen, according to Joseph Heitman, M.D., Ph.D., chairman of the Duke Department of Molecular Genetics and Microbiology.

"Inositol is abundant in the human brain and in the fluid that bathes it (cerebral spinal fluid), which may be why this fungus has a predilection to infect the brain and cause meningitis," Heitman said. "It has the machinery to efficiently move sugar molecules inside of its cells and thrive." The findings on Cryptococcus genes were published online this week in the inaugural issue of mBio, a new open access microbiology journal.

This specialized brain attack likely occurred because these fungi adapted to grow on plants in the wild, which also are abundant in inositol, said lead author Chaoyang Xue, Ph.D., formerly a postdoctoral research associate in the Heitman lab and now an assistant professor at the Public Health Research Institute at the University of Medicine and Dentistry of New Jersey (UMDNJ). "In fact, this pathogenic yeast has more inositol transporters than all other fungi we have compared it to in the fungal kingdom, based on what we know from genome research."

The team of researchers discovered that inositol stimulates Cryptococcus to sexually reproduce. "A connection between the high concentration of free inositol and fungal infection in the human brain is suggested by our studies," Xue said. "Establishing such a connection could open up a new way to control this deadly fungus."

Cryptococcus' love for sugar may also be a fungal Achilles Heel, Heitman said. "Now scientists may be able to target the fungi by developing ways to put them on the fungal equivalent of an Atkin's low-carbohydrate diet so they will stop multiplying." He said researchers could use the new findings to devise different types of strategies to block Cryptococcus infections.

These studies will be reported in the inaugural issue mBio, which will be launched in May by the American Society of Microbiology as an online journal that spans all areas of microbiology.

The Claim: For Better Muscle Tone, Go Lighter and Repeat

By ANAHAD O'CONNOR

THE FACTS Lifting heavy weights makes you big and bulky - or at least that's the conventional wisdom. It's the reason many women (and some men) who want slim and "toned" physiques opt for lighter weights, lifted more times.

But the notion is not supported by science. Producing bulky muscles requires not just heavy weights but heavy calorie consumption as well, typically far above the 2,000 daily calories recommended for many adults.

For people who lift weights to tone up and slim down, experts say, a regimen that includes a combination of challenging weights and fewer repetitions can help significantly. In a 2002 study, for example, scientists looked at what happened when women performed various resistance exercises at different weights and repetitions (85 percent of their maximum ability for 8 reps, versus 45 percent for 15). Subjects lifting more weight fewer times burned more energy and had a greater metabolic boost after exercise.

In another study published last year, scientists followed 122 women for six years. They found that those who were assigned to do resistance exercises three times a week - sets of 8 reps at 70 to 80 percent of their ability - lost the most weight and body fat. A similar two-year study of women who did strength training with challenging weight twice weekly found similar effects on body and "intra-abdominal" fat.

THE BOTTOM LINE For better tone, try fewer reps and more challenging weights.

Poisoning by prescription drugs on the rise

New study indicates US hospitalizations for poisoning by opioids, sedatives and tranquilizers increased 65 percent from 1999-2006

San Diego, CA – Poisoning is now the second leading cause of unintentional injury death in the U.S. While several recent high-profile Hollywood celebrity cases have brought the problem to public attention, the rates of unintentional poisoning deaths have been on the rise for more than 15 years, and in fact, unintentional poisoning has surpassed motor vehicle crashes as the leading cause of unintentional injury death among people 35-54 years of age. In a study published in the May issue of the American Journal of Preventive Medicine, researchers found that hospitalizations for poisoning by prescription opioids, sedatives and tranquilizers in the U.S. have increased by 65% from 1999 to 2006.

"Deaths and hospitalizations associated with prescription drug misuse have reached epidemic proportions," said the study's lead author, Jeffrey H. Coben, MD, of the West Virginia University School of Medicine. "It is

essential that health care providers, pharmacists, insurance providers, state and federal agencies, and the general public all work together to address this crisis. Prescription medications are just as powerful and dangerous as other notorious street drugs, and we need to ensure people are aware of these dangers and that treatment services are available for those with substance abuse problems."

In the first comprehensive examination of nationwide hospitalizations associated with these prescription medications, researchers examined data gathered from the Nationwide Inpatient Sample (NIS), which contains records for approximately 8 million hospitalizations per year. By using standard diagnosis codes from the ICD-9-CM, the authors extracted from the NIS all poisonings by drugs, medicinal, and biological substances reported from 1999-2006, and further categorized the specific types of drugs in each case. It was also possible to determine whether the poisoning was diagnosed as intentional, unintentional or undetermined.

Dr. Coben believes that while the data reveals a fast-growing problem, there's an urgent need for more in-depth research on this wave of injuries and deaths. Writing in the article, he said, "Interviews with survivors could provide important additional details regarding the pathways to abuse of these drugs, the methods used to obtain the medications, the sequencing and combination of drugs that result in overdose, and the immediate precursors to these serious events. The association between hospitalization for prescription opioids, sedatives, and tranquilizers and subsequent morbidity and mortality is another area in need of further research."

While the majority of hospitalized poisonings are classified as unintentional, substantial increases were also demonstrated for intentional overdoses associated with these drugs, likely reflecting their widespread availability in community settings.

From 1999-2006, total estimated hospitalizations in the U.S. for poisoning by prescription opioids, sedatives, and tranquilizers increased by 65%; while unintentional poisonings by these drugs increased by 37%. In comparison, during this same period, hospitalizations for poisoning by other drugs, medicinal and biological substances increased by 33%, while all other hospitalizations increased by just over 11%. Unintentional poisonings by other substances increased by 21%. Intentional poisonings from prescription opioids, sedatives, and tranquilizers rose by a total of 130% compared to a 53% increase in intentional poisonings from other substances.

The largest percentage increase in hospitalizations for poisoning for a specific drug was observed for methadone (400%). Poisonings by benzodiazepines increased 39%. Hospitalizations for poisoning by barbiturates actually decreased 41%, as did hospitalizations for poisoning by antidepressants (a decrease of 13%).

The article is "Hospitalizations for Poisoning by Prescription Opioids, Sedatives, and Tranquilizers" by Jeffrey H. Coben, MD, Stephen M. Davis, MPA, MSW, Paul M. Furbee, MA, Rosanna D. Sikora, MD, Roger D. Tillotson, MD, and Robert M. Bossarte, PhD. The article, doi: 10.1016/j.amepre.2010.01.022, appears in the American Journal of Preventive Medicine, Volume 38, Issue 5 (May 2010) published by Elsevier.

The immune system's guard against cancer

Researchers from Helmholtz Center for Infection Research in Braunschweig, Germany have discovered how immuno-messenger substances can inhibit tumour growth

The human body has developed various mechanisms, through which it can protect itself against newly-developing cancer cells. For instance, killer-cells recognize and destroy altered cells in our organs every day. Once tumours have developed, they may be inhibited in growth by messenger substances from the immune system. Scientists from the research group "Molecular Immunology" at the Helmholtz Center for Infection Research (HZI) in Braunschweig have now succeeded to reveal a completely unexpected function of such an immunological messenger substance in the suppression of tumours; i.e., the molecule "beta-interferon" inhibits the tumour in its attempts to connect into the human blood circulatory system. Moreover, it hinders the production of growth factors that support the formation of new blood vessels. The conclusion - the tumour cannot grow. The results from their study have been published in the latest issue of the scientific magazine "Journal of Clinical Investigation".

The connection with the blood circulatory system is a significant step in the development of cancer. Within the tissue where it is growing, the tumour develops an independent existence. With signal substances it entices white blood cells from the bone marrow into the tumour tissue. The task of these cells, usually, is to defend against infection and stimulate the healing of wounds. Within the tumour, these cells prompt new blood vessels to increase their rate of growth. Once the tumour is connected to the blood circulatory system, it is provided with nutrients for growth. It also can then disseminate its own cells into the overall blood circulatory system as well and form metastases. Scientists at the HZI are now in the process of deciphering precisely how a messenger substance is able to inhibit this integration process into the blood circulatory system.

Messenger substances are the fine-tuning regulators of immune-cells; they activate or deactivate them, generate the production of growth factors or further messenger substances and initiate or terminate an immune

reaction. One of these signal molecules is currently being used in therapy for several forms of cancer – interferon. How it works remains a mystery, so far, to scientists. The research scientist Jadwiga Jablonska from HZI has recently found a new mode of action against cancer beta-interferon a subtype of the interferons. The results surprised her: “Beta-interferon blocks the connection of the tumour into the blood vessel system by inhibiting immune cells to produce growth factors. This effect upon tumours was completely unexpected,” says Jadwiga Jablonska.

The research scientist allowed skin tumours to grow in two groups of mice; the first group of mice was not able to build beta-interferon, while the second group produced the messenger substance as usual within their bodies. After a few days, the research scientist investigated the growth rate of the tumour. “In mice that cannot produce beta-interferon, the tumours were considerably larger than in the animals that did have the signal molecule in their bodies.” With beta-interferon, the tumours not only grew slower – they formed fewer and smaller metastases as well.

The reason for the inferior rate of growth was found by the research scientist to be attributable to the lack of blood circulation within the tumours. “In the presence of beta-interferon, considerably fewer blood vessels developed within the tumour”, says Jadwiga Jablonska. The beta-interferon functioned through a small detour; it blocked the formation of vessel producing growth factors in cells that were enticed by the tumour to promote the connection with the blood-circulatory system. The research scientist discovered that the cells not only formed fewer growth factors, a smaller quantity of these cells found their way into the tumour, as well. “Only a negligible quantity of this messenger substance was sufficient to keep cells at bay and to inhibit growth factors, thus arresting the growth of tumours”, says Jadwiga Jablonska.

“This mode of action on the part of beta-interferon had previously been unidentified”, says Siegfried Weiss, leader of the working group “Molecular Immunology” at HZI. The messenger substance actually plays a significant role in viral diseases and reactions to infections. “We now are attempting to understand how the network of tumour, immune cells and messenger substance functions, in order to discover new target structures for cancer therapy”, says Weiss.

Original article: *Jablonska J, Leschner S, Westphal K, Lienenklaus S, Weiss S. Neutrophils responsive to endogenous IFN-beta regulate tumor angiogenesis and growth in a mouse tumor model. J Clin Invest. 2010 Apr 1. DOI: 10.1172/JCI37223*

In Syria, a Prologue for Cities

By JOHN NOBLE WILFORD

Archaeologists have embarked on excavations in northern Syria expected to widen and deepen understanding of a prehistoric culture in Mesopotamia that set the stage for the rise of the world’s first cities and states and the invention of writing.

In two seasons of preliminary surveying and digging at the site known as Tell Zeidan, American and Syrian investigators have already uncovered a tantalizing sampling of artifacts from what had been a robust pre-urban settlement on the upper Euphrates River. People occupied the site for two millenniums, until 4000 B.C. - a little-known but fateful period of human cultural evolution.

Scholars of antiquity say that Zeidan should reveal insights into life in a time called the Ubaid period, 5500 to 4000 B.C. In those poorly studied centuries, irrigation agriculture became widespread, long-distance trade grew in influence socially and economically, powerful political leaders came to the fore and communities gradually divided into social classes of wealthy elites and poorer commoners.

Gil Stein, director of the Oriental Institute of the University of Chicago, a leader of the excavations at Zeidan, said the site’s northern location promised to enrich knowledge of the Ubaid culture’s influence far from where the first urban centers eventually flourished in the lower Tigris and Euphrates Valley. The new explorations, he said, are planned to be the most comprehensive yet at a large Ubaid settlement, possibly yielding discoveries for decades. “I figure I’m going to be working there till I retire,” said Dr. Stein, who is 54.

There are several reasons for excitement over the Zeidan excavations. Warfare and ensuing unstable conditions have locked archaeologists out of Iraq and its prime sites of Mesopotamian antiquity. So they have redoubled research in the upper river valleys, across the border in Syria and southern Turkey. And Zeidan is readily accessible. Having never been built upon by subsequent cultures, it is free of any overburden of ruins to thwart excavators.

Above all, a driving ambition of archaeologists always is to dig beneath the known past for more than glimpses of the little known.

For almost two centuries, the glory went to expeditions unearthing the houses and temples, granaries and workshops of earliest urban centers like Uruk, seat of the legendary Gilgamesh, and the later splendors of Ur and Nineveh. The challenge was to decipher the clay tablets of a literate civilization with beginnings in what is known as the Uruk period, 4000 to 3200 B.C.

Uruk remains overshadowed the traces of Ubaid cultures, the region's earliest known complex society. Only a handful of ruins - at Ubaid, Eridu and Oueili in southern Mesopotamia and Tepe Gawra, in the north near Mosul, Iraq - had produced at best a sketchy picture of these older cultures. A few Ubaid sites in northern Syria were either too small to be revealing or virtually inaccessible under other ruins.

A decade ago, Richard L. Zettler, a University of Pennsylvania archaeologist with extensive experience in Syria, said, "Our real focus now should not be on the Uruk period, but the Ubaid."

Last week, Dr. Zettler, who is not associated with the Chicago team but has visited the site, said that Zeidan preserves artifacts over a long sequence of Ubaid culture at a junction of major trade routes. "We should see the transition as the Ubaid spread from the south up to farming regions in the north," he said.

Guillermo Algaze, an anthropologist at the University of California, San Diego, and an authority on early urbanism in the Middle East not involved in new research, said recently that Zeidan "has the potential to revolutionize current interpretations of how civilization in the Near East came about."

Tell Zeidan is a two-hour drive southeast of Aleppo and three miles from the modern town of Raqqa. Muhammad Sarhan, a curator of the Raqqa Museum, is co-director, with Dr. Stein, of the excavations, formally known as the Joint Syrian-American Archaeological Research Project at Tell Zeidan.

The site consists of three large mounds on the east bank of the Balikh River, just north of its confluence with the Euphrates. The mounds, the tallest being 50 feet high, enclose ruins of a lower town. Buried remains and a scattering of ceramics on the surface extend over an area of 31 acres, which makes this probably larger than any other known Ubaid community.

It would seem that the mounds had long stood on the semi-arid landscape as an open invitation for archaeologists to stop and dig. A few stopped. The American archaeologist William F. Albright identified the place in 1926. The British archaeologist Sir Max Mallowan, husband of the mystery writer Agatha Christie, was intrigued and made a brief survey in the 1930s. A Dutch team led by Maurits van Loon took an interest in 1983, finding that the site appeared to date to the Ubaid period. A German group asked the Syrians for permission to excavate but was turned down.

Finally, after initial visits to Zeidan, Dr. Stein said the Syrian government "encouraged me to submit an application" to dig. Why the change?

"I was incredibly thrilled, but can only speculate on what their reasons were," Dr. Stein said in a recent interview, referring to the Syrian decision. "Perhaps they were waiting for the right team to come along. Our institute had worked in Syria for something like 80 years, and we were interested in a long-term commitment. We also pointed out that the site was endangered from agricultural development along its edges. Parts of the site had already been bulldozed for fields and a canal."

In the summers of 2008 and 2009, Dr. Stein directed mapping of the Zeidan ruins and digging exploratory trenches. He said the initial findings confirmed this to be a "proto-urban community" in the Ubaid period, most likely the site of a prominent temple.

A description and interpretation of the discoveries so far was published in the Oriental Institute's recent annual report, followed by an announcement this week by the University of Chicago. The international excavation team, supported by the National Science Foundation in the United States, is to resume fieldwork in July.

Four distinct phases of occupation have been identified at Zeidan. A simpler culture known as the Halaf is found in the bottom sediments, well-preserved Ubaid material in the middle and two layers of late Copper Age remains on top. From the evidence so far, the transitions between periods seemed to have been peaceful.

Archaeologists have turned up remains of house floors with hearths, fragments of mudbrick house walls, painted Ubaid pottery and sections of larger walls, possibly part of fortifications or monumental public architecture. The ceramic styles and radiocarbon tests date the wall to about 5000 B.C.

One of the most telling finds was a stone seal depicting a deer, presumably used to stamp a mark on goods to identify ownership in a time before writing. About 2-by 2- 1/2 inches, the seal is unusually large and carved from a red stone not native to the area. In fact, archaeologists said, it was similar in design to a seal found 185 miles to the east, at Tepe Gawra, near Mosul.

To archaeologists, a seal is not just a seal. Dr. Zettler said it signifies that "somebody has the authority to restrict access to things - to close and seal jars, bags, doors - and so once you have these seals you must have had social stratification."

The existence of elaborate seals with near-identical motifs at such widely distant sites, Dr. Stein said, "suggests that in this period, high-ranking elites were assuming leadership positions across a very broad region, and those dispersed elites shared a common set of symbols and perhaps even a common ideology of superior social status."

Other artifacts attest to the culture's shift from self-sufficient village life to specialized craft production dependent on trade and capable of acquiring luxury goods, the archaeologists reported. Such a transition is assumed to have required some administrative structure and produced a wealthy class. The expedition will be searching for remains of temples and imposing public buildings as confirmation of these political and social changes.

In what appears to be the site's industrial area, archaeologists uncovered eight large kilns for firing pottery, one of the most ubiquitous Ubaid commodities over wide trading areas. They found blades made from the high-quality volcanic glass obsidian. An abundance of obsidian chips showed that the blades were produced at the site, and the material's color and chemical composition indicated that it came from mines in what is now Turkey.

"We found flint sickle blades everywhere," Dr. Stein said, noting that they had a glossy sheen "where they had been polished by the silica in the stems of wheat that they were used to harvest."

Zeidan also had a smelting industry for making copper tools, the most advanced technology of the fifth millennium B.C. The people presumably reached as far as 250 miles away to trade for the nearest copper ore, at sources around modern-day Diyarbakir, Turkey. Getting the ore home was no easy task. In a time before the wheel or domesticated donkeys, people had to bear the heavy burden on their backs.

A site like Tell Zeidan, Dr. Zettler said, is "telling us that the Uruk cities didn't come out of nowhere, they evolved from foundations laid in the Ubaid period."

Until recently, Dr. Algaze said, "accidents of data recovery" had led scholars to think the origin of cities and states in Mesopotamia was "a fairly abrupt occurrence in the fourth millennium that as concentrated in what is southern Iraq."

The southern cities may have been larger and more enduring, he said, but increasing exploration on the Mesopotamian periphery, especially the spread of trade and technology among interacting Ubaid cultures, suggests that "the seed of urban civilization" had been planted well before 4000 B.C.

Gene bandage rejuvenates wasted muscle

* 06 April 2010 **by Wendy Zukerman**

AN RNA "bandage" that masks genetic mutations has prompted boys with Duchenne muscular dystrophy (DMD) to make a missing, muscle-strengthening protein throughout their bodies for the first time.

Around 1 in 3500 boys are born with DMD, the result of mutations in a gene on the X chromosome for the protein dystrophin. Boys with DMD tend to need wheelchairs by age 12 and die of cardiac or respiratory failure before they reach 30.

"When the dystrophin gene was identified 24 years ago, there were very high hopes that gene therapy would correct the condition," says Steve Wilton of the University of Western Australia in Perth. But hopes fell when the gene's complexity and size became clear - it is the largest known in humans. "Reintroducing a healthy gene was not as simple or straightforward as anticipated."

Rather than trying to correct the genetic defects, Wilton's team created nucleic acid snippets that bind to sections of messenger RNA corresponding to the DMD mutations. If injected, these bandages cause the mutations, which normally prevent dystrophin production, to be skipped over during protein-making.

In 2003 the approach seemed to work in mice. In 2009, injecting the snippets into the foot muscle of seven boys with DMD triggered dystrophin production there. Now the team has injected the snippets into the blood of 20 boys with DMD.

Last week, Wilton told the World Congress of Internal Medicine in Melbourne, Australia, that tissue biopsies suggest dystrophin is being produced throughout the bodies of boys who received high doses of the bandage.

It is not yet clear if the dystrophin will increase the boys' muscle strength, but Wilton points out it did in animals. The protein resembles the version found in men with the milder Becker's MD, who live into their 60s. "This is the most promising therapeutic option for Duchenne's," says David Allen of the University of Sydney.

UCSB geologist discovers pattern in Earth's long-term climate record

Santa Barbara, Calif - In an analysis of the past 1.2 million years, UC Santa Barbara geologist Lorraine Lisiecki discovered a pattern that connects the regular changes of the Earth's orbital cycle to changes in the Earth's climate. The finding is reported in this week's issue of the scientific journal Nature Geoscience.

Lisiecki performed her analysis of climate by examining ocean sediment cores. These cores come from 57 locations around the world. By analyzing sediments, scientists are able to chart the Earth's climate for millions of years in the past. Lisiecki's contribution is the linking of the climate record to the history of the Earth's orbit.

It is known that the Earth's orbit around the sun changes shape every 100,000 years. The orbit becomes either more round or more elliptical at these intervals. The shape of the orbit is known as its "eccentricity." A related aspect is the 41,000-year cycle in the tilt of the Earth's axis.

Glaciation of the Earth also occurs every 100,000 years. Lisiecki found that the timing of changes in climate and eccentricity coincided. "The clear correlation between the timing of the change in orbit and the change in the Earth's climate is strong evidence of a link between the two," said Lisiecki. "It is unlikely that these events would not be related to one another."

Besides finding a link between change in the shape of the orbit and the onset of glaciation, Lisiecki found a surprising correlation. She discovered that the largest glacial cycles occurred during the weakest changes in the eccentricity of Earth's orbit — and vice versa. She found that the stronger changes in the Earth's orbit correlated to weaker changes in climate. "This may mean that the Earth's climate has internal instability in addition to sensitivity to changes in the orbit," said Lisiecki.

She concludes that the pattern of climate change over the past million years likely involves complicated interactions between different parts of the climate system, as well as three different orbital systems. The first two orbital systems are the orbit's eccentricity, and tilt. The third is "precession," or a change in the orientation of the rotation axis.

Building a better flu vaccine: Add second strain of influenza B

Saint Louis U research tackles problem of vaccine not matching virus

ST. LOUIS -- Vaccines likely would work better in protecting children from flu if they included both strains of influenza B instead of just one, Saint Louis University research has found.

"Adding a second influenza B virus strain to the seasonal influenza vaccine would take some of the guesswork out of strain selection and help improve the vaccine's ability to prevent influenza," said Robert Belshe, M.D., lead investigator and director of the Center for Vaccine Development at Saint Louis University.

"Since in five of the last 10 years, the influenza B component in the vaccine has been the incorrect one, this seems like an obvious advance to me."

Every spring, scientists predict which strain of influenza will be circulating in the community the following fall. Historically, they choose two different subtypes of influenza A and one of influenza B. When they choose the wrong strain of influenza B, the influenza vaccine is less effective in preventing the disease.

Research findings in the March issue of Vaccine highlight the importance of adding both lines of influenza B into the vaccine to better protect against the flu.

The research team examined how well current vaccines protect against influenza B by looking at the immune response of ferrets that were given FluMist, a live attenuated influenza vaccine manufactured by MedImmune, and at efficacy studies in children who received traditional flu shots or FluMist.

When ferrets were vaccinated against influenza, the ferrets that were exposed to a strain of influenza B virus that did not match what was in the vaccine didn't have a strong antibody response. However they had a vigorous antibody response when given a vaccine that contained both strains of influenza B. This showed that immunizing against one strain of influenza B does not appear to protect against the other strain and that a vaccine containing both influenza B strains is likely to offer greater protection from flu.

Similarly, children who received influenza vaccines that contained a strain of influenza B that matched what was circulating in the community were less likely to get the flu than those whose vaccines didn't match the circulating strain of influenza B.

"These data highlight the need for vaccination strategies that provide enhanced protection against both lineages of influenza B," Belshe said. "The pathway to further improving influenza vaccines for children is to include antigens of both influenza B virus strains in the vaccine."

The study was sponsored by MedImmune. Belshe has served as a consultant and as part of the speakers bureau for MedImmune and other study authors are MedImmune employees.

Mount Sinai study finds only a weak link between fruit and vegetable and reduced risk of cancer

An analysis by Mount Sinai researchers of over eight years of dietary data from more than 400,000 people has found that the relationship between high consumption of fruits and vegetables and a reduced risk of cancer is not as strong as commonly thought. The study is published online April 6, 2010 in the Journal of the National Cancer Institute.

It is widely believed that a diet rich in fruits and vegetables can reduce the risk of cancer. In 1990, the World Health Organization recommended eating five servings of fruits and vegetables a day to prevent cancer and other diseases. However, although many studies have been conducted since then, none have been able to confirm an association between fruit and vegetable intake and cancer resistance.

Paolo Boffetta, MD, MPH, lead author of the study and Deputy Director of The Tisch Cancer Institute at Mount Sinai School of Medicine, and colleagues analyzed data from the European Prospective Investigation

into Cancer and Nutrition (EPIC) study to assess relationships between cancer risk and intake of total fruits, total vegetables, and total fruits and vegetables combined.

The EPIC cohort, which is ongoing and coordinated by professor Elio Riboli at Imperial College in London, included 142,605 men and 335,873 women recruited between 1992 and 2000 from 10 Western European countries. Detailed information on their dietary habits and lifestyle variables was obtained. After a median follow-up of 8.7 years, more than 30,000 of the study's participants were diagnosed with cancer.

Dr. Boffetta and colleagues found a small but significant inverse relationship between high intake of fruits and vegetables and overall cancer risk. In this population, an increase of 200 grams a day of fruits and vegetables resulted in a reduction of about 3 percent of cancer risk. Vegetable consumption by itself also afforded a modest benefit but was restricted to women. Heavy drinkers who ate many fruits and vegetables had a somewhat reduced risk, but only for cancers caused by smoking and alcohol.

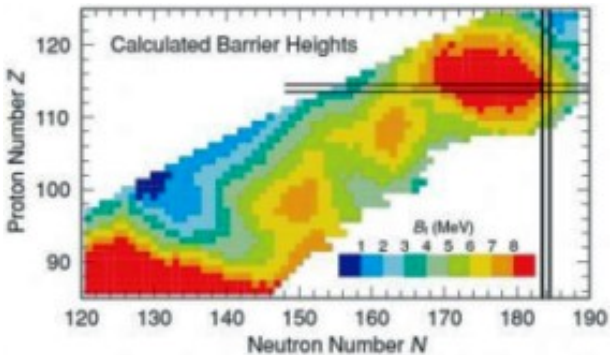
"The bottom line here is that, yes, we did find a protective effect of fruit and vegetable intake against cancer, but it is a smaller connection than previously thought," said Dr. Boffetta. "Any cancer protective effect of these foods is likely to be modest, at best.

"However, eating fruits and vegetables is beneficial for health in general and the results of this study do not justify changing current recommendations aiming at increasing intake of these foods," said Dr. Boffetta.

Nuclear missing link created at last: Superheavy element 117

Element 117 fills in the final gap in the list of observed elements up to element 118

A collaboration of Russian and US physicists has finally created element 117 - a superheavy element made of atoms containing 117 protons that is roughly 40% heavier than lead. The achievement fills in the final gap on the list of observed elements up to element 118. The team produced the elusive element 117 by fusing together atoms of calcium and another rare, heavy element known as berkelium. The research will appear in a forthcoming issue of the journal Physical Review Letters and will be the focus of a Viewpoint article by Sigurd Hofmann (Helmholtz Centre for Heavy Ion Research) to appear in APS Physics (physics.aps.org).



The lifetime of element 117 bolsters confidence in theories that predict that superheavy elements occupy an "island of stability" in a chart of elements and their isotopes. The island is indicated by the red region at the upper right. Atoms in the stable region decay much more slowly than atoms with characteristics that place them nearby, but outside, the region. **American Physical Society**

Like all superheavy atoms, element 117 is unstable, lasting only fractions of a second before self-destructing in a cascade of lighter elements and particles. After smashing calcium atoms into a target of berkelium in a particle accelerator at the Joint Institute for Nuclear Research in Dubna, Russia, the team deduced the fleeting existence of element 117 by studying the daughter particles emitted as the atom decayed.

Despite the atom's short lifetime, element 117 lives longer than many lighter elements. The discovery confirms theories that predict that 117 and its recently-synthesized cousins, elements 116 and 118, exist in an island of stability on the periodic table. Only synthesizing increasingly heavy elements will show just how far the stable region extends up the list of elements.

While there is no known practical application for such short-lived atoms, the synthesis of superheavy elements is vital for testing models that explain how the neutrons and protons that make up all the elements bind together. Such models in turn help explain the relative proportion of more common elements in the universe, as well as offering predictions of other exotic atoms that may be stable enough occur naturally on Earth or in meteorites.

First animals to live without oxygen discovered

Deep under the Mediterranean Sea small animals have been discovered that live their entire lives without oxygen and surrounded by 'poisonous' sulphides. Researchers writing in the open access journal BMC Biology report the existence of multicellular organisms (new members of the group Loricifera), showing that they are alive, metabolically active, and apparently reproducing in spite of a complete absence of oxygen.

Roberto Danovaro, from the Polytechnic University of Marche, Ancona, Italy, worked with a team of researchers to retrieve sediment samples from a deep hypersaline anoxic basin (DHABs) of the Mediterranean Sea and studied them for signs of life. "These extreme environments", said Danovaro, "have been thought to be exclusively inhabited by viruses, Bacteria and Archaea. The bodies of multicellular animals have previously been discovered, but were thought to have sunk there from upper, oxygenated, waters. Our results indicate that

the animals we recovered were alive. Some, in fact, also contained eggs". Electronmicroscopy shows that instead of aerobic mitochondria, these animals possess organelles resembling the hydrogenosomes found previously in unicellular organisms (protozoans) that inhabit anaerobic environments.

The implications of this finding may reach far beyond the darker parts of the Mediterranean Sea floor, according to Lisa Levin of the Scripps Institution of Oceanography. In one of two commentaries accompanying this piece of research, she said, "The finding by Danovaro et al. offers the tantalizing promise of metazoan life in other anoxic settings, for example in the subsurface ocean beneath hydrothermal vents or subduction zones or in other anoxic basins". In the second commentary Marek Mentel and William Martin, from Comenius and Dusseldorf Universities look at the incidence of anaerobic mitochondria and hydrogenosomes in other organisms and focus on the evolutionary significance of the new findings. "The discovery of metazoan life in a permanently anoxic and sulfidic environment provides a glimpse of what a good part of Earth's past ecology might have been like in 'Canfield oceans', before the rise of deep marine oxygen levels and the appearance of the first large animals in the fossil record roughly 550-600 million years ago".

Consumers over age 50 should consider steps to cut copper and iron intake

With scientific evidence linking high levels of copper and iron to Alzheimer's disease, heart disease, and other age-related disorders, a new report in ACS' Chemical Research in Toxicology suggests specific steps that older consumers can take to avoid build up of unhealthy amounts of these metals in their bodies. "This story of copper and iron toxicity, which I think is reaching the level of public health significance, is virtually unknown to the general medical community, to say nothing of complete unawareness of the public," George J. Brewer states in the report.

The article points out that copper and iron are essential nutrients for life, with high levels actually beneficial to the reproductive health of younger people. After age 50, however, high levels of these metals can damage cells in ways that may contribute to a range of age-related diseases.

"It seems clear that large segments of the population are at risk for toxicities from free copper and free iron, and to me, it seems clear that preventive steps should begin now." The article details those steps for people over age 50, including avoiding vitamin and mineral pills that contain cooper and iron; lowering meat intake: avoiding drinking water from copper pipes; donating blood regularly to reduce iron levels; and taking zinc supplements to lower copper levels.

"Risks of Copper and Iron Toxicity during Aging in Humans"

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BUSPH study links rheumatoid arthritis to vitamin D deficiency

Women living in the northeastern United States are more likely to develop rheumatoid arthritis (RA), suggesting a link between the autoimmune disease and vitamin D deficiency, says a new study led by a Boston University School of Public Health researcher.

In the paper, which appears online in the journal Environmental Health Perspectives, a spatial analysis led by Dr. Verónica Vieira, MS, DSc, associate professor of environmental health, found that women in states like Vermont, New Hampshire and southern Maine were more likely to report being diagnosed with RA.

"There's higher risk in the northern latitudes," Dr. Vieira said. "This might be related to the fact that there's less sunlight in these areas, which results in a vitamin D deficiency."

The study looked at data from the Nurses' Health Study, a long-term cohort study of U.S. female nurses. Looking at the residential addresses, health outcomes and behavioral risk factors for participants between 1988 and 2002, researchers based their findings on 461 women who had RA, compared to a large control group of 9,220.

RA is a chronic inflammatory disease that affects the lining of the joints, mostly in the hands and knees. This chronic arthritis is characterized by swelling and redness and can wear down the cartilage between bones. RA is two to three times more common in women than in men. Although the cause of RA is unknown, the researchers wrote, earlier studies have shown that vitamin D deficiency, which can be caused by a lack of sunlight, has already been associated with a variety of other autoimmune diseases.

"A geographic association with northern latitudes has also been observed for multiple sclerosis and Crohn's disease, other autoimmune diseases that may be mediated by reduced vitamin D from decreased solar exposure and the immune effects of vitamin D deficiency," the authors wrote.

The authors said further research is needed to look into the relationship between vitamin D exposure and RA.

Dr. Vieira said she and her co-authors were somewhat surprised by the findings. A previous geographic study of RA had suggested an ecologic association with air pollution, she said.

"The results were unexpected," Dr. Vieira said. "Prior to the analysis, we were more interested in the relationship with air pollution. I hadn't given latitudes much thought."

In addition to the geographic variation, the study suggested that the timing of residency may influence RA risk. "Slightly higher odds ratios were observed for the 1988 analysis suggesting that long term exposure may be more important than recent exposure," the study said.

Dr. Vieira and other BUSPH researchers previously have used innovative spatial-temporal analyses to study the incidence of breast cancer, specifically focused on Cape Cod.

In addition to Dr. Vieira, co-authors of the article are Dr. Jaime Hart, MS, ScD, research fellow, Department of Epidemiology, Harvard School of Public Health; Dr. Thomas Webster, DSc, professor and associate chair, Department of Environmental Health, Boston University School of Public Health; Dr. Janice Weinberg, ScD, MS, associate professor, Department of Biostatistics, Boston University School of Public Health; Dr. Robin Puett, PhD, MPH, research assistant professor, Environmental Health Sciences, University of South Carolina; Dr. Francine Laden, ScD, MS, associate professor, Department of Epidemiology, Harvard School of Public Health; Dr. Karen Costenbader, MD, assistant professor of medicine, Division of Rheumatology, Immunology and Allergy, Brigham and Women's Hospital and Harvard Medical School; and Dr. Elizabeth Karlson, MD, associate professor of medicine, Division of Rheumatology, Immunology and Allergy, Brigham and Women's Hospital and Harvard Medical School. The research was funded by grants from the National Institutes of Health.

The full study can be accessed online. (link: http://ehsehplp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.0901861)

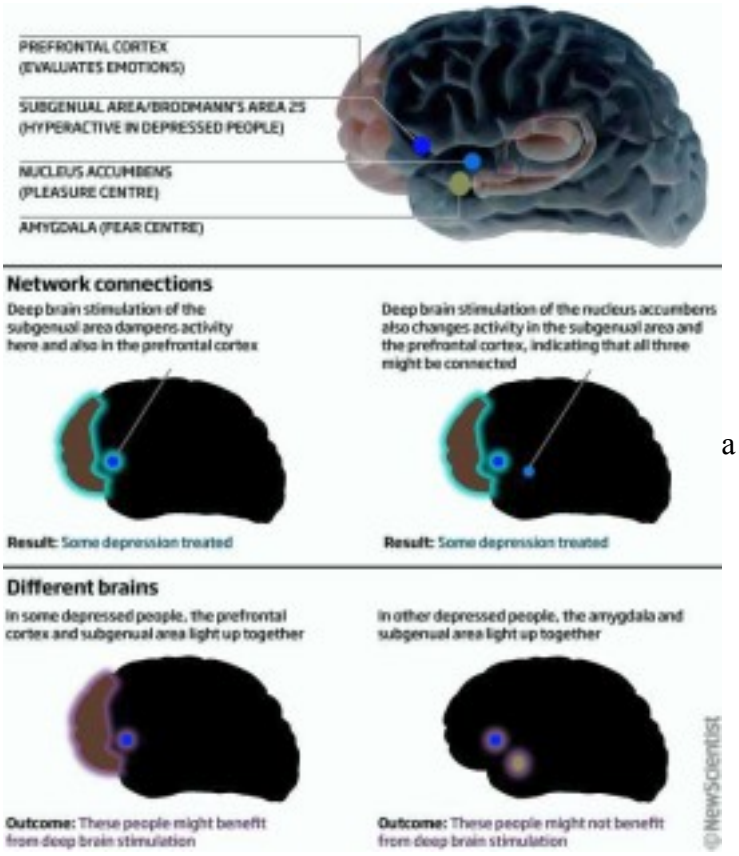
Electrical engineering fixes brain's circuit board

* 07 April 2010 **by Ewen Callaway**

DEEP brain stimulation has long been psychiatry's black magic: stick electrodes into a region linked to mental illness, deliver rapid pulses of weak current, and voila! Crippling symptoms of depression, obsessive compulsive disorder and even substance abuse are eased.

Now brain imaging of people undergoing deep brain stimulation (DBS) to treat depression is revealing the mechanism behind these effects - and who it will and won't work on. The crucial discovery is that DBS seems to tune an array of brain regions, not just the area around the electrode.

This once fringe treatment is now creating a new view of mental illness as a condition affecting an interconnected network rather than arising from chemical imbalances in specific regions. "The brain works on a circuit board," says Helen Mayberg of Emory University in Atlanta, Georgia, whose team is lifting the veil on DBS.



DBS involves continually delivering high-frequency pulses of weak current to a particular region via stimulators that are surgically inserted into the brain. Although invasive, it works so well for Parkinson's disease and other movement disorders that it is now mainstream, with tens of thousands of patients implanted.

In the last decade, researchers have tested DBS on a variety of other conditions. It has proved effective at reducing some symptoms of bipolar disorder and Tourette's syndrome (see table). It was recently approved by the US Food and Drug Administration to treat obsessive compulsive disorder.

Meanwhile, firms that manufacture DBS devices are looking to get the technique approved to treat depression, for which it seems to work well. In 2005, Mayberg's team showed that DBS could help people with a type of depression thought to be completely untreatable.

Instant response

The researchers implanted the stimulators into the subgenual area, which is involved in emotion, in six severely depressed patients for whom all other treatments had failed, including several types of antidepressant drugs and electroconvulsive therapy. Four reported vast improvements (Neuron, vol 45, p 651).

The region was selected because brain imaging studies had shown it to be hyperactive in many people with depression. Most researchers thought that DBS worked by silencing activity in that area. This would explain why so many patients responded as soon as their stimulators were switched on: many said the operating room looked brighter than when they had gone in, for example, a sign of a changed outlook on life. It was as if

"something painful had suddenly stopped", Mayberg said at a recent lecture on her work at the Massachusetts Institute of Technology.

That wasn't the whole story, however. PET scans revealed that while DBS damped down activity in the subgenual area as expected, other regions appeared affected too, particularly parts of the nearby prefrontal cortex, which is involved in decision-making and evaluating emotions. "We got lucky," says Mayberg. "It worked, but probably not for the reason we thought."

So why does DBS work? Thomas Schlaepfer at University Hospital in Bonn, Germany, says that the brain is increasingly seen as not just a collection of regions but also as consisting of multiple networks, which can become "misconnected" in mental illness. DBS "retrains these dysfunctional networks", he says.

The brain consists of multiple networks, which can become 'misconnected' in mental illness

His own recent work on 10 patients with treatment-resistant depression supports this notion. His team used DBS on the nucleus accumbens, an area involved in assessing pleasurable stimuli that is known to behave abnormally in depression (Biological Psychiatry, DOI: 10.1016/j.biopsych.2009.09.013).

PET scans of seven of the patients revealed that the implant didn't seem to affect activity in the nucleus accumbens itself, but instead suppressed the subgenual area - also called Brodmann's area 25 - just as with Mayberg's team (see diagram). It also had reverberations in parts of the prefrontal cortex.

"There are clear connections between area 25 and the nucleus accumbens," Schlaepfer says. He suspects that the three areas are part of a brain network that his and Mayberg's teams both tapped into.

Signs of success ©NewScientist

Deep brain stimulation is being tested in a wide range of psychiatric disorders

	Obsessive compulsive disorder	Depression	Tourette's syndrome	Bipolar disorder
Patients tested	45+	45+	30+	~12
Brain region targeted	Internal capsule, subthalamic nucleus, nucleus accumbens	Subgenual area and nucleus accumbens	Thalamus, nucleus accumbens, globus pallidus	Subgenual area
Success rate	About 50% of patients respond	50 to 60% of patients respond	Most patients respond; 30-90% reduction of symptoms	About 60% of patients respond

The experiments also raise the question of why DBS doesn't work in everyone. While all of Schlaepfer's patients felt their lives had improved a year after having the stimulator implanted - be it returning to work, taking up a hobby or making new friends - some fared much better than others. Mayberg noticed similar variation in 20 depressed people she treated with DBS, and 12 treated for bipolar disorder. "From a practical point of view you've got to figure out who you're going to offer this to," she says.

That's where Mayberg's most recent results, which she presented at the MIT lecture, come in. To see if there were any pre-existing differences in the brains of DBS responders and non-responders, which might predict who should go to the trouble of getting a DBS implant, Mayberg's team turned to functional MRI, which allows you to see which regions light up at the same time - indicating that they are "connected".

In depressed patients who went on to respond to DBS, a part of their prefrontal cortex tended to light up in conjunction with the subgenual area. This did not happen in non-responders. In these patients, the amygdala, which is involved in fear and other emotions, tended to be connected to the subgenual area - not the case in responders.

Mayberg cautions that the results are preliminary, but she thinks she may be onto something. "If this pans out in larger numbers, there's a total dissociation between the two groups," she says. The ability to predict who will and won't benefit from DBS should mean the treatment can be offered to a greater number of severely depressed patients.

The technology could have much wider implications. The National Institute of Mental Health in Bethesda, Maryland, is launching an initiative soon to encourage researchers to describe mental illnesses as disorders of networks rather than by how they make people feel - part of a broader shift across neuroscience.

DBS is helping to map these networks, says Thomas Insel, director of the institute. "For us not to understand the parts of the brain involved in mental illness is really unacceptable," he adds. For now, the initiative is only aimed at researchers, but Insel hopes the brain networks idea will be taken up by doctors too.

Insel and Mayberg hope that a better understanding of how brain regions form networks will improve doctors' ability to match drugs and therapies to patients. It could even lead to drugs that target specific networks.

Mayberg also has her sights on the nascent field of optogenetics, in which individual neurons are turned off and on with pulses of light. Its use in mental illness would demand a much better understanding of the circuits, which DBS studies could help provide. Ultimately, the specificity of optogenetics might allow researchers to make far more subtle changes to brain networks. "That's my dream," Mayberg says.

Urine test for kidney cancer a step closer to development

April 7, 2010 **By Jim Dryden**

Evan Kharasch, MD, PhD (left), and Jerry Morrissey, PhD, in the lab where they discovered that two key proteins are elevated in the urine of patients with the most common forms of kidney cancer, and the findings may be used to develop a screening test for the early diagnosis of kidney cancer.

Studying patients with kidney cancer, a team of researchers at Washington University School of Medicine in St. Louis has identified a pair of proteins excreted in the urine that could lead to earlier and more accurate diagnosis of the disease. The research, published online in the May issue of Mayo Clinic Proceedings, is the first to identify proteins secreted in urine that appear to accurately reveal the presence of about 90 percent of all kidney cancers.

Currently, there is no diagnostic test for kidney cancer. About 80 percent of kidney tumors are discovered incidentally, during a CT scan or ultrasound test that has been ordered for an unrelated abdominal complaint.

“Kidney cancer is a silent and frequently fatal cancer,” says principal investigator Evan D. Kharasch, MD, PhD. “More than 80 percent of patients die within two years of diagnosis, and more than 95 percent die within five years because, by the time the cancer is detected, it often has spread beyond the kidney. When it is identified early, however, kidney cancer is curable in a very high percentage of individuals."

Kharasch and co-investigator Jeremiah J. Morrissey, PhD, looked at urine samples from 42 patients who became aware that they had kidney cancer during an abdominal imaging test and from 15 individuals who did not have cancer but were scheduled for surgery. Another 19 healthy volunteers were included who were not having surgery of any kind.

The researchers focused on two proteins that previously had been found in kidney tumors: aquaporin-1 (AQP1) and adipophilin (ADFP). They discovered large amounts of those proteins in urine samples from kidney cancer patients. The AQP1 or ADFP proteins were not elevated in healthy individuals or surgery patients without cancer. The researchers also found that when the kidney tumors were removed, AQP1 and ADFP levels in the urine declined precipitously.

“We believe that in the same way we use mammograms to screen for breast cancer and blood tests to screen for prostate cancer, we may have the opportunity to detect these proteins in urine as a way to screen for kidney cancer,” Kharasch says. Kharasch, vice chancellor for research at Washington University, the Russell D. and Mary B. Shelden Professor of Anesthesiology and director of the Division of Clinical and Translational Research in the Department of Anesthesiology, has been working with lead author Morrissey, a research professor of anesthesiology, to detect kidney cancer at an earlier stage.

“When patients come to surgery, it tends to be late in the process, and many already have progressed to a stage where the prognosis is pretty bleak,” says Morrissey. “Screening patients to find kidney cancer when it is still small and treatable could save a number of lives and preserve kidney function in many people. It also may represent the difference between losing an entire kidney or extracting only a tumor while sparing healthy portions of the organ."

About 50,000 patients are diagnosed with kidney cancer each year. And about 13,000 people die from the disease annually in the United States alone. A test that could lead to earlier diagnosis could make a big dent in those numbers, according to Timothy J. Eberlein, MD, director of the Alvin J. Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine.

“One of the goals of the Siteman Cancer Center is to diagnose tumors as early as possible, when they are more curable,” Eberlein says. “Most kidney tumors are found in more advanced stages, when the patient is symptomatic and less likely to be cured. These new findings open the door for a quick, noninvasive test and could revolutionize our approach to the early, accurate diagnosis of kidney cancer."

Morrissey says further testing will be required to determine whether people with other types of kidney disease also have high levels of AQP1 and ADFP in their urine, too. But based upon their findings, Kharasch and Morrisey have filed a patent application through Washington University's Office of Technology Management for use of aquaporin-1 and adipophilin to diagnose kidney cancer.

Because this study looked only at patients who already had a cancer diagnosis following an imaging test, Kharasch and Morrissey say more research will be needed to see how early in the disease process levels of the AQP1 or ADFP proteins rise and whether the concentration of those proteins in the urine might correspond to the size of a kidney tumor.

If the research continues to demonstrate that AQP1 and ADFP urine levels are good markers of kidney cancer, it may someday be possible for routine screening for the disease in a doctor’s office, using a noninvasive urine test to determine whether they have the disease.

Morrissey JJ, London AN, Luo J, Kharasch ED. Urinary biomarkers for the early diagnosis of kidney cancer, Mayo Clinic Proceedings, vol. 85, number 5. May 2010. doi:10.4065/mcp.2009.0709
This research was supported by the Department of Anesthesiology at Washington University School of Medicine in St. Louis.

Japanese gut bacteria gain special powers from sushi

* 18:00 07 April 2010 **by Jessica Hamzelou**

Sushi arms the guts of the Japanese with new digestive powers. A seaweed-eating enzyme seems to have jumped from marine bacteria to the harmless bugs that call the intestines of sushi-eaters home. This is the first evidence that food bacteria can transfer genes to our own gut bacteria, and could help us extract more energy from food, says Mirjam Czjzek at the National Centre for Scientific Research (CNRS) in Roscoff, France.

Czjzek's group uncovered the genetic swap while hunting the genes for certain enzymes produced by bacteria. These enzymes break down carbohydrates in the cell walls of the algae that the bacteria feed on.

One enzyme, porphyranase, breaks down a polysaccharide that makes up around 40 per cent of the cell walls of Porphyra, a red alga used to make the nori sheets that wrap around sushi. The carbohydrate is rare in most other marine plants, however.

The enzyme turned up in samples of marine bacteria, but also, curiously, the gut of a Japanese person. "We thought this was a funny coincidence, especially as Porphyra is used in sushi," says Czjzek.

The guts for sushi

To see if a gene for the enzyme was present in the microflora of other Japanese people, Czjzek's team looked up a previous study of Japanese and North American guts. The gene was not found in any North American, but the group found porphyranase genes in 5 of the 13 Japanese.

"The number is low," says Czjzek. "But we can say that apparently this enzyme is present only in Japanese and not in [North] Americans." She thinks the difference is due to the seaweed-rich diet of Japanese people, who eat an average of 14.2 grams of the stuff a day.

Genes regularly shuttle between different bacteria, offering each other new traits such as drug resistance. But this is the first time a gut bacterium has been found to have got new genes from its host's food. In theory, Japanese people with the porphyranase enzyme can digest seaweed, while it passes straight through the North American gut.

"It's a really nice demonstration of genetic variation of microbiota between individuals," says Justin Sonnenburg, a microbiologist at Stanford University in California. He agrees that the gut bacteria from the Japanese people probably use the enzyme to break down seaweed carbs.

But non-Japanese readers shouldn't rush off for a sushi fix to "grow your own" porphyranase enzymes just yet. Supermarket seaweeds are commonly roasted to sterilise them, Czjzek says. "If the algae are roasted before preparing sushi, the microbes are destroyed, and the genes are not transferred."

Journal reference: Nature, DOI: 10.1038/nature08937

H.P. Sees a Revolution in Memory Chip

By JOHN MARKOFF

PALO ALTO, Calif. - Hewlett-Packard scientists on Thursday are to report advances in the design of a new class of diminutive switches capable of replacing transistors as computer chips shrink closer to the atomic scale.

The devices, known as memristors, or memory resistors, were conceived in 1971 by Leon O. Chua, an electrical engineer at the University of California, Berkeley, but they were not put into effect until 2008 at the H.P. lab here.

They are simpler than today's semiconducting transistors, can store information even in the absence of an electrical current and, according to a report in Nature, can be used for both data processing and storage applications.

The researchers previously reported in The Proceedings of the National Academy of Sciences that they had devised a new method for storing and retrieving information from a vast three-dimensional array of memristors. The scheme could potentially free designers to stack thousands of switches in a high-rise fashion, permitting a new class of ultradense computing devices even after two-dimensional scaling reaches fundamental limits.

Memristor-based systems also hold out the prospect of fashioning analog computing systems that function more like biological brains, Dr. Chua said.

"Our brains are made of memristors," he said, referring to the function of biological synapses. "We have the right stuff now to build real brains."

In an interview at the H.P. research lab, Stan Williams, a company physicist, said that in the two years since announcing working devices, his team had increased their switching speed to match today's conventional silicon transistors. The researchers had tested them in the laboratory, he added, proving they could reliably make hundreds of thousands of reads and writes.

That is a significant hurdle to overcome, indicating that it is now possible to consider memristor-based chips as an alternative to today's transistor-based flash computer memories, which are widely used in consumer devices like MP3 players, portable computers and digital cameras.

"Not only do we think that in three years we can be better than the competitors," Dr. Williams said. "The memristor technology really has the capacity to continue scaling for a very long time, and that's really a big deal." As the semiconductor industry has approached fundamental physical limits in shrinking the size of the devices that represent digital 1's and 0's as on and off states, it has touched off an international race to find alternatives.

New generations of semiconductor technology typically advance at three-year intervals, and today the industry can see no further than three and possibly four generations into the future.

The most advanced transistor technology today is based on minimum feature sizes of 30 to 40 nanometers - by contrast a biological virus is typically about 100 nanometers - and Dr. Williams said that H.P. now has working 3-nanometer memristors that can switch on and off in about a nanosecond, or a billionth of a second.

He said the company could have a competitor to flash memory in three years that would have a capacity of 20 gigabytes a square centimeter. "We believe that that is at least a factor of two better storage than flash memory will be able to have in that time frame," he said.

The H.P. technology is based on the ability to use an electrical current to move atoms within an ultrathin film of titanium dioxide. After the location of an atom has been shifted, even by as little as a nanometer, the result can be read as a change in the resistance of the material. That change persists even after the current is switched off, making it possible to build an extremely low-power device.

The new material offers an approach that is radically different from a promising type of storage called "phase-change memory" being pursued by I.B.M., Intel and other companies.

In a phase-change memory, heat is used to shift a glassy material from an amorphous to a crystalline state and back. The switching speed of these systems is slower and requires more power, the H.P. scientists say.

New hominid shares traits with Homo species

Fossil find sheds light on the transition to Homo genus from earlier hominids

Two partial skeletons unearthed from a cave in South Africa belong to a previously unclassified species of hominid that is now shedding new light on the evolution of our own species, Homo sapiens, researchers say. The newly documented species, called Australopithecus sediba, was an upright walker that shared many physical traits with the earliest known Homo species - and its introduction into the fossil record might answer some key questions about what it means to be human.

The fossils are between 1.95 and 1.78 million years old, and in this week's issue of Science, the peer-reviewed journal published by AAAS, the nonprofit science society, two reports describe both the physical characteristics of this new Australopithecus species as well as the ancient environment in which it lived and died. The emerging picture is one of a hominid with a bone structure similar to the earliest Homo species, but who employed it more as an Australopithecus, like the famed "Lucy," would have.

These new fossils, however, represent a hominid that appeared approximately one million years later than Lucy, and their features imply that the transition from earlier hominids to the Homo genus occurred in very slow stages, with various Homo-like species emerging first.

The U.W. 88-50 (MH1) cranium. The cranium forms part of the holotype skeleton of Australopithecus sediba from the Malapa site, South Africa. **Photo by Brett Eloff courtesy of Lee Berger and the University of Witwatersrand**

"It is not possible to establish the precise phylogenetic position of Australopithecus sediba in relation to various species assigned to early Homo," wrote Lee Berger, a lead author of one of the Science reports. "We can conclude that… this new species shares more derived features with early Homo than any other known australopith species, and thus represents a candidate ancestor for the genus, or a sister group to a close ancestor that persisted for some time after the first appearance of Homo."

Many scientists believe that the human genus Homo evolved from Australopithecus a little more than two million years ago - but the origin has been widely debated, with other experts proposing an evolution from the Kenyanthropus genus. This new Australopithecus sediba species might eventually clear up that debate, and help to reveal our direct human ancestors.

"Before this discovery, you could pretty much fit the entire record of fossils that are candidates for the origin of the genus Homo from this time period onto a small table. But, with the discovery of Australopithecus sediba and the wealth of fossils we've recovered - and are recovering - that has changed dramatically," Berger said.

The name itself, "sediba," means "fountain" or "wellspring" in the seSotho language, spoken in South Africa, and indeed, researchers do believe that the new fossils will provide a wealth of information about our human origins.

For now, these new hominid fossils make it clear that the evolutionary transition from small-bodied, and perhaps more tree-dwelling, ancestors to larger-bodied, full-striding bipeds occurred in gradual steps.

Berger, from the University of Witwatersrand in South Africa, along with Paul Dirks from James Cook University in Australia began a study on the distribution of cave deposits in the Cradle of Humankind - a World Heritage Site, set aside for its physical and cultural significance - in January 2008. Months later, Berger discovered the two partial skeletons in cave deposits at Malapa, South Africa, and analyzed the remains, including most of a skull, pelvis, and ankle of the new species with colleagues from the U.S., Switzerland, and Australia.

The two Australopithecus sediba - an adult female and a juvenile male - were found close together in a portion of the cave system that had been protected from scavengers, so the fossils are very well-preserved. The researchers describe the hominid's physical traits, highlighting the unique pelvic features and small teeth that it shared with early Homo species. Based on its physique, they suggest that the new species descended from Australopithecus africanus, and that the hominid's appearance signified the dawn of more energy-efficient walking and running.

"These fossils give us an extraordinarily detailed look into a new chapter of human evolution, and provide a window into a critical period when hominids made the committed change from dependency on life in the trees to life on the ground," said Berger. "Australopithecus sediba appears to present a mosaic of features demonstrating an animal comfortable in both worlds."

In a separate report published in Science, Paul Dirks and colleagues from around the world analyze the Malapa cave system, date the fossil deposits, and describe the geological and ecological environment that Australopithecus sediba would have dwelled in long ago.

"We think the environment sediba lived in was, in many ways, similar to the environment today," Dirks said. "For example, one with predominantly grassy plains, transected by more vegetated, wooded valleys. However, the rivers flowed in different directions and the landscape was not static, but changed all the time."

The caves at Malapa are not randomly distributed, but occur along fracture zones that criss-cross the landscape. They consist of mostly quartz, chert, dolomite, and peloids - though there are also iron-oxide coated grains, ooids, shale, and feldspar in the rocks.

"The fossils occur together in a near-articulated state in the sedimentary remains of a deeply eroded cave system," Dirks continued. "They were laid down by a single debris flow, indicating the timing of their deaths were closely related and occurred shortly before the debris flow carried them to their place of burial."

The researchers identified the fossils of at least 25 other species of animals, including saber-toothed cats, a wildcat, a brown hyena, a wild dog, antelopes, and a horse in the cave as well. They suggest that the Malapa caves were tens of meters deep when the Australopithecus sediba fossils were deposited - and also propose that the cave dwelling could have acted as a death trap for animals seeking water.

"One possible explanation for their entry into the cave could have been that they needed water," said Dirks. "To explain the fossil assemblage and their well-preserved state, we would speculate that perhaps at the time of their death, the area in which sediba lived experienced a severe drought… Animals may have smelled the water, ventured in too deep, fallen down hidden shafts in the pitch dark, or got lost and died."

'Nanovaccine' reverses autoimmunity without general immunosuppression

A new study, published online April 8 by Cell Press in the journal Immunity, describes a unique therapeutic "nanovaccine" that successfully reverses diabetes in a mouse model of the disease. In addition to providing new insight into diabetes, the research also reveals an aspect of the pathogenesis of the autoimmune response that may provide a therapeutic strategy for multiple autoimmune disorders.

Type 1 diabetes (T1D) is a chronic autoimmune disease that results from destruction of insulin-producing pancreatic cells by certain white blood cells, called T cells. "Unfortunately, eliminating the rather extensive repertoire of harmful T cells that attack the pancreas cannot currently be done without also eliminating T cells that protect us from infections and cancer," explains Dr. Pere Santamaria, from the Julia McFarlane Diabetes Research Centre at the University of Calgary in Alberta.

Dr. Santamaria and colleagues wanted to find a way to counteract the harmful autoimmune response without compromising general immunity. They discovered that our bodies have a built-in mechanism that tries to stop

the progression of autoimmune diseases like T1D. "Essentially, there is an internal tug-of-war between aggressive T- cells that want to cause the disease and weaker T cells that want to stop it from occurring," says Dr. Santamaria.

The researchers also developed a unique and inventive nanotechnology-based "vaccine" that selectively boosted the weak white blood T cells, enabling them to effectively counter the damage caused by their overactive T cell relatives. The vaccine consisted of nanoparticles (NPs, spheres thousands of times smaller than a single cell of the body) "coated" with individual T1D-relevant protein fragments bound to self MHC molecules (pMHC). MHC molecules are used by another type of white blood cell, called an "antigen presenting cell" to "present" antigen to T cells as part of all immune responses.

Using a mouse model of T1D, the researchers discovered that their nanovaccine blunted T1D progression in prediabetic mice and restored normal blood sugar in diabetic mice. Further, NPs displaying human diabetes-relevant complexes restored normal blood sugar levels in a humanized model of diabetes. The authors pointed out that only the disease-generated white blood cells responded to the pMHC-NP therapy, so the treatment would be inconsequential in healthy individuals because it would not have nonspecific effects on the immune system.

"If the paradigm on which this nanovaccine is based holds true in other chronic autoimmune diseases, such as multiple sclerosis, rheumatoid arthritis, and others, pMHC-nanovaccines might find general applicability in autoimmunity," suggests Dr. Santamaria. "In principle, the pMHC nanovaccines could be engineered with any disease-relevant pMHC complex as long as it is involved in the diseases process."

The researchers include Sue Tsai, The University of Calgary, Calgary, Canada; Afshin Shameli, The University of Calgary, Calgary, Canada; Jun Yamanouchi, The University of Calgary, Calgary, Canada; Xavier Clemente-Casares, The University of Calgary, Calgary, Canada; Jinguo Wang, The University of Calgary, Calgary, Canada; Pau Serra, The University of Calgary, Calgary, Canada; Yang Yang, The University of Calgary, Calgary, Canada; Zdravka Medarova, Massachusetts General Hospital, Charlestown, MA; Anna Moore, Massachusetts General Hospital, Charlestown, MA; and Pere Santamaria, The University of Calgary, Calgary, Canada.

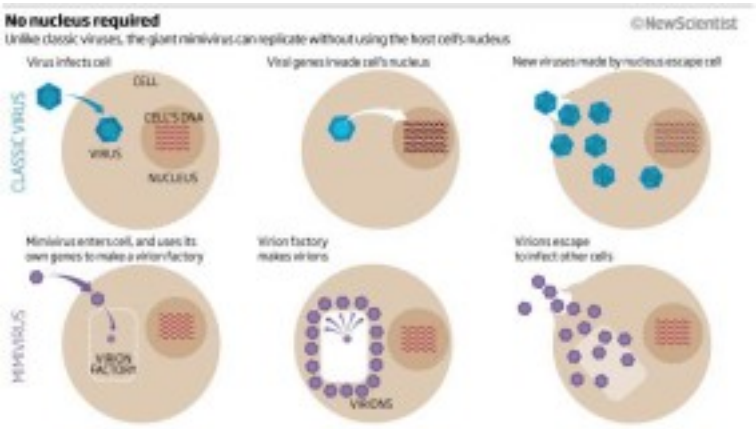
Giant mimivirus does its replication in-house

* 08 April 2010 **by Andy Coghlan**

THE world's largest known virus just got bigger, and analysis of its genome supports the controversial idea that giant viruses shaped the cells of all animals and plants.

Armed with almost 1000 genes, the mimivirus is a monster compared with classic viruses such as HIV or the flu virus, which seldom have more than 10 genes. Jean-Michel Claverie of the Structural and Genomic Information Laboratory in Marseilles, France, has performed the first analysis of its genetic machinery, identifying which of the mimivirus's genes are switched on during each stage of infection.

He found that the virus has 75 more genes than previously thought. Crucially, Claverie's study reveals that the mimivirus uses its own genes and proteins to orchestrate its replication (Genome Research, DOI: 10.1101/gr.102582.109).



Classic viruses insert their DNA into the nuclear DNA of the cells they infect and let their host do the hard work of replication for them (see diagram). In contrast, the mimivirus constructs a massive "factory" within the cell, where millions of new viruses, or virions, are produced. These eventually burst out from the dead host cell to spread and infect other cells. The only other viruses that replicate outside the nucleus are poxviruses, but even they rely on the nucleus to replicate some of their DNA.

In order to create the virus factory, the mimivirus appears to steal some of the host cell's resources. Claverie found that the virus has a gene that codes for a protein which carries ATP - the molecule that stores energy in a form that cells can use. It is also equipped to scavenge amino acids - the building blocks of proteins - from its host, thanks to genes that make proteins which transport amino acids.

Claverie found that these genes are activated when the mimivirus first invades a cell. He believes they are used to set up the virion factory, which then allows the mimivirus to replicate without help from the host cell's own nucleus. In fact, the factory is so large it was originally mistaken for a nucleus.

Claverie says the mimivirus's independence supports the theory that giant viruses gave rise to the nuclei that package up DNA in all plant and animal cells. Philip Bell of Macquarie University in Sydney, Australia, who first put forward the theory, agrees. "This paper shows the ability of viruses to completely take over cells," he says. "This is one of the key aspects of my theory."

Abraham Minsky of the Weizmann Institute in Rehovot, Israel, says the results support his own team's recent study showing that the mimivirus lives in a cell's cytoplasm entirely independently of the host nucleus.

But David Moreira of the University of Paris-South, France, remains unconvinced. He argues that the mimivirus owes its enormous size to its ability to "pickpocket" genes from the eukaryotic cells it infects. "This paper does not alter my view," he says.

Cold fronts linked to European H5N1 outbreaks

Avian influenza (H5N1) outbreaks in Europe during the winter of 2005-2006 occurred at the edge of cold weather fronts, according to researchers from Princeton University and the Erasmus Medical Centre, Rotterdam, the Netherlands. Their results, published April 8 in the open-access journal PLoS Pathogens, show that these outbreaks were driven by aggregated movements of wild waterbirds away from areas of frozen water.

The researchers found that most H5N1 outbreaks occurred at sites where maximum temperatures were between 0°C and 2°C. These usually occurred on the edge of cold fronts where bodies of freshwater remained unfrozen. Many wild waterbirds need unfrozen bodies of freshwater in winter to feed; in order to minimize the distance flown, they also try to stay as close as possible to the northern breeding grounds to which they will migrate during spring. The resulting congregation of different species of waterbirds along the freezing front likely created ideal conditions for the transmission of the H5N1 virus within and between wild bird species; in 2006, it caused many detectable outbreaks.

The genetic tree of the H5N1 virus that caused outbreaks in Europe is well known. However, the conditions favoring the virus' spread were previously unclear. Understanding these ecological links may help to predict and control future outbreaks.

Forecasts predicting near-freezing temperatures in Europe may act as an indication for concern, the authors say. When these conditions are forecasted, the authors suggest that targeted surveillance in areas along the extreme edge of cold fronts may help in the early detection of the virus.

Source: www.plospathogens.org FINANCIAL DISCLOSURE: The present study was supported in part by European Commission grant no. 044490 "New-FluBird". The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.
http://dx.plos.org/10.1371/journal.ppat.1000854 (link will go live upon embargo lift)

Handling Money Could Bring Pain Relief

Who needs aspirin when cold, hard cash could ease your aches and pains?

By Emily Sohn Fri Apr 9, 2010 07:00 AM ET

THE GIST:

**** Handling money reduces the amount of pain people feel.***
**** In separate experiments, negative experiences, both physical and emotional, were blunted by cash.***
**** If real-world poverty follows this principle, those with less money may feel pain more acutely.***

Money can't buy you love, happiness or even respect. Cash, however, might provide some relief from pain.

In a series of experiments, people who counted money felt less pain when their hands were dipped into scalding water. The soothing power of cash also helped them shrug off the emotional pain of social exclusion.

The findings might offer an easy way to ease life's stings and hurts, from painful medical treatments to social ostracism: Simply flip through a bulging wallet before enduring a painful experience.

"When people are reminded of money in a subtle manner by counting out hard currency, they experience painful situations as being not very painful," said lead author Kathleen Vohs, a consumer psychologist at the University of Minnesota's Carleton School of Management in the Twin Cities.

"You could think about being able charge yourself up before you encounter pain," she said. "When I used to run marathons, I would've maybe wanted to be reminded of money first."

Although scientists have been studying pain for years, they still don't entirely understand why or how the perception of discomfort can vary so much. On a scale from one to 10, for example, one person's four might be another's eight. Even a single experience can feel more or less painful to the same person under different circumstances.

In her own research, Vohs has found that thinking about money gives people a sense of self-sufficiency, making them less likely to ask for or offer help. Other studies have linked a strong sense of self-worth with a greater ability to withstand pain. So, Vohs began to wonder whether money might shift the balance on how much pain people feel.

Among other experiments, she and colleagues challenged college students to a supposed finger-dexterity task in which they counted out either 80 $100 bills or 80 slips of paper. Afterward, the cash-counters reported less pain than the paper-counters when their fingers were dipped briefly into 122-degree Fahrenheit water.

In another experiment, cash-counters felt less distressed during a computer game in which two other players threw a virtual ball mostly to each other. The game is used often in studies like these, and data clearly show that the brain's physical and emotional pain centers light up when the other players reject them.

As bolstering as it can be to handle money, the study found that being reminded of money you don't have makes pain worse. Reflecting on your shrunken 401K, in other words, could make it more difficult to cope with stubbing a toe or failing to connect with others at a party.

In an attempt to understand the source of money's power over pain, the researchers asked study participants to rate their feelings of self-esteem, attractiveness and mood, among other measures. The only reliable link they found was that having money made people feel strong, possibly providing a coping mechanism for whatever negative experiences they encountered next. Likewise, thinking about money they had spent made them feel weak, deflating their ability to cope.

"These findings are groundbreaking," said Eli Finkel, a social psychologist at Northwestern University in Evanston, Ill. "If real-world poverty follows the principles of these laboratory demonstrations, then confronting social rejection or physical pain should be experienced as more painful for poor people than for wealthier people."

But you don't have to be rich to use money to your benefit, Vohs said. Merely touching cash or even staring at a money-filled screensaver could blunt the impact of hard or painful events.

"I always got a kick out of counting money," she said. "Now I know why."

Different Strokes for Married Folks?

TAU reports that a happy marriage may prevent fatal strokes in men

"Love and marriage," sang philosopher Frank Sinatra, "is an institute you can't disparage." Especially, a new Tel Aviv University study suggests, when a happy marriage may help to prevent fatal strokes in men.

The first study of its kind to assess the quality of a marriage and its association with stroke risk, Prof. Uri Goldbourt of Tel Aviv University's Neufeld Cardiac Institute found a correlation between reported "happiness" in marriage and the likelihood that a man will die from stroke. Drawn from data collected from 10,000 men, all of them civil servants, beginning in 1965, the research was presented to experts at the American Stroke Association's International Conference earlier this year.

In the retrospective study, men were surveyed about their happiness levels and marital status; 34 years later, a follow-up study determined how many of the men died from stroke. Single men were found to have a 64% higher risk of a fatal stroke than married men. The quality of the marriage appeared to matter as well — men in an unhappy union had a 64% higher risk of a fatal stroke than those who reported being happy in their marriage.

A foundation for future study

"The association we've found adjusts for factors such as age, blood type and cholesterol levels," Prof. Goldbourt notes, but he cautions that his results are only preliminary, taking into consideration only a few of many possible variables while laying the groundwork for future research. The survey measured fatal strokes only, not those that were survived, for example. And similar data was not collected from women. "It's too bad we don't have that kind of information," Prof. Goldbourt notes.

Dr. Goldbourt hopes that his research will be taken up by younger researchers as a foundational study. While many studies today report the benefits of marriage, the negative effects of an unhappy marriage may be hidden. It is plausible, Prof. Goldbourt's study suggests, that a bad marriage is just as bad for one's health as not being married at all.

Happiness is no magic bullet

Prof. Goldbourt describes his new research as "a hypothesis generator" instead of statistical proof, because only about 4% of the men reported being completely satisfied and happy in their marriage. And the study didn't include follow-up research on the different kinds of strokes men can succumb to. "Happiness may very well likely create healthier men and reduce the risk of a fatal stroke," he says, "but we don't have all the information necessary to say that this is the magic bullet."

Previous medical studies have suggested that happiness can stave off the flu, promote positive cardiac health, and may even help people fight cancer. Much more research is needed on the happiness question, Prof. Goldbourt says, taking into account such factors as medication and the effects of happiness over time.

"We have opened a new channel of research into factors associated with death-by-stroke risk. Until that research is done, the best way to avoid one," Prof. Goldbourt concludes, "is still to maintain a healthy lifestyle."

New study of autism reveals a 'DNA tag' (methylation) amenable to treatment

Research in the FASEB Journal describes discrete epigenetic changes of DNA in a certain subgroup of twins and siblings with autism

A new discovery raises hope that autism may be more easily diagnosed and that its effects may be more reversible than previously thought. In a new study appearing online in The FASEB Journal (http://www.fasebj.org), scientists have identified a way to detect the disorder using blood and have discovered that drugs which affect the methylation state ("DNA tagging") of genes could reverse autism's effects. This type of drug is already being used in some cancer treatments.

"As the mother of a now 22-year-old son with an autism spectrum disorder, I hope that our studies as well as those of others, will lead to therapies that are designed to address specific deficiencies that are caused by autism, thus improving the lives of affected individuals," said Valerie W. Hu, Ph.D., one of the researchers involved in the work from the Department of Biochemistry and Molecular Biology at The George Washington University Medical Center in Washington, D.C. "Since autism is very diverse in the array of symptoms present in any given individual, it is first necessary to be able to identify specific deficits in each individual in order to design and then prescribe the best treatment. As an example of this personalized approach to medicine, we identified RORA as one of the genes that was altered specifically in the sub group of autistic individuals who exhibited severe language deficits."

To make their discovery, Hu and colleagues identified chemical changes in DNA taken from cells of identical twins and sibling pairs, in which only one of the twins or siblings was diagnosed with autism. The researchers then compared genes that showed changes in DNA tagging (methylation) with a list of genes that showed different levels of expression from these same individuals. Then the scientists studied the amount of protein product produced by two genes that appear on both lists in autistic and control regions of the cerebellum and frontal cortex of the brain. They found that both proteins, as predicted by the observed increase in DNA tagging, were reduced in the autistic brain. This suggests that blocking the chemical tagging of these genes may reverse symptoms of the disorder and demonstrates the feasibility of using more easily accessible cells from blood (or other non-brain tissues) for diagnostic screening.

"For far too long, autism research has been side-tracked by the cranky notion that it's caused by the MMR vaccine," said Gerald Weissmann, M.D., Editor-in-Chief of The FASEB Journal. "Studies like this, which define genetic and epigenetic changes in discrete subgroups of the autism spectrum, offer real hope that effective treatments and accurate diagnosis are closer at hand."

Venus is alive – geologically speaking

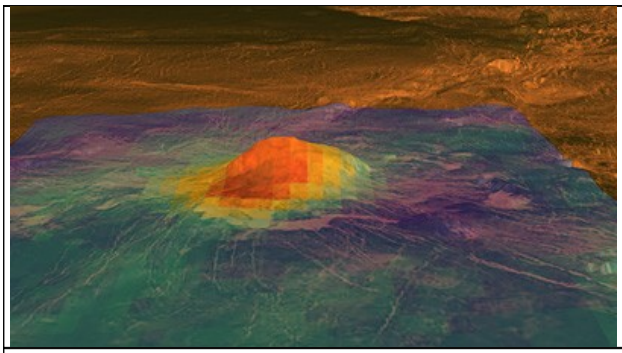
ESA's Venus Express has returned the clearest indication yet that Venus is still geologically active. Relatively young lava flows have been identified by the way they emit infrared radiation. The finding suggests the planet remains capable of volcanic eruptions.

It has long been recognised that there are simply not enough craters on Venus. Something is wiping the planet's surface clean. That something is thought to be volcanic activity but the question is whether it happens quickly or slowly? Is there some sort of cataclysmic volcanic activity that resurfaces the entire planet with lava, or a gradual sequence of smaller volcanic eruptions? New results suggest the latter.

"Now we have strong evidence right at the surface for recent eruptions," says Sue Smrekar, a scientist at NASA's Jet Propulsion Laboratory in California.

That strong evidence comes in the form of compositional differences compared to the surrounding landscape in three volcanic regions. The data were collected by the Visible and Infrared Thermal Imaging Spectrometer (VIRTIS) on ESA's Venus Express spacecraft, which has been orbiting the planet since April 2006.

VIRTIS records the brightness of surface rocks, providing an estimate of 'emissivity'. In 2008, Jörn Helbert and Nils Müller, Institute of Planetary Research, German Aerospace



The volcanic peak Idunn Mons (at 46°S, 214.5°E) in Imdr Regio. The background image is radar data from NASA's Magellan mission. Bright areas are either rough or have an eastward facing slope, or both. Dark areas are smooth. The radar data is draped on the Magellan topography, shown with a vertical exageration of 30 times. The summit stands about 2.5 km above the plains and has a diameter of ~200 km. The coloured overlay shows the emissivity derived from ESA's VIRTIS surface brightness data, taken from Venus Express. The high emissivity area (shown in red and yellow) is centered on the summit and the bright flows that originate there.

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Center, Berlin and co-authors on this new work, published a map of the variation of infrared emissivity across the southern hemisphere of Venus.

Dr Smrekar and her colleagues targeted three regions that geologically resemble Hawaii, well known for its active volcanism. They show that the regions on Venus have higher emissivities than their surroundings, indicating different compositions.

On Earth, lava flows react rapidly with oxygen and other elements in the atmosphere, changing their composition. On Venus, the process should be similar, though more intense because of the hotter, denser atmosphere, chiefly of carbon dioxide.

The researchers interpret the fact that the lava flows appear to have different compositions from their surroundings as being evidence of a lack of surface weathering, indicating that the flows erupted relatively recently. They estimate that the flows are possibly as geologically recent as 2 500 000 years – and likely much less, possibly even currently active. “This is a significant result,” says Håkan Svedhem, ESA Venus Express Project Scientist. Whilst the gradual resurfacing scenario might not be the most spectacular, it does make Venus look a little more Earth-like.

“There are some intriguing models of how Venus could have completely covered itself in kilometres of volcanic lava in a short time, but they require that the interior of Venus behaves very differently from Earth. If volcanism is more gradual, this implies that the interior may behave more like Earth, though without plate tectonics,” says Dr Smrekar.

Simple test can detect signs of suicidal thoughts in people taking antidepressants

UCLA researchers say changes in brain function in first 48 hours are key

While antidepressant medications have proven to be beneficial in helping people overcome major depression, it has long been known that a small subset of individuals taking these drugs can actually experience a worsening of mood, and even thoughts of suicide. No clinical test currently exists to make this determination, and only time - usually weeks - can tell before a psychiatrist knows whether a patient is getting better or worse.

Now, UCLA researchers have developed a non-invasive biomarker, or indicator, that may serve as a type of early warning system.

Reporting in the April edition of the peer-reviewed journal Acta Psychiatrica Scandinavica, Aimee Hunter, an assistant research psychologist in the UCLA Department of Psychiatry, and colleagues report that by using quantitative electroencephalographic (QEEG), a non-invasive measurement of electrical activity in the brain, they were able to observe a sharp reduction of activity in a specific brain region in individuals who proved susceptible to thoughts of suicide — within 48 hours of the start of treatment.

Prior research, Hunter said, has shown that between 8 and 14 percent of depressed patients develop thoughts of suicide while taking the most common forms of depression drugs, known as selective serotonin reuptake inhibitors (SSRI). Although reports have suggested that SSRIs are to blame, no firm link between these drugs and thoughts of suicide has been established.

This study suggests, for the first time, a link between worsening suicidality and specific changes in brain function while on these medications.

The researchers treated 72 people suffering from major depressive disorder (MDD) with one of two anti-depressants, fluoxetine or venlafaxine, or with a placebo. All were evaluated by a clinician using the Hamilton Depression Rating Scale, a standard instrument that assesses the severity of a wide range of depression symptoms. Of the 37 participants on medication, five (13.5 percent) had worsening thoughts of suicide.

All of the participants were also examined using QEEG, which evaluates brain function based on the brain's electrical activity. Among the 13.5 percent of participants who got worse, the researchers found a sharp drop in brain activity within 48 hours of the start of medication. The drop occurred in the midline and right-frontal sections of the brain, areas known to control emotions.

Of note, eight of the 35 participants taking a placebo (22.9 percent) also had increased thoughts of suicide. However, the placebo participants did not show the precipitous drop in brain activity within the first 48 hours. "This is the first study to show a change in brain function after the start of medication that appears to be linked to the subsequent development of worsening thoughts of suicide during antidepressant treatment," Hunter said. "Importantly, changes in this biomarker did not predict worsening suicidal thoughts in the placebo-treated subjects, so the results suggest that the biomarker specifically detected medication-related worsening only."

QEEG is a relatively inexpensive instrument that is non-invasive; measurements are obtained by placing electrodes on the scalp. As a result, Hunter said, further development of this biomarker could potentially lead to a tool that could be used by clinicians to predict, in the early stages of treatment, whether an individual suffering from depression will develop thoughts of suicide.

Other authors of the study included Andrew Leuchter, Ian Cook and Michele Abrams, all of UCLA.

Funding for the study was provided by the National Institute of Mental Health; the National Center for Complementary and Alternative Medicine; grants from Lilly Research Laboratories, Wyeth Pharmaceuticals and Aspect Medical Systems; and an endowment from Joanne and George Miller and family to the UCLA Brain Research Institute. The funding providers had no role in any aspect of the study.

Ageing makes it harder to cope with repeated stress

* 09 April 2010 **by Wendy Zukerman**

GRUMPY old people may be bad-tempered because their brains react differently to chronic stress. At least that's what happens to elderly rats.

Elderly humans are more vulnerable to stress than their youthful counterparts. "There is more low-level anxiety and depression," says Nancy Pachana of the University of Queensland in Brisbane, Australia.

To investigate why, Hirotaka Shoji of the National Centre for Geriatrics and Gerontology in Obu, Japan, put 3-month-old and 24-month-old rats under stress by placing them inside a wire-mesh container for 1 hour every day for two weeks. Before this treatment began, the two sets of rats had similar levels of the stress hormone, corticosterone. All the rats had higher levels of the hormone after two weeks, but the old rats had significantly more. The old rats also showed increased activity in areas of the brain associated with anxiety and decreased activity in regions linked with controlling emotions (Behavioural Brain Research, DOI: 10.1016/j.bbr.2010.03.025).

Shoji suggests that ageing may reduce the brain's ability to damp down the release of corticosterone in response to repeated stress. When another group of rats were put in the cage just once, for an hour, stress hormone levels were similar in old and young rats, suggesting that ageing increases vulnerability to repeated stress rather than one-off episodes.

The brain's ability to damp down the release of stress hormones may be reduced with age

Chris Krägeloh of the Auckland University of Technology, New Zealand, says it is difficult to compare lab rats with humans. Physical and mental exercise can protect the human brain, but lab rats don't have equivalent stimuli, he says.

Why we need a World Social Health Insurance

ANTWERP – We are in need of a social security fund on a global scale. That is what scientists of the Institute of Tropical Medicine Antwerp (ITM) argue in a Viewpoint in the leading medical journal The Lancet. Such a 'Global Fund for Health' would make the use of international donor money a lot more transparent and efficient.

Today, 44% of international health aid money cannot be traced in the budgets of the receiving countries. This doesn't necessarily mean it has disappeared in somebody's pockets, but it is unclear when nor on what it has been spent. For convenience's sake it often is assumed that governments trim down their own health expenditure in proportion to the aid they receive. An article in the same issue of The Lancet, by a group of researchers led by Christopher Murray of the Institute for Health Metrics and Evaluation (University of Washington) states that for every dollar of international health aid provided to governments, on average government health funding falls by $0.43–1.14.

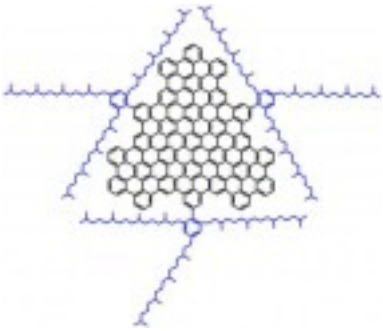
The Lancet asked Gorik Ooms and colleagues at the ITM to comment. Their reaction: it's not as simple as it might seem at first sight. One cannot just assert that for every euro rich countries spend on international assistance, poor countries spend one euro less. For some countries, the domestic contribution indeed goes down in response to increasing international assistance, but for other countries the domestic contribution goes up. Global averages seem to mask important variances.

There is much more work to be done to accurately trace health funding both from foreign and domestic sources, Ooms learned from a survey of 15 countries. Do governments shift money form their own health budget to other sectors as soon as aid money comes in? Do they put their own money aside, assuming external aid will run dry? Or do they spread the aid money over several years to avoid short peaks in the health service supply to their people? While at the same time tailoring their budget to give the impression that the donor money was immediately and fully used? Do governments keep the valuable hard currency, while reporting domestic expenditure as aid? Every case is different.

International assistance would be more effective if it were not as unpredictable as it is, the ITM scientists argue. The Global Fund to fight AIDS, Tuberculosis and Malaria has shown that one can pool different streams of international assistance into one stable and reliable aid source. Why don't we broaden the mandate of the Global Fund to all elements of a comprehensive primary health care, into a World Social Health Insurance fund, to which every country contributes according to its means, and receives according to its needs? The receiving countries would no longer have to shuffle money around or adapt unpredictable charity to what they perceive as their real needs.

Closing in on a carbon-based solar cell

BLOOMINGTON, Ind. -- To make large sheets of carbon available for light collection, Indiana University Bloomington chemists have devised an unusual solution -- attach what amounts to a 3-D bramble patch to each side of the carbon sheet. Using that method, the scientists say they were able to dissolve sheets containing as many as 168 carbon atoms, a first. The scientists' report, online today (April 9), will appear in a future issue of Nano Letters, an American Chemical Society journal. "Our interest stems from wanting to find an alternative, readily available material that can efficiently absorb sunlight," said chemist Liang-shi Li, who led the research. "At the moment the most common materials for absorbing light in solar cells are silicon and compounds containing ruthenium. Each has disadvantages."



This is a 2-D view of a graphene sheet (black) and attached sidegroups (blue) that IU Bloomington chemist Liang-shi Li and his collaborators devised. In reality, each sidegroup rotates 90 degrees or so out of graphene's plane. The three blue, tail-like hydrocarbons of each sidegroup have great freedom of movement, but two are likely to hover over the graphene, making it very unlikely that one graphene sheet will touch another. **Image by Liang-shi Li**

Their main disadvantage is cost and long-term availability. Ruthenium-based solar cells can potentially be cheaper than silicon-based ones, but ruthenium is a rare metal on Earth, as rare as platinum, and will run out quickly when the demand increases.

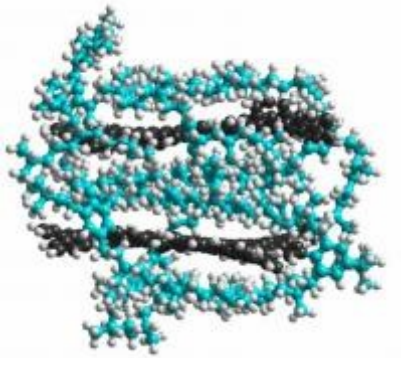
Carbon is cheap and abundant, and in the form of graphene, capable of absorbing a wide range of light frequencies. Graphene is essentially the same stuff as graphite (pencil lead), except graphene is a single sheet of carbon, one atom thick. Graphene shows promise as an effective, cheap-to-produce, and less toxic alternative to other materials currently used in solar cells. But it has also vexed scientists.

For a sheet of graphene to be of any use in collecting photons of light, the sheet must be big. To use the absorbed solar energy for electricity, however, the sheet can't be too big. Unfortunately, scientists find large sheets of graphene difficult to work with, and their sizes even harder to control. The bigger the graphene sheet, the stickier it is, making it more likely to attract and glom onto other graphene sheets. Multiple layers of graphene may be good for taking notes, but they also prevent electricity.

Chemists and engineers experimenting with graphene have come up with a whole host of strategies for keeping single graphene sheets separate. The most effective solution prior to the Nano Letters paper has been breaking up graphite (top-down) into sheets and wrap polymers around them to make them isolated from one another. But this makes graphene sheets with random sizes that are too large for light absorption for solar cells.

Li and his collaborators tried a different idea. By attaching a semi-rigid, semi-flexible, three-dimensional sidegroup to the sides of the graphene, they were able to keep graphene sheets as big as 168 carbon atoms from adhering to one another. With this method, they could make the graphene sheets from smaller molecules (bottom-up) so that they are uniform in size. To the scientists' knowledge, it is the biggest stable graphene sheet ever made with the bottom-up approach.

The sidegroup consists of a hexagonal carbon ring and three long, barbed tails made of carbon and hydrogen. Because the graphene sheet is rigid, the sidegroup ring is forced to rotate about 90 degrees relative to the plane of the graphene. The three brambly tails are free to whip about, but two of them will tend to enclose the graphene sheet to which they are attached.



The tails don't merely act as a cage, however. They also serve as a handle for the organic solvent so that the entire structure can be dissolved. Li and his colleagues were able to dissolve 30 mg of the species per 30 mL of solvent. "In this paper, we found a new way to make graphene soluble," Li said. "This is just as important as the relatively large size of the graphene itself."

Two graphene molecules (dark grey) are caged by sidegroups (blue) attached to each graphene sheet. The sidegroups help prevent the graphene sheets from stacking, as they are prone to do.

To test the effectiveness of their graphene light acceptor, the scientists constructed rudimentary solar cells using titanium dioxide as an electron acceptor. The scientists were able to achieve a 200-microampere-per-square-cm current density and an open-circuit voltage of 0.48 volts. The graphene sheets absorbed a significant amount of light in the visible to near-infrared range (200 to 900 nm or so) with peak absorption occurring at 591 nm.

The scientists are in the process of redesigning the graphene sheets with sticky ends that bind to titanium dioxide, which will improve the efficiency of the solar cells. "Harvesting energy from the sun is a prerequisite step," Li said. "How to turn the energy into electricity is the next. We think we have a good start."

PhD students Xin Yan and Xiao Cui and postdoctoral fellow Binsong Li also contributed to this research. It was funded by grants from the National Science Foundation and the American Chemical Society Petroleum Research Fund.

First baby treated with xenon gas

A newborn baby has become the first in the world to receive xenon gas treatment, pioneered in Bristol in a bid to prevent brain injury.

Riley Joyce had no pulse and was not breathing when he was first delivered by emergency Caesarean section at the Royal United Hospital, Bath. He had a 50:50 chance of permanent brain injury and was transferred to St Michael's Hospital, Bristol. His parents agreed to the experimental treatment and Riley is now doing well.

'Cooling babies'

Every year in the UK more than 1,000 otherwise healthy babies born at full term die or suffer brain injury caused by a lack of oxygen or blood supply at birth.

The xenon technique was developed by Marianne Thoreson, professor of neonatal neuroscience at the University of Bristol, and Dr John Dingley, consultant anaesthetist at Swansea University's School of Medicine.

Professor Thoreson said: "After seven days, Riley was alert, able to look at his mother's face, hold up his head and begin to take milk."

The professor has pioneered new treatments at the hospital since 1998 when she began cooling babies to reduce damage in the newborn brain. However, cooling only partly reduces disability and does not prevent it in all babies.

She said: "Over the past eight years, we have shown in the laboratory that xenon doubles the protective effect of cooling on the brain. However we faced the challenge of how to safely and effectively deliver this rare and extremely expensive gas to newborn babies."

Dr Dingley, who invented a machine to deliver the gas, said: "A key design feature of this machine is that it is very efficient, using less than 200ml of xenon per hour - less than the volume of a soft drinks can.

"Xenon is a precious and finite resource and difficult to extract so it can cost up to £30 a litre. As ventilated newborns breathe many litres of air per minute, any xenon-based treatment would be impossibly expensive without an economical delivery method."

The device is now authorised for clinical trials and will be used on a minimum of 12 babies over the coming months in a feasibility trial before it can be used on a larger scale.

Twelve-day-old Riley's parents, Dave and Sarah Joyce, said: "We are delighted that Riley is doing so well and we are extremely grateful that we were given this opportunity.

"Marianne was so passionate about the treatment and we truly believe that she had and still has the best interests of Riley in mind. It was traumatic to see our baby not breathing, but seeing the ambulance coming to collect Riley to take him to Bristol gave us hope that something could be done to help him."

The study is being funded by Sparks, the children's medical research charity, which has committed almost £800,000 to the team's work.

Earthworms make 'group decisions'

By Matt Walker Editor, Earth News

Earthworms form herds and make "group decisions", scientists have discovered.

The earthworms use touch to communicate and influence each other's behaviour, according to research published in the journal Ethology. By doing so the worms collectively decide to travel in the same direction as part of a single herd.

The striking behaviour, found in the earthworm Eisenia fetida , is the first time that any type of worm, or annelid, has been shown to form active herds.

A 'herd' of worms travel together

"Our results modify the current view that earthworms are animals lacking in social behaviour," says Ms Lara Zirbes, a PhD student at the University of Liege in Gembloux in Belgium.

"We can consider the earthworm behaviour as equivalent the of a herd or swarm."

Ms Zirbes and colleagues were originally interested in how earthworms interact with other microorganisms in the soil.

These interactions are part of the important ecological role of that earthworms play.

However, the researchers began to notice that the earthworms seemed also to interact with each other.

"In experiments, I noticed that earthworms frequently clustered and formed a compact patch when they were out of the soil," Ms Zirbes told the BBC.

Follow the leader

So Ms Zirbes and her colleagues set up a series of experiments to test how earthworms decided where to go, and whether they preferred to travel alone or in groups. They chose the earthworm Eisenia fetida , which tends to live near or at the soil surface, typically within the litter lining forest floors.

First, they placed 40 earthworms into a central chamber, from which extended two identical arms. The idea was to leave the animals alone, and then to see how many earthworms moved to either arm over a 24-hour period.

Over 30 identical repeats of the trial, the worms preferred to group within one chamber over the other.

"We noted that earthworms moving out of the central chamber influenced the directional choice of other earthworms. So our hypothesis was confirmed: a social cue influences earthworm behaviour," says Ms Zirbes.

Touching moments

A second experiment tested how the worms affected each other's behaviour, investigating whether the worms use either chemical signals or touch to decide which chamber to move to.

The researchers placed one worm at the start of a soil-filled maze, with two routes to a food source at the end.

After the worm chose its route to the food, the researchers added a second worm to see if it followed the same route as the first.

However, after repeated trials, the second worms were no more likely to take the same route as their predecessors. This indicated that the worms did not leave a chemical trail behind them that communicated their direction of travel. Yet if two worms were placed together at the start of the maze, they were more likely to follow one another, suggesting that they used touch to communicate where they were going.

In two-thirds of these trials, the worms followed each other.

"I have observed contact between two earthworms. Sometimes they just cross their bodies and sometimes they maximise contact. Out of soil, earthworms can form balls," says Ms Zirbes.

A modelling study then showed that, by using touch alone, up to 40 earthworms could follow each other in a similar way, explaining how herds of the animals preferred to move together into one chamber in the initial experiments.

"To our knowledge this is the first example of collective orientation in animals based on contact between followers," the researchers wrote in the journal. “It is also the first one of collective movements of annelids."

Defensive posture

The researchers suspect that other earthworm species may behave in a similar way. They now hope to investigate why the animals come together to form herds. One reason may be that clustering helps the worms protect themselves.

Individual Eisenia fetida earthworms secrete proteins and fluids which have antibacterial properties, potentially deterring soil pathogens. They also secrete a yellow fluid to deter predatory flatworms.

Gathering into groups may increase the amount of fluids covering the earthworms and hence better protect individuals, the researchers say.

'Dark sun' is one of our nearest neighbours

* 18:11 09 April 2010 **by Ken Croswell**

A dim object less than 10 light years from Earth appears to be the closest brown dwarf yet found. The "star" is so cold that any residents on an orbiting planet would see a dark sun in their starry "daytime" sky.

The discovery suggests that brown dwarfs are common and that the objects could exist even closer to Earth.

Brown dwarfs have so little mass that they never get hot enough to sustain the nuclear fusion reactions that power stars like the sun. Still, they do shine, because they glow from the heat of their formation, then cool and fade.

Philip Lucas of the University of Hertfordshire in Hatfield, UK, and his colleagues discovered the brown dwarf, named UGPS 0722-05, from the infrared radiation it gives off. It is only about 9.6 light years from Earth, a bit more than twice as far as Proxima Centauri, our nearest star after the sun. At that distance, it is the seventh closest star or star system to the sun. Not since 1947 have astronomers uncovered a new star so close to Earth.

Parallax view

"Great stuff!" says Todd Henry, a nearby-star researcher at Georgia State University in Atlanta, who was not part of the team. "This discovery is as cool as its temperature."

Lucas and his colleagues caution that their estimated distance is preliminary. It is based on parallax, which offers a reliable method of deducing a star's distance from Earth: if an observer on Earth measures the star's position in the sky and then looks at it again months later, the star will appear to have moved slightly because it is being viewed from a different point in our planet's orbit around the sun. Knowing the dimensions of Earth's orbit, astronomers can calculate the star's distance from the amount of its apparent movement.

But at the moment, Lucas and his colleagues don't have good enough parallax measurements to be sure of the brown dwarf's precise distance and could be a light year or so out. In just a few weeks, however, new parallax observations should pin the distance down.

If the current distance estimate is right, the brown dwarf is closer than any other known. The previous record-holder is a pair of brown dwarfs around the star Epsilon Indi, 11.8 light years from Earth.

Record breaker

The new brown dwarf breaks two other records as well. It's the coldest brown dwarf ever seen, with a temperature of just 130 to 230 °C. And it's the dimmest: it emits only 0.000026 per cent as much energy as our sun, and this energy emerges at infrared rather than visible wavelengths. It would take 3.8 million of these brown dwarfs to equal the sun's power. It is about the size of Jupiter, but its mass is 5 to 30 times greater.

The object's feeble nature explains why it has only now been spotted, despite its proximity. It was found after surveying only a few per cent of the sky, which implies that many more brown dwarfs are lurking nearby undetected. *Journal reference: arxiv.org/abs/1004.0317*

Biological link between stress, anxiety and depression identified for the first time

Scientists at The University of Western Ontario have discovered the biological link between stress, anxiety and depression. By identifying the connecting mechanism in the brain, this high impact research led by Stephen Ferguson of Robarts Research Institute shows exactly how stress and anxiety could lead to depression. The study also reveals a small molecule inhibitor developed by Ferguson, which may provide a new and better way to treat anxiety, depression and other related disorders. The findings are published online in the journal Nature Neuroscience.

Ferguson, Ana Magalhaes and their colleagues used a behavioural mouse model and a series of molecular experiments to reveal the connection pathway and to test the new inhibitor. "Our findings suggest there may be an entire new generation drugs and drug targets that can be used to selectively target depression, and therefore treat it more effectively, " says Ferguson, the director of the Molecular Brain Research Group at Robarts, and a professor in the Department of Physiology & Pharmacology at Western's Schulich School of Medicine & Dentistry.

"We've gone from mechanism to mouse, and the next step is to see whether or not we can take the inhibitor we developed, and turn it into a pharmaceutical agent."

The research was conducted in collaboration with Hymie Anisman at Carleton University, and funded through the Canadian Institutes of Health Research (CIHR). "According to the World Health Organization, depression, anxiety and other related mood disorders now share the dubious distinction of being the most prevalent causes of chronic illness," says Anthony Phillips, the scientific director of the CIHR Institute of Neurosciences, Mental Health and Addiction. "Using the power of molecular biology, Stephen Ferguson and colleagues provide novel insights that may be the key to improving the lives of so many individuals coping with these forms of mental ill health."

The linking mechanism in the study involves the interaction between corticotropin releasing factor receptor 1 (CRFR1) and specific types of serotonin receptors (5-HTRs). While no one has been able to connect these two receptors on a molecular level, the study reveals that CRFR1 works to increase the number of 5-HTRs on cell surfaces in the brain, which can cause abnormal brain signaling. Since CRFR1 activation leads to anxiety in response to stress, and 5-HTRs lead to depression, the research shows how stress, anxiety and depression pathways connect through distinct processes in the brain. Most importantly, the inhibitor developed by the Ferguson lab blocks 5-HTRs in the pathway to combat anxious behaviour, and potentially depression, in mice.

While major depressive disorder often occurs together with anxiety disorder in patients, the causes for both are strongly linked to stressful experiences. Stressful experiences can also make the symptoms of anxiety and depression more severe. By discovering and then blocking a pathway responsible for the link between stress, anxiety and depression, Ferguson not only provides the first biological evidence for a connection, but he also pioneers the development of a potential drug for more effective treatment.

McMaster study unveils lifeline for 'antibiotic of last resort'

Researchers identify the specific mechanism that triggers resistance to vancomycin

Hamilton, ON – A new study led by the scientific director of the Michael G. DeGroote Institute for Infectious Disease Research has uncovered for the first time how bacteria recognize and develop resistance to a powerful antibiotic used to treat superbug infections.

Gerry Wright, a professor in the Department of Biochemistry and Biomedical Sciences at McMaster University in collaboration with colleagues at the John Innes Centre in Norwich, and the University of Cambridge in the UK, have identified the specific mechanism that triggers resistance to vancomycin.

The discovery reveals new understanding about what is happening at the molecular level in vancomycin resistance. It also represents an essential first step in developing new antibiotics that can evade the sensing mechanism of bacteria and overcome resistance.

The research, funded in part by the Canadian Institutes of Health Research and the Canada Research Chairs program, will be published online in the high-impact journal Nature Chemical Biology on April 11, 2010.

"Vancomycin is the antibiotic of last resort and is only given when all other treatments fail," said Wright, who holds the Canada Research Chair in Molecular Studies of Antibiotics and an endowed research Chair in Infection and Anti-Infective Research. "For years it was thought that resistance would be slow to emerge since vancomycin works in an unusual way. But with the widespread use of the drug to treat infections caused by the hospital superbug MRSA, it has become a serious clinical problem."

MRSA is the short-form for methicillin-resistant staphylococcus aureus, a bacterial infection that is highly resistant to some antibiotics. MRSA bacteria are responsible for a large percentage of hospital-acquired staph infections, but may also be acquired in the community.

Vancomycin is used to treat enterococcal infections that develop in patients following abdominal surgery. Enterococcal bacteria first developed resistance to vancomycin in 1986 and the first case of vancomycin-resistant MRSA (VMRSA) was reported in 2002.

For 20 years, scientists around the world have debated whether bacteria sense the drug itself to trigger resistance or whether they sense the impact it has on the cell wall of bacteria.

Most antibiotics work by inhibiting an enzyme but vancomycin binds to cell wall building blocks, causing a weakness in the structure of the cell wall so the cell bursts and dies. Some scientists believed that bacteria detect the cell wall degradation to trigger resistance. Others argued that bacteria detect the presence of the drug directly.

Wright and his team studied the vancomycin-resistance mechanism in the harmless soil bacteria Streptomyces coelicolor. The scientists showed that bacteria detect vancomycin itself. They also conducted preliminary experiments that suggest the same mechanism exists in disease causing bacteria.

"We have finally cracked the alarm system used by bacteria, and hopefully new antibiotics can be developed that don't set it off," said Mark Buttner, a study collaborator and senior scientist at the John Innes Centre.

Marc Ouellette, scientific director of the Institute of Infection and Immunity at the Canadian Institutes for Health Research (CIHR), said the research findings shed new light on the antibiotic resistance issue.

"Thousands of Canadians die every year from antibiotic-resistant infections," Ouellette said. "This issue has long been a priority of the CIHR and this exciting work expands our understanding of how bacteria develop resistance to antibiotics. It lays the groundwork for developing new therapies to prevent and treat antibiotic-resistant infections."

Additional research support was received from the Biotechnology and Biological Sciences Research Council of the UK, the Royal Society and the Medical Research Council (UK).

Warm and Cold Patches Power Underwater Probe

A Navy-funded thermal engine produces more energy than it consumes by tapping ocean waters' temperature differences.

By Irene Klotz

THE GIST:

**** New underwater vehicles draw power from temperature differences in the oceans.***

**** The technology has potential to revolutionize monitoring of the world's oceans.***

**** A prototype probe worked flawlessly for three months.***

Engineers have come up with a unique solution to the problem of powering underwater robotic vehicles -- tapping the unlimited energy difference between the ocean's cold spots and its more temperate regions.

A prototype submersible southwest of Hawaii has been chugging away for more than three months collecting data about ocean temperature, pressure and salinity, producing more power than it consumes.

"Having a long-duration underwater vehicle has been a dream for a long long," oceanographer Li Chao, with NASA's Jet Propulsion Laboratory in Pasadena, Calif., told Discovery News.

Chao is the lead scientist on a project called SOLO-TREC, an acronym for Sounding Oceanographic Lagrangrian Observer Thermal Recharging, which makes use of naturally occurring temperature variations in the ocean to generate electrical power.

Here's how it works: Ten tubes outside the underwater vehicle contain a wax which melts and expands when exposed to warmer ocean water. When it encounters deeper water, it contracts.

This expansion and compression pressurizes oil, which drives a hydraulic motor. The motor generates a high torque and rotation that is passed on to a generator. The energy is then stored in rechargeable batteries.

It's a horribly inefficient way to generate electricity -- the thermodynamic efficiency is about 2 percent or less -- but that hardly matters when there is literally an ocean of potential power.

"The fact that we have so much energy in the ocean allows us to do this," Jack Jones, the lead SOLO-TREC engineer, told Discovery News. "Finding a mechanical means to do this really was the biggest stumbling block. The trick was making this simple."

"The beauty of this technology is that it's scaleable," added Chao. "You can almost start with the science you want to do and pretty much design to scale. We can generate more power than what you need to power the entire vehicle."

SOLO-TREC has the potential to revolutionize ocean monitoring, providing a long-term solution to the problem of powering the armada of 3,200 underwater robotic vehicles currently keeping tabs on the oceans' health.

"About 70 percent of the world's oceans have enough of a temperature variation for a system like SOLO-TREC to operate. It would not work in the ubiquitously cold waters around the Antarctic and Arctic.

SOLO-TREC, which has been under development for five years, is sponsored by NASA, the Office of Naval Research Institute, Scripps Institution of Oceanography and the University of California, San Diego.

A successful, three-month pilot project, which included three dives per day, wrapped up in March. The vehicle remains in the ocean, collecting data and generating power, while project leaders develop plans for a next-generation vehicle that would include wings for increased mobility.

Terminal cancer patients do not receive appropriate radiation therapy

A new analysis has found that a considerable proportion of patients with end-stage or terminal cancer do not benefit from palliative radiation therapy (radiotherapy) despite spending most of their remaining life undergoing treatments. Published early online in CANCER, a peer-reviewed journal of the American Cancer Society, the study indicates that greater efforts are needed to tailor appropriately palliative radiotherapy to patients with end-stage cancer.

Palliative radiotherapy for end-stage cancer patients is intended to control cancer-related pain and other symptoms and to help patients maintain a good quality of life when long-term cancer control is not possible. By reducing the number of cancer cells, palliative radiotherapy can ease pain, stop bleeding, and relieve pressure, even when the cancer cannot be controlled.

However, for many patients, the treatments are not effective. In addition, if patients are close to death, they may wish to stop treatments if they would like to die at home.

To investigate the adequacy of palliative radiotherapy in end-stage cancer patients, Stephan Gripp, MD, of the University Hospital Düsseldorf in Germany and colleagues evaluated the treatment of patients who were referred for palliative radiotherapy at their hospital from December 2003 to July 2004 and who died within 30 days. The investigators identified 33 such patients.

Radiotherapy was delivered to 91 percent of patients. Half of the patients spent more than 60 percent of their remaining lifespan on radiotherapy, and in only 58 percent of patients was radiotherapy completed. Many physicians overestimated the length of time their patients would survive. Among this group who died within one month, about one in five physicians predicted more than six months survival.

In addition, progressive complaints were noted in 52 percent of patients, and palliation or pain reduction was reported by only 26 percent of patients.

The authors concluded that radiotherapy was not appropriately customized to these cancer patients, many of whom did not benefit despite spending most of their remaining life on therapy. Excessive radiotherapy in end-stage cancer patients may reflect overoptimistic prognoses and unrealistic concerns about radiation damage.

"Radiation oncologists have fallen short in accurately determining the life span of terminally ill cancer patients. This has resulted in unduly prolonged radiation therapy regimens that often go uncompleted due to death or withdrawal from treatment," said Dr. Gripp.

He added that physicians need better methods for estimating how long their end-stage cancer patients will live. He also recommended that they use shorter-duration radiation schedules for palliative radiotherapy.

Article: "Palliative radiotherapy tailored to life expectancy in end-stage cancer patients: reality or myth?" Stephan Gripp, Sibylle Mjartan, Edwin Boelke, and Reinhardt Willers. CANCER; Published Online: April 12, 2010 (DOI: 10.1002/cncr. 25112).

Hallucinogens Have Doctors Tuning In Again

By JOHN TIERNEY

As a retired clinical psychologist, Clark Martin was well acquainted with traditional treatments for depression, but his own case seemed untreatable as he struggled through chemotherapy and other grueling regimens for kidney cancer. Counseling seemed futile to him. So did the antidepressant pills he tried.

Nothing had any lasting effect until, at the age of 65, he had his first psychedelic experience. He left his home in Vancouver, Wash., to take part in an experiment at Johns Hopkins medical school involving psilocybin, the psychoactive ingredient found in certain mushrooms.

Scientists are taking a new look at hallucinogens, which became taboo among regulators after enthusiasts like Timothy Leary promoted them in the 1960s with the slogan "Turn on, tune in, drop out." Now, using rigorous protocols and safeguards, scientists have won permission to study once again the drugs' potential for treating mental problems and illuminating the nature of consciousness.

After taking the hallucinogen, Dr. Martin put on an eye mask and headphones, and lay on a couch listening to classical music as he contemplated the universe.

"All of a sudden, everything familiar started evaporating," he recalled. "Imagine you fall off a boat out in the open ocean, and you turn around, and the boat is gone. And then the water's gone. And then you're gone."

Today, more than a year later, Dr. Martin credits that six-hour experience with helping him overcome his depression and profoundly transforming his relationships with his daughter and friends. He ranks it among the most meaningful events of his life, which makes him a fairly typical member of a growing club of experimental subjects.

Researchers from around the world are gathering this week in San Jose, Calif., for the largest conference on psychedelic science held in the United States in four decades. They plan to discuss studies of psilocybin and other psychedelics for treating depression in cancer patients, obsessive-compulsive disorder, end-of-life anxiety, post-traumatic stress disorder and addiction to drugs or alcohol.

The results so far are encouraging but also preliminary, and researchers caution against reading too much into these small-scale studies. They do not want to repeat the mistakes of the 1960s, when some scientists-turned-evangelists exaggerated their understanding of the drugs' risks and benefits.

Because reactions to hallucinogens can vary so much depending on the setting, experimenters and review boards have developed guidelines to set up a comfortable environment with expert monitors in the room to deal with adverse reactions. They have established standard protocols so that the drugs' effects can be gauged more accurately, and they have also directly observed the drugs' effects by scanning the brains of people under the influence of hallucinogens.

Scientists are especially intrigued by the similarities between hallucinogenic experiences and the life-changing revelations reported throughout history by religious mystics and those who meditate. These similarities have been identified in neural imaging studies conducted by Swiss researchers and in experiments led by Roland Griffiths, a professor of behavioral biology at Johns Hopkins.

In one of Dr. Griffiths's first studies, involving 36 people with no serious physical or emotional problems, he and colleagues found that psilocybin could induce what the experimental subjects described as a profound spiritual experience with lasting positive effects for most of them. None had had any previous experience with hallucinogens, and none were even sure what drug was being administered.

To make the experiment double-blind, neither the subjects nor the two experts monitoring them knew whether the subjects were receiving a placebo, psilocybin or another drug like Ritalin, nicotine, caffeine or an amphetamine. Although veterans of the '60s psychedelic culture may have a hard time believing it, Dr. Griffiths said that even the monitors sometimes could not tell from the reactions whether the person had taken psilocybin or Ritalin.

The monitors sometimes had to console people through periods of anxiety, Dr. Griffiths said, but these were generally short-lived, and none of the people reported any serious negative effects. In a survey conducted two months later, the people who received psilocybin reported significantly more improvements in their general feelings and behavior than did the members of the control group.

The findings were repeated in another follow-up survey, taken 14 months after the experiment. At that point most of the psilocybin subjects once again expressed more satisfaction with their lives and rated the experience as one of the five most meaningful events of their lives.

Since that study, which was published in 2008, Dr. Griffiths and his colleagues have gone on to give psilocybin to people dealing with cancer and depression, like Dr. Martin, the retired psychologist from Vancouver. Dr. Martin's experience is fairly typical, Dr. Griffiths said: an improved outlook on life after an experience in which the boundaries between the self and others disappear.

In interviews, Dr. Martin and other subjects described their egos and bodies vanishing as they felt part of some larger state of consciousness in which their personal worries and insecurities vanished. They found themselves reviewing past relationships with lovers and relatives with a new sense of empathy.

"It was a whole personality shift for me," Dr. Martin said. "I wasn't any longer attached to my performance and trying to control things. I could see that the really good things in life will happen if you just show up and share your natural enthusiasms with people. You have a feeling of attunement with other people."

The subjects' reports mirrored so closely the accounts of religious mystical experiences, Dr. Griffiths said, that it seems likely the human brain is wired to undergo these "unitive" experiences, perhaps because of some evolutionary advantage.

"This feeling that we're all in it together may have benefited communities by encouraging reciprocal generosity," Dr. Griffiths said. "On the other hand, universal love isn't always adaptive, either."

Although federal regulators have resumed granting approval for controlled experiments with psychedelics, there has been little public money granted for the research, which is being conducted at Hopkins, the University of Arizona; Harvard; New York University; the University of California, Los Angeles; and other places.

The work has been supported by nonprofit groups like the Heffter Research Institute and MAPS, the Multidisciplinary Association for Psychedelic Studies.

"There's this coming together of science and spirituality," said Rick Doblin, the executive director of MAPS. "We're hoping that the mainstream and the psychedelic community can meet in the middle and avoid another culture war. Thanks to changes over the last 40 years in the social acceptance of the hospice movement and yoga and meditation, our culture is much more receptive now, and we're showing that these drugs can provide benefits that current treatments can't."

Researchers are reporting preliminary success in using psilocybin to ease the anxiety of patients with terminal illnesses. Dr. Charles S. Grob, a psychiatrist who is involved in an experiment at U.C.L.A., describes it as "existential medicine" that helps dying people overcome fear, panic and depression.

"Under the influences of hallucinogens," Dr. Grob writes, "individuals transcend their primary identification with their bodies and experience ego-free states before the time of their actual physical demise, and return with a new perspective and profound acceptance of the life constant: change."