CSIRO scientists announce Alzheimer's disease breakthrough

Rapid screening system may lead to prevention or delay of Alzheimer's disease

December 15, 2008, Amsterdam, The Netherlands – Australian scientists at CSIRO (Commonwealth Scientific and Industrial Research Organisation), have developed a new system to screen for compounds that can inhibit one of the processes that takes place during the progression of Alzheimer's disease. In a paper published in the November issue of the Journal of Alzheimer's Disease, folate is shown to be beneficial in the screening system.

Lead author, CSIRO's Dr Ian Macreadie says folate is already well known to have a protective effect against Alzheimer's disease, which is believed to be caused by the loss of neurons in the brain due to a process whereby toxic multimers of a small protein called Aβ are formed.

"However, a team of scientists working within CSIRO's Preventative Health Flagship has discovered a rapid screening system to identify inhibitors of this process. Compounds that inhibit the formation of the toxic multimers may lead to the prevention or delay of the disease," Dr Macreadie says.

"Although many other research groups and drug companies around the world are trying to find compounds that act in the same way, the advance by the Flagship team involves using live yeast with the Aβ protein fused to a green fluorescent protein that comes from jellyfish.

"The significance of this development is that the yeast trial we developed could lead to the discovery of new agents which may prove useful in preventing or delaying the onset of Alzheimer's disease."

Currently Alzheimer's disease is an incurable illness and the fourth leading cause of death in people aged 65 years and over.

Although folate is abundant in foods like leafy green vegetables, legumes and liver, CSIRO studies have shown that many Australians do not consume enough folate to benefit from its ability to prevent cell damage. Folate levels can, however, be readily restored by dietary folate supplementation.

GUMC researchers find gene function 'lost' in melanoma and glioblastoma

Washington, D.C. – Researchers at Georgetown University Medical Center have found a gene they say is inactivated in two aggressive cancers – malignant melanoma, a form of skin cancer, and glioblastoma multiforme, a lethal brain tumor. They add that because this gene, known as PTPRD, has recently been found to be inactivated in several other cancers as well, their discovery suggests that PTPRD may play a tumor suppressor role in a wide variety of different cancers. The findings are published in the December 15 issue of Cancer Research.

"Over the past decade several dozen tumor suppressor genes have been identified, but only a minority of them is important in causing many different tumor types. PTPRD seems to be one of these broad spectrum tumor suppressor genes," says the study's lead investigator, Todd Waldman, MD, PhD, an associate professor of oncology at Georgetown's Lombardi Comprehensive Cancer Center.

If the hypothesis is true – and Waldman and his team are now investigating loss of PTPRD in a number of additional cancers – then it may be possible to design a therapy that has wide applicability in oncology, he says.

"Most targeted cancer drugs today work by inhibiting gene products that are overactive in cancer cells. In this case, it is loss of the PTPRD gene that leads to cancer," Waldman says. "Therefore, we are trying to discover the molecules that PTPRD's protein controls, and then we plan to target these downstream molecules with a novel agent."

Waldman found that when the researchers restored production of the gene's protein in cancer cells that harbored PTPRD deletions or mutations, these tumors stopped growing and initiated a program of cell suicide.

The researchers also discovered PTPRD mutations in both the blood and in tumors of a patient with multiple different kinds of cancers. "This suggests that the gene could be responsible for an inherited predisposition to cancer," Waldman says

PTPRD produces a receptor protein tyrosine phosphatase that bisects the outer membrane of a cell. The part that protrudes outside the cell body is thought to be involved in helping cells stick to each other to form a tissue as well as in cell-to-cell communication. The part that juts into the cell is an enzyme that removes phosphates from other proteins – in other words, it changes the activity of proteins either by activating or deactivating them, Waldman says.

"In the absence of PTPRD, there are as yet unknown proteins floating around inside the cell with more phosphate residues than they should have, and it is a well known fact that the presence of these residues activates cellular growth pathways," he says. But it is not yet known which specific proteins PTPRD regulates, Waldman says.

Deletions of PTPRD in human cancer cells were first discovered in 2005, and since then, deletions or mutations of the gene have been discovered in several cancer types, including those of the colon and lung.

In this study, Waldman and his research team, which includes investigators from the National Cancer Institute, the University of Iowa and Duke University, used a laboratory technique known as copy number analysis to look for PTPRD in melanoma cell lines and in samples of human glioblastoma multiforme, the deadliest of brain cancers.

This technique uses a gene microarray that contains millions of probes that can stick to different regions of the human genome. The researchers purified DNA from tumors and then used the microarray chip to quantify genomic copy number. They found that PTPRD was deleted or mutated in 12 percent of melanoma tumors and in 14 percent of glioblastoma tumors examined. "That makes PTPRD one of the most commonly mutated genes discovered yet in melanoma," Waldman says.

"Before this study, no single tyrosine phosphatase was thought to play a generally important role as a tumor suppressor gene n multiple tumor types," Waldman says. "Now we have provided the first functional evidence that PTPRD is a tumor suppressor gene, and potentially an important one at that."

The study was supported by an intramural research grant from the Georgetown University School of Medicine. The authors have no financial interests to disclose.

Colonoscopy significantly reduces death from left-sided colon cancer but not from right-sided

Physicians should advise patients of test limitations

Philadelphia - A new study finds that colonoscopy is strongly associated with fewer deaths from colorectal cancer. However, the risk reduction appears to be entirely due to a reduction in deaths from left-sided cancers. According to the study, colonoscopy shows almost no mortality prevention benefit for cancer that develops in the right side of the colon. Colorectal cancer is the second-leading cause of cancer death in North America.

The study appears today on the Annals of Internal Medicine Web site (www.annals.org) and will be printed in the January 6, 2009, issue.

"While colonoscopy remains the gold standard for evaluation of the colon, our study sheds light on some of the real-world limitations of this practice for screening and prevention," said Nancy Baxter, MD, PhD, Colorectal Surgeon and a Researcher at St. Michael's Hospital, who is lead author on the study.

Researchers reviewed health records for persons aged 52 to 90 who received a colorectal cancer diagnosis between 1996 and 2001 and died of colorectal cancer by 2003. These patients were compared to a control group who were selected from the population of Ontario and had not died of colorectal cancer.

According to the researchers, complete colonoscopy was strongly associated with fewer deaths from left-sided colorectal cancer. Conversely, the data showed that colonoscopy seemed to have almost no mortality prevention benefit for right-sided colorectal cancer.

"Colonoscopy is an effective intervention," said David F. Ransohoff, MD, author of an accompanying editorial. "The study results, however, should caution physicians about saying that colonoscopy will reduce the risk of dying from colorectal cancer by 90 percent. A 60 to 70 percent risk-reduction rate seems more reasonable."

The researchers suggest several reasons why colonoscopy may be less effective in preventing death from right-sided colorectal cancer. First, some colonoscopies considered "complete" may not evaluate the entire right colon. Second, bowel preparation may be worse in the right colon. Third, right and left colonic cancers and polyps may differ biologically. Right-sided growths may be less likely to have a fleshy stalk and are occasionally flat, which makes them harder to identify and remove, or they may grow more rapidly.

"Although improvements in the quality of screening colonoscopy may improve detection at the right side, differences in tumor biology may limit the potential to prevent right-sided colorectal cancer deaths with current endoscopic technology. Nevertheless, this study clearly demonstrates that colonoscopy is an effective procedure for the prevention of death from colorectal cancer, it just may not be quite as effective as we've thought in the past." said Dr. Baxter.

A complete colonoscopy is a procedure where a physician inserts a long, flexible tube called a colonoscope up into the patient's rectum to scan the entire colon for potentially cancerous growths. If a polyp or lesion is detected, it can often be removed during the colonoscopy so that no additional procedures or surgery are needed.

Breathing problems during sleep associated with calories burned at rest

Individuals with sleep-related breathing disorders appear to burn more calories when resting as their conditions become more severe, according to a report in the December issue of Archives of Otolaryngology–Head & Neck Surgery, one of the JAMA/Archives journals.

Sleep-related breathing disorders include snoring, pauses in breathing (sleep apnea) and other conditions in which airways are partially or completely obstructed during sleep. "Obesity is a major risk factor for the development of sleep-disordered breathing, and changes in body weight are associated with changes in sleep-disordered breathing severity," the authors write as background information in the article. "It is unclear whether

weight gain is simply a cause of sleep-disordered breathing or whether sleep-disordered breathing may be associated with alterations in energy metabolism that, in turn, lead to weight gain and complicate the treatment of these two disorders that often coexist."

Body weight is based on the balance between energy or calorie intake and expenditure, the authors note. Resting energy expenditure, or the number of calories burned while resting, is one component of total daily energy expenditure. Eric J. Kezirian, M.D., M.P.H., of the University of California, San Francisco, and colleagues assessed the resting energy expenditure in 212 adults with signs or symptoms of sleep-related breathing disorders. Participants' medical history was taken, and they underwent a physical examination, sleep monitoring through polysomnography and determination of resting energy expenditure using a device known as an indirect calorimeter. The calorimeter measures oxygen consumption and carbon dioxide production, which can be used to determine resting energy expenditure in calories per day.

Among the 212 participants, the average resting energy expenditure was 1,763 calories per day. Several measures of sleep-disordered breathing severity were associated with increases in resting energy expenditure. For example, those who scored the highest on a scale of apnea and hypopnea (disruptions in breathing) had a resting energy expenditure of 1,999, while those who scored the lowest expended an average of 1,626 calories per day resting.

Resting energy expenditure may be affected by responses of the nervous system that occur during sleep-related breathing disorders and has been previously shown to increase when sleep has been disrupted. "This study advances our knowledge concerning sleep-disordered breathing and metabolic rates, but it does not define the connection between sleep-disordered breathing and body weight," the authors write. "Body weight is determined by the balance between energy intake and expenditure. Although the findings of this study suggest that sleep-disordered breathing increases energy expenditure, it ignored two important aspects of this balance."

"First, sleep-disordered breathing often results in fatigue and other decrements in daytime functioning that can limit physical activity. Second, this work does not specifically incorporate the emerging evidence that suggests that sleep-disordered breathing may alter energy intake, whether through hormonal or other mechanisms. Future research considering the effect of sleep-disordered breathing on body weight can include the effects on energy intake and expenditure."

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Certain factors associated with attrition during graduate medical education training

Graduates from a single medical school who began graduate medical education (residency) programs appear more likely to change specialty or discontinue graduate medical education training if they are academically highly qualified or are pursuing training in general surgery or a five-year surgical specialty, according to a report in the December issue of Archives of Surgery, one of the JAMA/Archives journals.

"Although it is possible to change specialties during graduate medical education (GME), failure of a resident to complete the stipulated period of GME can be a problem for both program directors and residents," according to background information in the article. "Such resident attrition, in which the resident discontinues GME in his or her initial specialty to pursue GME in a different specialty or to discontinue GME entirely, can have widespread ramifications, causing difficulties with program scheduling for remaining trainees and disruption of patient care delivery."

Dorothy A. Andriole, M.D., of the Washington University School of Medicine, St. Louis, and colleagues assessed GME enrollment and attrition of 795 students graduating from a single institution from 1994 to 2000. Participants planned to pursue training in a chosen specialty right after graduation from medical school or a year of preliminary training followed by entry into an advanced position. Students were considered as having high academic achievement if they had been elected to the Alpha Omega Alpha (AOA) Honor Medical Society or if they graduated with advanced degrees (such as combined M.D. – Ph.D. degrees).

After a minimum of six years of follow-up, 47 (6 percent) of the 795 participants did not complete GME in their initial specialty of choice. Of the 47 who discontinued training, 22 completed one year of training or less, 14 completed one to two years of training, and three completed more than two years of training in their initial specialty. "For many of the 41 graduates who continued GME in different specialties, there was an interval of up to several years before they resumed GME, often because they had pursued research in a desired specialty."

Attrition was not associated with graduation year, sex or age. However, "attrition was significantly associated with advanced degrees held at graduation, AOA election and specialty choice group," the authors write. "Four of the six graduates who entirely discontinued GME training held M.D. and Ph.D. degrees and subsequently pursued exclusively research-based careers."

"Finally, the issue of attrition during GME should be considered in the context of the projected physician shortage in the United States and growing concerns about the structure and efficiency of the GME process," they conclude. "Efforts to redesign unnecessarily circuitous or lengthy specialty-specific training paths and to minimize nondurable specialty choice decisions by our students could enhance the systemwide efficiency of GME at the national level."

(Arch Surg. 2008;143[12]:1172-1177. Available pre-embargo to the media at www.jamamedia.org.)

Diet may cut second breast cancers in women without hot flashes

A secondary analysis of a large, multicenter clinical trial has shown that a diet loaded with fruits, vegetables and fiber and somewhat lower in fat compared to standard federal dietary recommendations cuts the risk of recurrence in a subgroup of early-stage breast cancer survivors – women who didn't have hot flashes – by approximately 31 percent. These patients typically have higher recurrence and lower survival rates than breast cancer patients who have hot flashes. The study team, led by researchers at the Moores Cancer Center at the University of California, San Diego, along with six other sites, including the University of California, Davis, reported its results online December 15, 2008, in the Journal of Clinical Oncology.

The results come on the heels of a report last year on the findings of the original study, the Women's Healthy Eating and Living Trial (WHEL), which compared the effects of the two diets on cancer recurrence in more than 3,000 early-stage breast cancer survivors. That study showed no overall difference in recurrence among the two diet groups.

"Women with early stage breast cancer who have hot flashes have better survival and lower recurrence rates than women who don't have hot flashes," said Ellen B. Gold, Ph.D., professor and chair of the UC Davis Department of Public Health Sciences and first author of the study. "Our results suggest that a major change in diet may help overcome the difference in prognosis between women with and without hot flashes."

"Our interest in looking at this subgroup came because hot flashes are associated with lower circulating estrogen levels, while the absence of hot flashes is associated with higher estrogen levels. Reducing the effect of estrogen is a major treatment strategy in breast cancer," said the WHEL study principal investigator John P. Pierce, Ph.D., Sam M. Walton Professor for Cancer Prevention and director of Cancer Prevention and Control at the UC San Diego School of Medicine and the Moores UCSD Cancer Center. "It appears that a dietary pattern high in fruits, vegetables and fiber, which has been shown to reduce circulating estrogen levels, may only be important among women with circulating estrogen levels above a certain threshold."

About 30 percent of the original group of 3,088 breast cancer survivors did not report hot flashes at study entry. The women had been randomly assigned to one of the two diets between 1995 and 2000 and were followed until 2006. About one-half (447) of the "no hot flashes" group were randomized to the special, "intervention" high-vegetable fruit diet while the other half (453) was given the generally recommended diet of five servings of fruits and vegetables a day. The team found that those on the intervention diet had a significantly lower rate of a second breast cancer event (16.1 percent) compared to those eating the government-recommended five-a-day dietary pattern (23.6 percent).

The dietary effect was even larger (a 47 percent lower risk) in women who had been through menopause.

According to Pierce, another possible mechanism has been proposed recently for why this diet may have affected only 30 percent of the WHEL study population. Women with estrogen receptor-positive cancers usually receive hormone therapy (tamoxifen or aromatase inhibitors) aimed at combating the effect of circulating estrogen. However, more than 30 percent of these women appear to have a gene-drug interaction that prevents them from getting an effective dose of this therapy.

"This hypothesis says that if the endocrine therapy is working, no further reduction in estrogen levels would be needed," said Pierce. "If your genes are preventing you from getting a therapeutic dose, then following this rigorous dietary pattern may reduce estrogen levels enough to reduce risk." Because this is speculation, he said, the research team will be using biological samples collected throughout the study to further investigate the mechanisms behind the study diet's protective effects.

Other co-authors include: Cheryl Rock, Ph.D., Barbara Parker, M.D., Lisa Madlensky, Ph.D., Loki Natarajan, Ph.D., Linda Wasserman, M.D., Vicky Jones, M.D., Gail Laughlin, Ph.D., Nazmus Saquib M.D., Ph.D., Sheila Kealey MPH, Shirley Flatt, Jennifer Emond and Minya Pu, UCSD; Joanne Mortimer, M.D., City of Hope; Marcia Stefanek, Ph.D., Stanford University; Bette Caan, Dr.P.H, Kaiser Permanente, Oakland, Cynthia Thomson, Ph.D., University of Arizona, Njeri Karanja, Ph.D., Kaiser Permanente, Portland, OR; Richard Hajek, Ph.D., M.D. Anderson Cancer Center.

Drug tests will prevent repeat of Northwick Park trial

Scientists investigating the 2006 Northwick Park drug-trial disaster that left six healthy volunteers hospitalised say they have developed new pre-clinical tests that could have stopped the trial from ever going ahead.

But Dr Stephen Poole, speaking at the British Pharmacological Society's Winter Meeting in Brighton today (Tuesday), said that research is still "ongoing" to understand why the drug had such an adverse effect in the clinic but not in pre-clinical testing.

Describing the incident as "the most obvious setback for medicines testing since thalidomide", Dr Poole and his colleagues, from the National Institute for Biological Standards and Control (NIBSC) have, with new tests, successfully reproduced the devastating reaction suffered by the volunteers using human cells in the test tube (in vitro).

Standard preclinical in vitro tests on TGN1412 – the immunotherapy drug responsible for the Northwick Park disaster – failed to predict the catastrophic reaction that would occur when TGN1412 was administered to human subjects.

TGN1412 is from a class of drugs developed to re-balance the immune system for the treatment of autoimmune diseases, where the immune system has started to attack the body, such as rheumatoid arthritis and multiple sclerosis.

The Northwick Park disaster resulted in the UK Medicine and Healthcare products Regulatory Agency (MHRA) suspending all clinical trials of immunotherapy drugs and commissioning NIBSC, a government-funded institute, to investigate why both in vitro human cell tests and in vivo animal tests failed to predict the human immune system's response to the drug.

"With hindsight testing this drug in man was a mistake, but at the time the standard required pre-clinical tests failed to predict the effects it would have on the six volunteers," said Dr Poole, who said that the NIBSC's group's second paper on TGN1412 was due to be published shortly.

"While we are still investigating why the effect of this drug was so catastrophically different in the clinic than in pre-clinical testing, we have at least managed to develop new pre-clinical tests that should help us to avoid such outcomes in the future."

Speaking at the British Pharmacological Society (BPS) conference, Dr Poole identifies new pre-clinical in vitro testing of immunotherapy drugs that should help prevent any repetition of the disastrous events that were witnessed at Northwick Park.

These measures include ensuring that such drugs are not tested solely on immune (white blood) cells in isolation. The NIBSC group has shown that having a mixed human cell culture of white blood cells and endothelial cells – the cells that line blood vessels – is a much better indicator of how this type of drug will react in vivo.

The NIBSC group has also developed a technique that dries the drug onto a plastic surface, rather than testing it on cells as a solution in water, which has proven to be a far more reliable indicator of how the drug will react in the human body.

"The aim of our research is to improve the preclinical testing of immunotherapy drugs on human cells in vitro, as well as to establish why the antibody was not toxic in pre-clinical testing," said Dr Poole.

"We have made significant progress in designing new in vitro tests that hopefully will avoid the consequences that occurred at Northwick Park; indeed such tests could prevent harmful drugs of this type even reaching the animal-testing stage."

Immunotherapy drugs have the potential to be incredibly important in the treatment of diseases that have so far eluded medical advances, including many forms of cancer, so it is vital that the scientific community has its faith in clinical trials and in immunotherapy fully restored.

Notes for editors:

About the Northwick Park trial

The Phase 1 clinical trial of TGN1412 took place at an independent clinical trials unit at Northwick Park and St Mark's Hospital, London, on 13 March 2006. TGN1412 was intended for the treatment of leukaemia, multiple sclerosis and rheumatoid arthritis. Eight volunteers were given the drug or a placebo by intravenous infusion, with an interval of about 10 minutes between patients. Within minutes of the last patient being administered the drug, the first began to complain of headache, followed by fever and pain. The five other patients to receive TGN1412, as opposed to the placebo, became ill soon afterwards. All six male volunteers experienced cytokine release syndrome with effects similar to those of people suffering a severe allergic reaction. Each of the men was hospitalised for several weeks, with the worst affected requiring hospital treatment for four months.

Unmarried Dads: Pre-natal Involvement, Not Marriage, Ties Knot

COLLEGE PARK, Maryland - The best chance of "reeling-in" an unmarried father and building the foundations for a stable family life are the critical months of pregnancy, says new research from the University of Maryland. Marriage itself is no guarantee, the study adds.

"Unmarried dads are less likely to drift away if they are involved during this vital period when a family can begin to bond," says University of Maryland human development professor Natasha Cabrera, the principal investigator and a researcher at the school's Maryland Population Research Center.

The study, published in the December Journal of Marriage and Family, is the first to examine the importance of the pre-natal period in the formation of non-traditional family patterns.

The researchers analyzed data drawn from an ongoing project - the Fragile Families Child Well Being Study - of mostly unmarried couples, a total of 1,686 couples in all.

In their analysis, Cabrera and her colleague, Jay Fagan at Temple University, found that fathers involved during pregnancy were significantly more likely to remain involved in raising their child at age three.

"The unmarried father is much more likely either to maintain or move into a more committed relationship if he's involved before the birth, and that's the critical difference," Cabrera says. "As you might expect, research has consistently shown that creating a stable home life predicts whether a father will be an active participant in raising the child, but what we've learned here is that the pre-natal months are when that kind of family structure is most likely to coalesce."

The study found that marital status is not a critical predictor of a father's involvement. "It is the decision that couples make to strengthen commitment and move in together that is important, rather than marital status per se," Cabrera said. "You don't need much imagination to see that a live-in dad is likely to be more involved in child care and family life. It's the personal investment in the child's and the mother's future that counts the most, not the paperwork."

Copies Of The Study Available Media representatives only may receive a pdf-version of the complete study by emailing ntickner@umd.edu

Goose eggs may help polar bears weather climate change

New research highlights the ability to adapt to a changing Arctic

As polar bears adapt to a warming Arctic-a frozen seascape that cleaves earlier each spring-they may find relief in an unlikely source: snow goose eggs. New calculations show that changes in the timing of sea-ice breakup and of snow goose nesting near the western Hudson Bay could provide at least some polar bears with an alternative source of food. This new analysis appears in Polar Biology.

Polar bears -- especially the marginal individuals like some sub-adult males -- could adapt to changes in ice and the ability to hunt seals by eating snow goose eggs. **Patricia Rockwell**

"Over 40 years, six subadult male bears were seen among snow goose nests, and four of them were sighted after the year 2000," says Robert Rockwell, a research associate in Ornithology at the American Museum of Natural History and a Professor of Biology at City College at City University of New York. "I've seen a subadult male eat eider duck eggs whole or press its nose against the shell, break it, and eat the contents. This is similar to a different research group's observations of polar bears eating Barnacle Goose eggs on Svalbard, an island near Norway."

Polar bears, Ursus maritimus, are listed as a threatened species under the United States' Endangered Species Act and are classified as "vulnerable with declining populations" under IUCN's Red List. Polar bears' habitat rings the Arctic south of 88° latitude. Most of this area is sea ice from which bears hunt seals, although the breakup of sea ice over the summer forces some bears to move north, to pack ice, or onto land. More often, it is subadult males that are pushed to these less ideal conditions, where they live, in part, off stored fat reserves.

When bears switch to the tundra in some areas, they may enter the nesting grounds of snow geese. Goose eggs and developing embryos are a highly nutritious source of food to opportunistic foragers. Although geese populations were in decline in the early 1900s, the population rebounded and expanded. There are now too many geese for the Arctic to support in the summer, mainly because their over-wintering habitat has increased to cover the northern plains, where they eat waste corn and forage in rice fields.

Polar bear and snow geese populations come into contact in the Hudson Bay. Here, some bears routinely live on land for 4-5 months of the year, subsisting on fat reserves. The new research shows that the effects of climate change will bring additional sources of food as the movement of both populations begins earlier each spring. Rockwell and his graduate student, Linda Gormezano, calculated that the rate of change in ice breakup is, on

average, 0.72 days earlier each year, and that hatching time is also moving forward by 0.16 days each year. Current trends indicate that the arrival of polar bears will overlap the mean hatching period in 3.6 years, and egg consumption could become a routine, reliable option. At this point, a bear would need to consume the eggs of 43 nests to replace the energy gained from the average day of hunting seals. But within a decade, because timing changes would put bears in contact with even more nests with younger embryos (younger embryos are more nutritious), a bear would only need to consume the eggs of 34 nests to get the same amount of energy.

"Polar bears went through the Eemian 125,000 years ago, when sea level was 4-6 meters higher than it is now and trees lived above the Arctic Circle. They've been through warming before," says Rockwell. "I just read a piece in Natural History with a quote from Ilkoo Angutikjuak that sums this up: 'If the changes continue…the animals will adapt. I've heard that because they depend on sea ice, polar bears will go extinct, but I don't believe it…Polar bears might get skinnier and some might die, but I don't think they will go extinct.'"

Rockwell and Gormezano authored this research article, currently available in the early online version of Polar Biology. Research was funded by the Hudson Bay Project and the American Museum of Natural History.

Pain hurts more if the person hurting you means it

CAMBRIDGE, Mass. -- Researchers at Harvard University have discovered that our experience of pain depends on whether we think someone caused the pain intentionally. In their study, participants who believed they were getting an electrical shock from another person on purpose, rather than accidentally, rated the very same shock as more painful. Participants seemed to get used to shocks that were delivered unintentionally, but those given on purpose had a fresh sting every time.

The research, published in the current issue of Psychological Science, was led by Kurt Gray, a graduate student in psychology, along with Daniel Wegner, professor of psychology.

It has long been known that our own mental states can alter the experience of pain, but these findings suggest that our perceptions of the mental states of others can also influence how we feel pain.

"This study shows that even if two harmful events are physically identical, the one delivered with the intention to hurt actually hurts more," says Gray. "Compare a slap from a friend as she tries to save us from a mosquito versus the same slap from a jilted lover. The first we shrug off instantly, while the second stings our cheek for the rest of the night."

The study's authors suggest that intended and unintended harm cause different amounts of pain because they differ in meaning. "From decoding language to understanding gestures, the mind distills meaning from our social environment," says Gray. "An intended harm has a very different meaning than an accidental harm."

The study included 48 participants who were paired up with a partner who could administer to them either an audible tone or an electric shock. In the intentional condition, participants were shocked when their partner chose the shock option. In the unintentional condition, participants were shocked when their partner chose the tone option. Thus, in this condition, they only received a shock when their partner did not intend them to receive one. The computer display ensured that participants both knew their partner's choice and that a shock would be coming, to ensure the shock was not more surprising in the unintentional condition.

Despite identical shock voltage between conditions, those in the intentional condition rated the shocks as significantly more painful. Furthermore, those in the unintentional condition habituated to the pain, rating them as decreasingly painful, while those in the intentional condition continued to feel the full sting of pain.

Gray suggests that it may be evolutionarily adaptive for this difference in meaning to be represented as different amounts of pain.

"The more something hurts, the more likely we are to take notice and stop whatever is hurting us," he says. "If it's an accidental harm, chances are it's a one-time thing, and there's no need to do anything about it. If it's an intentional harm, however, it may be the first of many, so it's good to take notice and do something about it. It makes sense that our bodies and brains might amplify our experience of pain when we know that the pain could signal threats to our survival."

These findings speak to how people experience pain and negative life events. If negative events are seen as intended, they may hurt more. This helps to explain why torture is so excruciating – not only are torture techniques themselves exceptionally painful, but it's the thought that counts-and makes torture hurt more than mere pain.

On the other hand, if negative events are seen as unintended, they may hurt less. This may explain, in part, why people in abusive relationships sometimes continue to stay in them. By rationalizing that an abusive partner did not intend harm, some victims may reduce their experience of pain, which could make them less likely to leave the relationship and escape the abuse.

The research was supported by the National Institute of Mental Health, the Canadian Social Sciences and Humanities Research Council and the Institute for Humane Studies.

Does a Younger Dad Mean a Healthier Child?

A father's age is associated with decreased social abilities in boys, TAU researchers say

New studies from Tel Aviv University suggest that waiting until a man can give his son "all the advantages" may have a disadvantage, too.

Tel Aviv University researchers found in several consecutive studies that older dads are more likely to have boys with autism and lower IQs. Most recently, they found that the older a father's age, the greater the chance that his son will display poor social abilities as a teen. Dr. Mark Weiser from TAU's Sackler School of Medicine and his team of researchers are now studying what causes this phenomenon.

"There is a growing body of data showing that an advanced age of parents puts their kids at risk for various illnesses," says Dr. Weiser. "Some illnesses, such as schizophrenia, appear to be more common the older parents get. Doctors and psychologists are fascinated by this, but don't really understand it. We want to know how it works."

Questions and Answers

To explore this important question, Dr. Weiser looked at data collected by the Israeli army. Subjects included more than 450,000 male teens, aged 16 and 17. The teens were asked these questions: How many good friends do you have? Do you have a girlfriend? Do you generally prefer to be with or without a group of friends? How often do you go out on Friday evenings? Do you tend to be at the center of a party?

Controlling for the variables of IQ, mother's age, socioeconomic status and birth order, the researchers found that the prevalence of poor social functioning increased by 50% in boys with fathers 45 years old and up.

Cause for Concern?

Dr. Weiser, who also works at the Chaim Sheba Medical Center at Tel Hashomer hospital, cautions that the results are far from conclusive. "It could be that men with poorer social skills get married later in life, and therefore transmit this characteristic to their boys. But our studies attempted to control for this variable by looking at brothers from the same father," he explains.

He also suggests that older men shouldn't change their minds about having children since the statistical risk is relatively minor. "The effects of a father's age on the health of his son are quite small, and many of the most dramatic effects in this study are driven by dads in their 50s," says Dr. Weiser. "The difference in risk between someone who is 35 or 45 is so small that it's irrelevant."

Dr. Weiser continues, "But the findings are interesting for clinicians who are looking at the bigger picture of how parental age affects the mental functioning of offspring and what mechanisms are at play in that functioning." And Dr. Weiser doesn't rule out the possibility that older fathers may have better resources for getting their boys tested for autism when symptoms arise.

Published in Oxford Journal's "Schizophrenia Bulletin," the study builds on Dr. Weiser's previous research on parental age, autism and IQ scores.

Reducing the Damage of a Heart Attack

Mechanism Behind Cardiac Scarring Discovered

NEW YORK - In the aftermath of a heart attack, the body's own defenses may contribute to future heart failure. Authors of a new study believe they have identified a protein that plays an important role in a process that replaces dead heart muscle with stiffening scar tissue. The researchers are hopeful that the findings will lead to the development of new therapies to prevent this damage.

"The body tries to fix the injury to the heart muscle by depositing the fibers, but this causes a greater problem," says Dr. Thomas Sato, co-senior author of the study and the Joseph C. Hinsey Professor in Cell and Developmental Biology at Weill Cornell Medical College in New York City. "This process, called fibrosis, causes the heart to become like steel, unable to contract and pump blood throughout the body. The result can be fatal."

Myocardial infarction causes 13 percent of deaths worldwide and is the leading cause of death in industrialized countries. The researchers' promising findings were published online, Dec. 14, in Nature Cell Biology and will be featured in the upcoming January issue. Due to the findings' significance, the journal has selected the study as an issue highlight.

"Treatments for fibrosis in the heart are relatively limited, making it important to develop new and novel approaches to limit fibrosis," explains Dr. Craig Basson, co-author of the study, the Gladys and Roland Harriman Professor of Medicine and director of the Center for Molecular Cardiology at Weill Cornell Medical College, and attending physician at New York-Presbyterian Hospital/Weill Cornell Medical Center.

Dr. Sato and his team removed from a mouse's genome a gene called Sfrp2, stopping the mice from producing the protein sFRP2. They found that there was less scar tissue formed in the hearts of mice without the gene, compared to normal mice that still had the gene within their DNA.

The experimental mice also had improved recovery to their heart function, which leads the authors to believe that the protein has a direct affect on muscle scarring and stiffening following myocardial infarction.

The Weill Cornell team collaborated with Dr. Daniel S. Greenspan, co-senior author and professor of pathology and laboratory medicine from the University of Wisconsin School of Medicine and Public Health in Madison, Wis. Dr. Greenspan determined how the main component of connective tissue, collagen, interacts with the sFRP2 protein, and how these molecules play a crucial role in scar formation.

"With many injuries and diseases, large amounts of collagen are formed and deposited in tissues, leading to scarring and fibrosis," says Dr. Greenspan, an expert in collagen. "Fibrosis can severely affect the functioning of the heart, lung, liver and other tissues."

Together, the researchers determined that the sFRP2 protein works by accelerating the processing of pro-collagen, a precursor of mature collagen, the main component deposited in scar tissue. Following a heart attack, fibrous collagen deposits are increased, replacing the dead muscle and leading to more scar tissue, which prevents recovery. "Therapeutically, the findings mean that it is possible to create a drug that may one day inhibit the functioning of the protein in order to limit fibrosis within the heart," says Dr. Sato. "Doing so may aid in controlling the degree of scarring, and allow the heart to continue to function following myocardial infarction."

Co-authors of the study include Drs. Koichi Kobayashi, Min Luo, Yue Zhang, David C. Wilkes, Chikaomi Yamada and Ting-Chun Liu, all from Weill Cornell; Drs. Gaoxiang Ge and Guorui Huang from the departments of pathology and laboratory medicine and pharmacology, at the University of Wisconsin; and Drs. Thomas Grieskamp and Andreas Kispert from the Institut für Molekularbiologie, Medizinische Hochschule Hannover, Hannover, Germany.

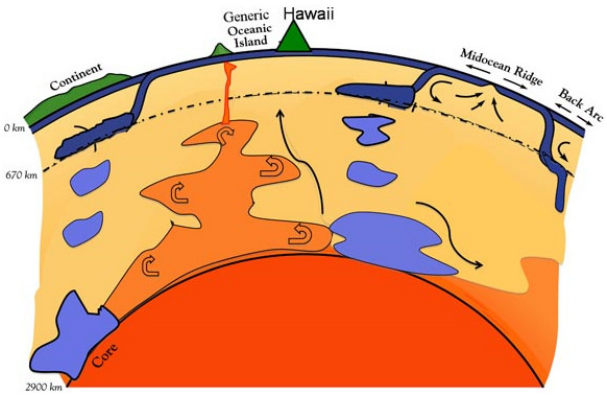
The study was supported by grants from the National Institutes of Health, the American Heart Association, the German Research Foundation and by the European Union FP6 contract "Heart Repair."

Ancient Magma "Superpiles" May Have Shaped The Continents

COLUMBUS, Ohio -- Two giant plumes of hot rock deep within the earth are linked to the plate motions that shape the continents, researchers have found.

The two superplumes, one beneath Hawaii and the other beneath Africa, have likely existed for at least 200 million years, explained Wendy Panero, assistant professor of earth sciences at Ohio State University.

The giant plumes -- or "superpiles" as Panero calls them -- rise from the bottom of Earth's mantle, just above our planet's core. Each is larger than the continental United States. And each is surrounded by a wall of plates from Earth's crust that have sunk into the mantle.



Researchers have linked two giant plumes of hot rock deep within the earth to the plate motions that shape the continents. This new drawing of Earth's interior is based on one originally developed by study co-author Louise C. Kellogg of the University of California, Davis and her colleagues in 1999. A giant plume of hot rock called a "superpile" (orange) sits atop Earth's core (red), while the remnants of two subducted continental plates (blue) sink down on either side of it. A magma plume (orange with red outline) can be seen rising from the superpile to the surface as a hotspot that creates island chains such as Hawaii. **Image by the Cooperative Institute for Deep Earth Research (CIDER) collaboration, courtesy of Ohio State University.**

She and her colleagues reported their findings at the American Geophysical Union meeting in San Francisco.

Computer models have connected the piles to the sunken former plates, but it's currently unclear which one spawned the other, Panero said. Plates sink into the mantle as part of the normal processes that shape the continents. But which came first, the piles or the plates, the researchers simply do not know.

"Do these superpiles organize plate motions, or do plate motions organize the superpiles? I don't know if it's truly a chicken-or-egg kind of question, but the locations of the two piles do seem to be related to where the continents are today, and where the last supercontinent would have been 200 million years ago," she said.

That supercontinent was Pangea, and its breakup eventually led to the seven continents we know today.

Scientists first proposed the existence of the superpiles more than a decade ago. Earthquakes offer an opportunity to study them, since they slow the seismic waves that pass through them. Scientists combine the seismic data with what they know about Earth's interior to create computer models and learn more.

But to date, the seismic images have created a mystery: they suggest that the superpiles have remained in the same locations, unchanged for hundreds of millions of years.

"That's a problem," Panero said. "We know that the rest of the mantle is always moving. So why are the piles still there?"

Hot rock constantly migrates from the base of the mantle up to the crust, she explained. Hot portions of the mantle rise, and cool portions fall. Continental plates emerge, then sink back into the earth.

But the presence of the superpiles and the location of subducted plates suggest that the two superpiles have likely remained fixed to the Earth's core while the rest of the mantle has churned around them for millions of years.

Unlocking this mystery is the goal of the Cooperative Institute for Deep Earth Research (CIDER) collaboration, a group of researchers from across the United States who are attempting to unite many different disciplines in the study of Earth's interior.

Panero provides CIDER her expertise in mineral physics; others specialize in geodynamics, geomagnetism, seismology, and geochemistry. Together, they have assembled a new model that suggests why the two superpiles are so stable, and what they are made of.

As it turns out, just a tiny difference in chemical composition can keep the superpiles in place, they found.

The superpiles contain slightly more iron than the rest of the mantle; their composition likely consists of 11-13 percent iron instead of 10-12 percent. But that small change is enough to make the superpiles denser than their surroundings.

"Material that is more dense is going to sink to the base of the mantle," Panero said. "It would normally spread out at that point, but in this case we have subducting plates that are coming down from above and keeping the piles contained."

CIDER will continue to explore the link between the superpiles and the plates that surround them. The researchers will also work to explain the relationship between the superpiles and other mantle plumes that rise above them, which feed hotspots such as those beneath Hawaii and mid-ocean ridges. Ultimately, they hope to determine whether the superpiles may have contributed to the breakup of Pangea.

This work was funded by the National Science Foundation.

University of Denver uses 'gross' messaging to increases handwashing, fight Norovirus

DU professor's work recently published in Communication in Healthcare journal

DENVER – Research conducted by University of Denver (DU) Associate Professor Renée Botta suggests that it takes "gross" messaging to get undergraduate students to wash their hands more frequently after going to the bathroom.

In fall quarter 2007, researchers posted messages in the bathrooms of two DU undergraduate residence halls. The messages said things like, "Poo on you, wash your hands" or "You just peed, wash your hands," and contained vivid graphics and photos. The messages resulted in increased handwashing among females by 26 percent and among males by 8 percent.

"Fear of spreading germs or getting sick by not washing didn't mean much to students," says Botta, the lead author of the study and an associate professor in the Department of Mass Communications and Journalism Studies. "What got their attention was the knowledge that they might be walking around with "gross things" on their hands if they didn't wash."

Observations in two control dorms over the same four-week period showed handwashing decreased 2 percentage points among females and 21.5 percentage points among males.

"We tried gross messages, germ messages and you'll-get-sick messages. And the only ones that stuck was gross," says Assistant Director of Health Promotions Katie Dunker, one of a team of five who conducted the pilot study. "We found that the 'gross factor' is what works, and we were able to increase hand washing behavior by a lot."

The findings are generating interest. Universities including UC Santa Barbara, Wyoming, Colorado State and CU–Colorado Springs want to borrow DU's techniques in hopes of improving student handwashing behavior on their campuses.

"The relevance of the message is really, really important," she says. "You can threaten that they'll get the flu or promise a flu-free winter, but if they don't really care about that, your message is going to fall flat," Botta says.

What was clear, she adds, was that the grossness campaign brought positive results not only in the study but also in a campus emergency that broke out last April. A week before the study was to be expanded to the entire University, a Norovirus outbreak made 63 students ill over a four-day period. Handwashing was identified as an important way to prevent the disease from spreading.

The study appears in the October edition of the Journal of Communication in Healthcare.

Female genital tissue not foolproof barrier to HIV sexual transmission

Scientists to report findings at ASCB conference

Contrary to a widely-held assumption about heterosexual transmission of HIV, the normal mucosal lining of the female genital tract is not a foolproof barrier to viral penetration, scientists at the Northwestern University School of Medicine in Chicago report at the American Society for Cell Biology (ASCB) 48th Annual Meeting, Dec. 13-17, 2008 in San Francisco.

"This is an unexpected and important result," says Thomas Hope of Northwestern, "because it is generally believed that the squamous epithelium of the female genital tract is an efficient barrier to viral penetration."

By labeling individual HIV virons with photoactivated fluorescent tags, Hope and his Northwestern colleagues were able to view the virus as it penetrated the squamous epithelium, the outermost most lining of the female genital tract.

The studies were conducted with lab cultures of human tissue obtained during hysterectomies and in tissue from rhesus macaque monkeys.

The researchers determined that HIV penetrated the genital skin barrier primarily by moving quickly, in just four hours, between skin cells to reach 50 microns beneath the skin, the depths in the tissue at which the immune cells targeted by HIV are located. HIV penetration was more common in the outermost superficial squamous epithelial layers and likely occurred during the normal turnover and shedding of skin cells. Then the skin cells are no longer tightly bound together, so water and HIV can easily enter.

Until now, scientists have had minimal data about how the virus penetrates epithelial barriers to find its specific immune cell targets such as CD4 positive T cells, macrophages, Langerhans cells, and dendritic cells.

Hope points out that new therapeutics or prevention strategies to block the entry of HIV through the superficial layers protecting the female genital tract are urgently needed.

The latest data from the U.S. Centers for Disease Control show that 31 percent of total new HIV infections each year can be traced to high-risk heterosexual contact.

Scientists fool bacteria into killing themselves to survive

James E. Kloeppel, Physical Sciences Editor

CHAMPAIGN, Ill. - Like firemen fighting fire with fire, researchers at the University of Illinois and the University of Massachusetts at Amherst have found a way to fool a bacteria's evolutionary machinery into programming its own death. "The basic idea is for an antimicrobial to target something in a bacteria that, in order to gain immunity, would require the bacteria to kill itself through a suicide mutation," said Gerard Wong, a professor of materials science and engineering, of physics, and of bioengineering at the U. of I.

Wong is corresponding author of a paper accepted for publication in the Proceedings of the National Academy of Sciences. The paper is to be posted this week on the journal's Web site.

The researchers show that a synthetic "hole punching" antimicrobial depends on the presence of phosphoethanolamine, a cone-shaped lipid found in high concentrations within Gram-negative bacterial membranes. Although PE lipids are commandeered to kill the bacteria, without the lipids the bacteria would die, also. "It's a Catch-22," Wong said. "Some mutations bacteria can tolerate, and some mutations they cannot tolerate. In this case, the bacteria would have to go through a mutation that would kill it, in order to be immune to these antimicrobials."

In their work, the researchers compared the survival of the bacterium Escherichia coli with that of a mutant strain of E. coli, which lacked PE lipids in its membrane. The fragile PE-deficient mutant strain out-survived the normal, healthy bacteria, when exposed to a "hole punching" synthetic antibiotic.

However, the opposite was true when both strains were exposed to tobramycin, a conventional metabolic antibiotic that targets the bacterial ribosomal machinery rather than the membrane.

The researchers first reported on compounds that functioned as molecular "hole punchers" last year in the Journal of the American Chemical Society. Their latest work further elucidates the "hole punching" mechanism.

"The antimicrobial re-organizes PE lipids into holes in the membrane," said Wong, who also is a researcher at the university's Beckman Institute. "The perforated membranes leak, and the bacteria die."

Finding new ways to treat emerging pathogens that are more and more resistant to the best antibiotics will be increasingly important in the future, Wong said. "Now that we more fully understand how our molecular 'hole punchers' work, we can look for similar ways to make antimicrobials that bacteria cannot evolve immunity to."

With Wong, the paper's co-authors include U. of I. graduate student and lead author Lihua Yang, materials science and engineering professor Dallas R. Trinkle, microbiology professor John E. Cronan Jr., and University of Massachusetts polymer science and engineering professor Gregory N. Tew, who earned a doctorate from Illinois.

The work was funded by the National Science Foundation, the National Institutes of Health and the Office of Naval Research.

MU Researcher Identifies Possible Genetic Causes of Borderline Personality Disorder

Story Contact: Jeffrey Beeson, (573) 882-9144, BeesonJ@missouri.edu

COLUMBIA, Mo. – According to the National Institute of Mental Health, borderline personality disorder (BPD) is more common than schizophrenia or bipolar disorder and is estimated to affect 2 percent of the population. In a new study, a University of Missouri researcher and Dutch team of research collaborators found that genetic material on chromosome nine was linked to BPD features, a disorder characterized by pervasive instability in moods, interpersonal relationships, self-image and behavior, and can lead to suicidal behavior, substance abuse and failed relationships.

"The results of this study hopefully will bring researchers closer to determining the genetic causes of BPD and may have important implications for treatment programs in the future," said Timothy Trull, professor of psychology in the MU College of Arts and Science. "Localizing and identifying the genes that influence the development of BPD will not only be important for scientific purposes, but will also have clinical implications."

In an ongoing study of the health and lifestyles of families with twins in the Netherlands, Trull and colleagues examined 711 pairs of siblings and 561 parents to identify the location of genetic traits that influences the manifestation of BPD. The researchers conducted a genetic linkage analysis of the families and identified chromosomal regions that could contain genes that influence the development of BPD. Trull found the strongest evidence for a genetic influence on BPD features on chromosome nine.

In a previous study, Trull and research colleagues examined data from 5,496 twins in the Netherlands, Belgium and Australia to assess the extent of genetic influence on the manifestation of BPD features. The research team found that 42 percent of variation in BPD features was attributable to genetic influences and 58 percent was attributable to environmental influences, and this was consistent across the three countries. In addition, Trull and colleagues found that there was no significant difference in heritability rates between men and women, and that young adults displayed more BPD features then older adults.

"We were able to provide precise estimates of the genetic influence on BPD features, test for differences between the sexes, and determine if our estimates were consistent across three different countries," Trull said. "Our results suggest that genetic factors play a major role in individual differences of borderline personality disorder features in Western society."

Trull's study, "Chromosome 9: linkage for borderline personality disorder" was recently published in Psychiatric Genetics and "Heritability of borderline personality disorder features is similar across three countries" was published in Psychological Medicine.

Quiet Bison Sire More Calves Than Louder Rivals

During bison mating season, the quietest bulls score the most mates and sire the most offspring while studs with the loudest bellows see the least action, according to a surprising new study by researchers at University of California, Davis, and Point Loma Nazarene University in San Diego. The researchers also found that the volume of a bull's bellow was not related to its weight or age.

"We were expecting to find that the bigger, stronger guys - the high-quality males - would have the loudest bellows, because they can handle the costs of it," said Megan Wyman, a graduate student in geography at UC Davis and the lead author of the study. "But instead, we found the opposite. My collaborator in San Diego wanted me to call the paper 'Speak softly and carry a big stick.'"

***UC Davis geography graduate student Megan Wyman measures the amplitude of a bison's bellow in Nebraska's Fort Niobrara National Wildlife Refuge*. (Paul Haverkamp/UC Davis photo)**

The study is the first to examine how the amplitude, or loudness, of a mammal's vocalizations correlate with reproductive success. It was published in the November issue of the journal Animal Behaviour.

Most studies of vocalized sexual signals among animals have focused on the pitch characteristics, timing and duration of calls. Amplitude has received much less attention, Wyman said, largely because loudness is especially difficult to measure in the field. By the time a grunt or a roar reaches a sound-level meter, its amplitude may have been affected by the animal's distance from the meter, the direction the animal was facing when it called, wind conditions and a number of other factors.

Bison bellows are loud, low-frequency vocalizations performed by bulls during the rut. They are most commonly used when one male challenges another, typically when the two are within 45 to 90 feet of one

another. Yet sometimes a bellow will attract bulls from further away, and this may be one reason that a herd's dominant bulls keep their voices down, Wyman speculates.

"It could be that bulls provide information about their high quality through other signals - for example, the frequency or the duration of their bellows. So they don't have to be louder, they just have to be heard," she said. "If you bellow too loudly, it could bring in too many other bison to check you out."

The bigger question raised by the study, Wyman said, is why lower-quality males don't turn down the volume of their bellows to emulate their more successful rivals.

"That's a lot harder to explain," she said. "It could be that if you use a quieter volume, other bulls have to approach even closer to check you out, and any time you bring someone that close, there's a higher risk of attack. And that's the type of cost that these low-ranking bulls may not be able to bear."

To learn how bison communicate with one another, Wyman and Michael S. Mooring of Point Loma Nazarene University, and a number of student interns spent two summers monitoring 325 wild bison in Fort Niobrara National Wildlife Refuge in the Sandhills region of north-central Nebraska. The animals were well habituated to the four-wheel drive vehicles the team used to shadow them, and each was easily identifiable by a unique brand it had been given as a calf.

Observing the herd for 14 hours each day during the two-month rut of July and August, the team was able to record each copulation and to detail the tangled web of connections between males and females as bulls lost and gained cows during their intense competitions. To assess where each bull ranked in the herd's hierarchy of dominance, Wyman tallied outcomes of challenges between rivals, including threats that ended with an animal backing down in the face of combat, as well as full-blown, head-to-head fights. When calves were born the following spring, DNA samples were taken to determine parentage.

For measurements of amplitude, Wyman used a hand-held sound-level meter from the safety of her vehicle. With each reading, she also recorded specific behaviors of the bull, his female and any challenging rivals, as well as noting the factors that could affect the level of the reading such as the bull's head orientation, its distance from the meter and wind conditions. After selecting for accuracy and quality, she narrowed some 2,000 readings taken from 67 bulls down to 408 readings from 44 bulls.

Her analysis showed that, on average, the least successful bulls - those with the lowest number of copulations and offspring - bellowed at least 50 percent louder than their more successful rivals, corresponding to decibel readings averaging from 109 per bull down to 103. This drop in volume correlated with a rise in the number of times a bull copulated from none to five, and the number of calves it sired from none to nine.

These data are just a portion of the information the researchers collected in the field with the overarching goal of understanding how bison communicate vocally. Yet the results clearly indicate that loudness as a factor of animal communication should receive more attention, Wyman said. "We've shown a way of using simple, affordable instruments in the field that can give a good measure of amplitude," she explained. "I'm hoping that researchers will now start looking at amplitude as something that matters."

Along with Wyman and Mooring, co-authors of the study are Professor Lynette Hart and Associate Researcher Brenda McCowan with the Department of Population Health and Reproduction in the School of Veterinary Medicine, and Associate Research Geneticist Cecilia Penedo in the Veterinary Genetics Laboratory, all at UC Davis. Funding for the study was provided by the National Science Foundation; the American Society for Mammalogists Grant-in-Aid; Animal Behavior Society Student Research Grant; and the Marjorie and Charles Elliott Fellowship Fund of University of California, Davis.

Galaxy clusters' stunted growth confirms dark energy

* 22:59 16 December 2008 by **Rachel Courtland**

Dark energy is stunting the growth of the universe's galaxy clusters, new observations reveal.

The finding uses a new technique to confirm that the universe is accelerating in its expansion, pushed apart by a mysterious repulsion - dark energy - that is overpowering the effect of gravity.

"We are in effect looking at dark energy from a new angle that was never quite possible before," Alexey Vikhlinin of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, told reporters on Tuesday.

Vikhlinin and colleagues used NASA's Chandra X-Ray Observatory to measure the hot gas in 86 galaxy clusters. These groups of hundreds or thousands of galaxies are filled with 100-million-degree-gas that can best be detected with X-ray telescopes.

The team estimated the total mass of each cluster and their distance from Earth. In the absence of dark energy, gravity's pull should have caused the total number of clusters to increase by a factor of 50 over the last 5.5 billion years, Viklinin said.

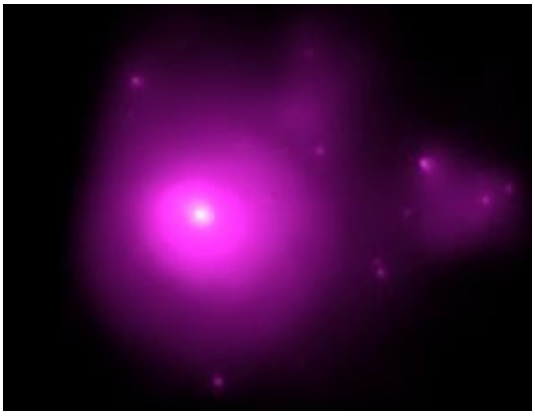
Instead, something counteracted the force of gravity, and the number of clusters only increased by a factor of 10. "This is an unmistakable signature of dark energy," Vikhlinin said.

Independent methods

Several other research groups are also studying dark energy by observing galaxy clusters, and astronomers expect the precision of the approach to improve with more observations.

The effect of dark energy was first reported in 1998, when two teams of astronomers found exploding stars that were dimmer, and thus farther away, than expected.

Since then, mounting evidence - from the big bang's afterglow and ripples in the distribution of matter in the universe - have honed a picture of the universe in which some 72% of all matter and energy is composed of dark energy.



Galaxy clusters, such as Abell 85 pictured in this X-ray image, are the largest collapsed structures in the universe. A new study shows dark energy has stunted the growth of these clusters in the last 5.5 billion years by counteracting the force of gravity **(Image: NASA/CXC/SAO/A.Vikhlinin et al.)**

"This is very impressive and important work," says Charles Bennett, who heads NASA's Wilkinson Microwave Anisotropy Probe, a satellite that measures the big bang's afterglow. "The results provide a crucial cross-check against the pre-existing set of cosmological results."

Theorist David Spergel of Princeton University agrees, saying the fact that different techniques are all consistent is a "triumph".

He says the new study will help pin down dark energy's properties, paving the way for researchers to one day determine what it is. The leading idea is that it is an inherent property of space itself - called the cosmological constant - but an alternative theory called quintessence posits that it could be an as-yet-unidentified quantum field that can vary depending on time and place.

Journal reference: Astrophysical Journal (forthcoming)

Pitt Researchers Create Nontoxic Clean-up Method for Common, Potentially Toxic Nano Materials

Horseradish enzyme biodegrades carbon nanotubes increasingly used in products, from electronics to plastics

PITTSBURGH-University of Pittsburgh researchers have developed the first natural, nontoxic method for biodegrading carbon nanotubes, a finding that could help diminish the environmental and health concerns that mar the otherwise bright prospects of the super-strong materials commonly used in products, from electronics to plastics.

A Pitt research team has found that carbon nanotubes deteriorate when exposed to the natural enzyme horseradish peroxidase (HRP), according to a report published recently in “Nano Letters” coauthored by Alexander Star, an assistant professor of chemistry in Pitt's School of Arts and Sciences, and Valerian Kagan, a professor and vice chair of the Department of Environmental and Occupational Health in Pitt's Graduate School of Public Health. These results open the door to further development of safe and natural methods-with HRP or other enzymes-of cleaning up carbon nanotube spills in the environment and the industrial or laboratory setting.

Carbon nanotubes are one-atom thick rolls of graphite 100,000 times smaller than a human hair yet stronger than steel and excellent conductors of electricity and heat. They reinforce plastics, ceramics, or concrete; conduct electricity in electronics or energy-conversion devices; and are sensitive chemical sensors, Star said. (Star created an early-detection device for asthma attacks wherein carbon nanotubes detect minute amounts of nitric oxide preceding an attack. See link below.)

“The many applications of nanotubes have resulted in greater production of them, but their toxicity remains controversial,” Star said. “Accidental spills of nanotubes are inevitable during their production, and the massive use of nanotube-based materials could lead to increased environmental pollution. We have demonstrated a nontoxic approach to successfully degrade carbon nanotubes in environmentally relevant conditions.”

The team's work focused on nanotubes in their raw form as a fine, graphite-like powder, Kagan explained. In this form, nanotubes have caused severe lung inflammation in lab tests. Although small, nanotubes contain thousands of atoms on their surface that could react with the human body in unknown ways, Kagan said. Both he and Star are associated with a three-year-old Pitt initiative to investigate nanotoxicology.

“Nanomaterials aren't completely understood. Industries use nanotubes because they're unique-they are strong, they can be used as semiconductors. But do these features present unknown health risks? The field of nanotoxicology is developing to find out,” Kagan said. “Studies have shown that they can be dangerous. We wanted to develop a method for safely neutralizing these very small materials should they contaminate the natural or working environment.”

To break down the nanotubes, the team exposed them to a solution of HRP and a low concentration of hydrogen peroxide at 4 degrees Celsius (39 degrees Fahrenheit) for 12 weeks. Once fully developed, this method could be administered as easily as chemical clean-ups in today's labs, Kagan and Star said.

Caltech researchers interpret asymmetry in early universe

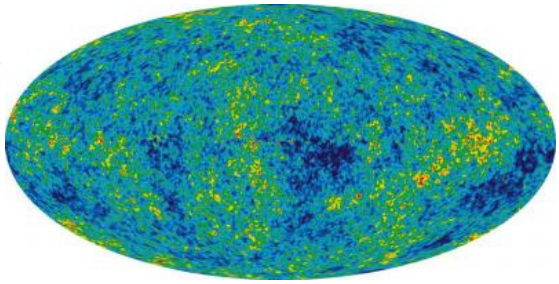
PASADENA, Calif.--The Big Bang is widely considered to have obliterated any trace of what came before. Now, astrophysicists at the California Institute of Technology (Caltech) think that their new theoretical interpretation of an imprint from the earliest stages of the universe may also shed light on what came before.

"It's no longer completely crazy to ask what happened before the Big Bang," comments Marc Kamionkowski, Caltech's Robinson Professor of Theoretical Physics and Astrophysics. Kamionkowski joined graduate student Adrienne Erickcek and senior research associate in physics Sean Carroll to propose a mathematical model explaining an anomaly in what is supposed to be a universe of uniformly distributed radiation and matter.

Their investigations turn on a phenomenon called inflation, first proposed in 1980, which posits that space expanded exponentially in the instant following the Big Bang. "Inflation starts the universe with a blank slate," Erickcek describes. The hiccup in inflation, however, is that the universe is not as uniform as the simplest form of the theory predicts it to be. Some parts of it are more intensely varied than others.

Until recently, measurements of the Cosmic Microwave Background (CMB) radiation, a form of electromagnetic radiation that permeated the universe 400,000 years after the Big Bang, were consistent with inflation--miniscule fluctuations in the CMB seemed to be the same everywhere. But a few years ago, some researchers, including a group led by Krzysztof Gorski of NASA's Jet Propulsion Laboratory, which is managed by Caltech, scrutinized data from NASA's Wilkinson Microwave Anisotropy Probe (WMAP). They discovered that the amplitude of fluctuations in the CMB is not the same in all directions.

"If your eyes measured radio frequency, you'd see the entire sky glowing. This is what WMAP sees," Kamionkowksi describes. WMAP depicts the CMB as an afterglow of light from shortly after the Big Bang that has decayed to microwave radiation as the universe expanded over the past 13.7 billion years. The probe also reveals more pronounced mottling--deviations from the average value--in the CMB in one half of the sky than the other.



This is the cosmic microwave background as seen by the WMAP satellite. This radiation was emitted when the Universe was 380,000 years old and has an average temperature of 2.7 Kelvin. The red and blue spots are temperature fluctuations that differ from the average temperature by only 0.0002 degrees. The region of maximal variation is in the lower right quadrant. **NASA/WMAP Science Team**

"It's a certified anomaly," Kamionkowski remarks. "But since inflation seems to do so well with everything else, it seems premature to discard the theory." Instead, the team worked with the theory in their math addressing the asymmetry.

They started by testing whether the value of a single energy field thought to have driven inflation, called the inflaton, was different on one side of the universe than the other. It didn't work--they found that if they changed the mean value of the inflaton, then the mean temperature and amplitude of energy variations in space also changed. So they explored a second energy field, called the curvaton, which had been previously proposed to give rise to the fluctuations observed in the CMB. They introduced a perturbation to the curvaton field that turns out to affect only how temperature varies from point to point through space, while preserving its average value.

The new model predicts more cold than hot spots in the CMB, Kamionkowski says. Erickcek adds that this prediction will be tested by the Planck satellite, an international mission led by the European Space Agency with significant contributions from NASA, scheduled to launch in April 2009.

For Erickcek, the team's findings hold the key to understanding more about inflation. "Inflation is a description of how the universe expanded," she adds. "Its predictions have been verified, but what drove it and how long did it last? This is a way to look at what happened during inflation, which has a lot of blanks waiting to be filled in."

But the perturbation that the researchers introduced may also offer the first glimpse at what came before the Big Bang, because it could be an imprint inherited from the time before inflation. "All of that stuff is hidden by a veil, observationally," Kamionkowski says. "If our model holds up, we may have a chance to see beyond this veil."

The study appears December 16 in the journal Physical Review D. It was supported by the Department of Energy and by Caltech's Moore Center for Theoretical Cosmology and Physics

Enceladus has 'spreading surface'

By Jonathan Amos Science reporter, BBC News, San Francisco

A US space agency (Nasa) probe has witnessed a moon of Saturn do something very unusual and Earth-like.

Pictures of the icy satellite Enceladus suggest its surface splits and spreads apart - just like the ocean floor on our planet splits to create new crust.

The information was released at a meeting of the American Geophysical Union in San Francisco.

The data from the Cassini spacecraft is said to strengthen the idea that Enceladus harbours a sub-surface sea.

"Bit by bit, we're accumulating the evidence that there is liquid water on Enceladus," said Carolyn Porco, team leader of the Cassini imaging group and one of the senior scientists on the mission.

The observation on Earth that the sea floor is splitting at mid-ocean ridges and moving apart was one of the great scientific discoveries of the 20th Century; and became a key feature in the theory of plate tectonics - the idea that massive slabs of the Earth's surface move around and are recycled.

Cassini sees something very similar on Enceladus.

The surface of this snow-white moon is riven with cracks - dubbed tiger stripes - at its south pole.

The tiger stripe fractures (bottom right) are places where the surface spreads

Dr Paul Helfenstein from Cornell University used digital maps of this region to reconstruct a history of the stripes, pushing the fractures around on a computer screen until they fitted together like pieces in a puzzle.

He found that sections of the cracks had clearly moved from their original locations.

Dr Helfenstein told BBC News that the resemblance to the Earth process was remarkable.

"What's different about them is that spreading ridges on the Earth typically spread symmetrically about a rift," he said.

"On Enceladus, what we see is a type of spreading but it is strongly asymmetric - it's like a conveyor belt, in which, if it's true it's coming up from a convection well, it seems to be only pushing in one direction. It does happen on Earth, but only in very peculiar situations."

On Earth, sea-floor spreading is fuelled by molten rock upwelling from deep inside the Earth.

On Enceladus, the scientists speculate the liquid may be water.

If that is the case, it makes this moon one of the most exciting targets for future exploration.

Enceladus is already known to have some of the fundamental chemistry required to make and sustain life. Liquid water currently is the major missing ingredient.

Dr Porco commented: "We first discovered this region in early 2005 and now it's nearly four years later, so it's still kind of brand new; but already there are some of us who really want to go back with a spacecraft that focuses on the south pole of Enceladus and investigates whether or not it is a site of either pre-biotic or biotic processes." *Jonathan.Amos-INTERNET@bbc.co.uk*

Personal Health

Query for Aging Patients: How Much Do You Drink?

By JANE BRODY

Aude Van Ryn

Is alcohol a tonic or a toxin? The question is especially critical to older people, whose overall medical picture gives alcohol the potential to be a health benefit or a life-shortening hazard.

Yet experts say that doctors rarely ask older patients how much and how often they drink. Not knowing the answers to these questions can result in misdiagnosis, medical complications and life-threatening accidents. Doctors may also fail to recognize the symptoms of alcohol abuse, a problem that is expected to become increasingly common as baby boomers, who have been found to drink more than previous generations, reach age 65 and beyond.

At the same time, older people who are in good health should know that moderate drinking under the right conditions may improve their health in several important ways. In a comprehensive review in the October issue of The Journal of the American Dietetic Association, Maria Pontes Ferreira and M. K. Suzy Weems described the myriad health benefits and risks of alcohol consumption by aging adults.

In summarizing the findings in an interview, Dr. Ferreira, a registered dietitian, said that "although there are a lot of benefits from moderate alcohol consumption, you can't make a blanket statement; you have to look at the big picture." "Moderate alcohol consumption can improve appetite and nutrition and reduce the risk of several important diseases, including cardiovascular diseases and diabetes," said Dr. Ferreira, a postdoctoral fellow at Haskell Indian Nations University in Lawrence, Kan. "But a lot of folks over 50 are already dealing with diseases associated with aging and medication use that can result in possible complications and drug interactions. And older people who abuse alcohol are consuming an inordinate amount of calories that can displace important nutrients."

Furthermore, Dr. Frederick C. Blow, professor of psychiatry at the University of Michigan Medical School and an expert on alcohol and aging, pointed out in an interview that "even at lower levels of consumption, alcohol can be problematic for older people."

"Because of an increased sensitivity to alcohol and decreased tolerance as one ages, lower amounts of alcohol can have a bigger effect," he said. "Older people get into trouble with doses of alcohol that wouldn't be a problem with a younger person."

Madeline A. Naegle, professor at the New York University College of Nursing, fears that publicity about the benefits of alcohol has dangerously tipped the scales, prompting some people to think that "if one drink is good, two or three must be better. Recommendations about drinking must be qualified by the level of a person's health," she emphasized in an interview.

In an article on screening for alcohol use and abuse among older adults in the November issue of The American Journal of Nursing, she noted: "Often clinicians fail to ask, 'Do you drink alcohol?' when obtaining medical histories and performing routine examinations. Because alcohol consumption is such a common practice, questions about drinking are necessarily part of a general health assessment."

The Benefits

Evidence for the benefits of moderate alcohol consumption comes almost entirely from epidemiological, or population, studies that can reveal important associations but cannot prove cause and effect. There have been few randomized controlled clinical trials of alcohol use to definitively show that alcohol consumed in any amount by any group of people benefits health.

That said, here is what the studies indicate. It's important to note that most findings refer to moderate consumption, defined as one alcoholic drink a day for women and up to two for men. Also, the benefits are confined to people who do not have ailments, like chronic liver disease, or take medications, like psychoactive drugs, that would render any amount of alcohol risky.

Heart disease and mortality. While many studies have emphasized the benefits of red wine to cardiovascular health and longevity, more than 100 studies in 25 countries have linked these benefits to moderate consumption of any type of alcoholic beverage. On average, moderate drinkers 50 and older are less likely to suffer heart attacks and die prematurely than abstainers and heavy drinkers.

Diabetes. Though it may seem counterintuitive, a controlled clinical trial of nondiabetic older women found that insulin sensitivity was improved among those who consumed two drinks a day.

In studies of men with diabetes, drinking up to two drinks a day was associated with lower levels of factors linked to an increased risk of heart disease, like markers of inflammation and arterial dysfunction.

Dementia. Although excessive alcohol drinking can raise the risk of dementia in older people, "there are emerging data to suggest that moderate alcohol intake - one to three drinks a day - is associated with a reduced risk of developing Alzheimer's disease and vascular dementia," Dr. Ferreira and Dr. Weems wrote. In this case, they added, drinking wine confers the primary benefit; drinking beer, on the other hand, appears to raise the risk of dementia.

Osteoporosis. Several studies have suggested that elderly women who drink moderately tend to have better bone density. But chronic heavy drinking "can dramatically compromise bone quality and may increase osteoporosis risk," H. Wayne Sampson of Texas A & M University Health Science Center in College Station has reported for the National Institute on Alcohol Abuse and Alcoholism. Furthermore, skeletal damage from excessive drinking is not reversible.

Psychosocial effects. Although there is relatively little research on the effects of moderate alcohol consumption on mental and social well-being among the elderly, studies in retirement communities have noted an improvement in social interactions, health-related quality of life and survival.

Nutritional benefits. Again, there is not a lot of research, but studies so far indicate that an alcoholic drink taken with meals can improve appetite and the consumption of calories and nutrients needed by many elderly people, Dr. Ferreira said.

The Risks

Immoderate consumption of alcohol - more than three drinks a day - can be hazardous for people of all ages, but it is especially so for the elderly, who reach higher levels of blood alcohol faster and maintain them longer than younger people.

Yet, Dr. Blow said, "we don't do well identifying older people who are getting into trouble with alcohol."

Potential hazards include an increased risk of falls and vehicular accidents, a decline in short-term memory, a worsening of existing health problems and interactions with medications that may diminish the effectiveness of some drugs and increase the toxic effects of others.

Dr. Ferreira called alcohol abuse and alcoholism in aging adults "a silent epidemic." Dr. Naegle wrote that "many older people pursue drinking patterns established earlier in life and may not realize that continuing to drink the same amount of alcohol as they did when they were younger may place them at risk for health problems."

She recommended using diet and exercise to reduce cardiac risk; trying alternative relaxation methods like meditation, yoga and exercise; and, for those who drink, cutting down on the amount of alcohol consumed by mixing it with water, taking an hour to finish one drink and alternating alcohol with nonalcoholic drinks.

Dr. Blow and Dr. Naegle urged health professionals who treat the elderly to administer the "Short Michigan Alcoholism Screening Test - Geriatric Version" as part of routine checkups. This test, which also can be self-administered, has proved highly accurate in identifying older people with alcohol-related problems. A "yes" answer to two or more questions suggests an alcohol problem, Dr. Blow has reported.

When talking with others, do you ever underestimate how much you drink?
After a few drinks, have you sometimes not eaten or skipped a meal because you didn't feel hungry?
Does having a few drinks help decrease your shakiness or tremors?
Does alcohol sometimes make it hard for you to remember parts of the day or night?
Do you usually take a drink to relax or calm your nerves?
Do you drink to take your mind off your problems?
Have you ever increased your drinking after experiencing a loss in your life?
Has a doctor or nurse ever expressed concern about your drinking?
Have you ever made rules to manage your drinking?
When you feel lonely, does having a drink help?

Defeating Bedlam

This week, I want to look at one of the unglamorous, but essential, parts of science: the problem of how to organize the information you have so that you know what you've got. For, like everything else in the digital age, the process of collecting and managing scientific information has been evolving. Fast.

Here's what I used to do, way back, oh, seven years ago when I was writing a book about the sex lives of animals. When I wanted to do research on a topic, I would go to the university library - how quaint! - and photocopy the scientific papers I wanted to read. Papers such as "Homosexual rape and sexual selection in Acanthocephalan worms" from the journal Science. Or "Deformed sperm are probably not adaptive" from Animal Behaviour. If I was looking for something more obscure - say, "A review of tool use in insects" from Florida Entomologist - I sometimes had to go to a specialist library, like the one in London's Natural History Museum.

Having collected the papers, I would take them back to my office, type the bibliographic details (authors, title, year published and so on) into my computer and put the photocopies into folders with other papers on the same general topic. In the case of the Acanthocephalan worms, it was a folder labeled "sabotage"; for the deformed sperm, it was "other sperm." When the time came to write up my discoveries and thoughts on the subject of sperm evolution, or how males sabotage their rivals, I went to the relevant folder, read the papers, made notes on them and started writing.

As a system, it was a little clumsy - photocopying was a bore, and if I wanted to spend a couple of months writing somewhere other than my office, I had to take boxes of papers with me - but it worked. I knew what I had and where it was.

Then the scientific journals went digital. And my system collapsed.

On the good side, instead of hauling dusty volumes off shelves and standing over the photocopier, I sit comfortably in my office, downloading papers from journal Web sites.

On the bad side, this has produced informational bedlam.

The journal articles arrive with file names like 456330a.pdf or sd-article121.pdf. Keeping track of what these are, what I have, where I've put them, which other papers are related to them - hopeless. Attempting to replicate my old way of doing things, but on my computer - so, electronic versions of papers in electronic folders - didn't work, I think because I couldn't see what the papers actually were.

And so, absurdly, it became easier to re-research a subject each time I wanted to think about it, and to download the papers again. My hard drive has filled up with duplicates; my office, with stalagmites of paper. And it isn't just that I have the organizational skills of a mosquito. Many of my colleagues have found the same thing. (Yes, we talk about it. Oh, they are lofty, the conversations in university common rooms.) In short, access to information is easier and faster than ever before (for a caveat, see the notes, below, but there's been no obvious way to manage it once you've got it.

Several pieces of software are now being developed to address this problem. I want to look at two of them here. The first is called Zotero; the second, Papers. Both are in version 1 and are still a bit buggy; but each has the potential, I think, to become a valuable tool for research.

Zotero aims to let you build a library of useful books and articles that you encounter while surfing online. It's an extension of the Web browser Firefox, and as you'd expect, it's free to download and easy to install.

Once you've installed it, each time you visit a Web page that contains items - books, newspaper articles, soundtracks, films, etc. - with bibliographic information, it extracts that information and allows you to save it to your Zotero library if you want to.

So, suppose you're interested in books about the psychology of war, and you go to Amazon and type "On Killing" into the search box. A list of books appears; Zotero collects the information for all of them and allows you to select the ones you want to keep. These are then put into your Zotero library. Once they're there, you can make notes on them, put them into folders with other items that are related, and so on. If you ask it to, Zotero will see if it can find a given book in a local lending library. And, supposedly, you can also pull bibliographic information from Zotero into documents you're writing, but I haven't tried that part yet.

It's a powerful piece of software with a lot of capabilities, though not all of them work as well as they could. For instance, it's hit-or-miss with newspaper articles - sometimes it recognizes them, sometimes it doesn't - and it can't interpret information from, alas, my local lending library. It does, however, allow you to screen grab, so you can still collect such information if you want it. The screen grab also allows you to add interesting Web pages to your Zotero library. (This is different from storing the link to a Web site. The screen grab gives you the page as it was when you looked at it; clicking a link gives you a site as it is today.)

A minor quibble: if you use a small laptop, as I do, you may find the Zotero window occupies too much of the screen. But I shall certainly keep using it, though not, perhaps as its conceivers intended. For me, it'll be a scrapbook of interesting stuff - books to buy later, press releases on subjects I think I might write about one day, magazine pieces about cities I'm thinking of visiting.

For the bulk of my researches, however, I shall use Papers. This software has been designed for the Macintosh by two avid fans who call themselves Mekentosj; it only works on the Macintosh platform. It's not free, but it is quite cheap (20 pounds sterling; 40 U.S. dollars) and, for me, it's been worth the money. For it solves the problem I started out describing - how to keep on top of scientific articles. How to know which ones you have, where they are, and what else you've got on the same subject.

The makers describe it as iTunes for .pdf files, and that's broadly right. (For anyone who's never encountered these things, a .pdf file is a type of document file that any computer can open using a free downloadable piece of software. This is the form electronic journal articles come in, and it means they look just as they would have done if you were reading the journal the old fashioned way. iTunes is a piece of music management software.) The idea is that, when you download an article, it goes into your Papers library. The bibliographic information immediately appears; so does, if you're lucky, the "metadata" - like the abstract and the list of subjects that the authors thought their article touches on. (I say "if you're lucky" because this doesn't always happen automatically.) The document itself gets neatly filed in a folder on your hard drive, and renamed by authors and year. Gone are the days of 456330a.pdf and sd-article121.pdf. Hallelujah.

And that's just the beginning. Not only can you read the papers, annotate them, find them and create folders of papers on related subjects, you can also use the software to search the big scientific databases like PubMed and the Web of Science. (Such databases are where you go to find out what's already been published on the subject you're interested in; it's where most scientists find out about the papers they want to collect.) It doesn't (yet) replace bibliographic software such as Endnote; but it can be used with it quite neatly.

Papers does have some teething problems. As I said, it's still buggy, so not everything functions as it should. Moreover, the way it works is not always intuitive, and there's no formal "help." Instead, if you have a question, you have to wade through user forums to try to see if anyone else has had the same question before - and, more to the point, whether anyone has answered it. But after a couple of days of experimenting, I got it doing exactly what I need.

Organizing materials is always idiosyncratic. I have one friend who organizes the novels he owns by the year in which the books were published; another goes by the color of the spine. (The first accused the second of having the soul of an interior decorator.) But the important thing is not how you do it, but whether it works - whether you can find what you're looking for. These bits of software open up possibilities; for some people they will be useful, for others they won't. Some will use both, others neither. For me, well, a few days after discovering Papers, I put 20 sacks of real paper into the recycling bin. At last, I'm back to knowing what I have and where it is.

Bedlam has been defeated. http://www.zotero.org/ http://mekentosj.com/papers/

Looking Under the Hood and Seeing an Incubator

By MADELINE DREXLER

The heat source is a pair of headlights. A car door alarm signals emergencies. An auto air filter and fan provide climate control.

But this contraption has nothing to do with transportation. It is a sturdy, low-cost incubator, designed to keep vulnerable newborns warm during the first fragile days of life.

Unlike the notoriously high-maintenance incubators found in neonatal intensive care units in the United States, it is easily repaired, because all of its operational parts come from cars.

And while incubators can cost $40,000 or more, this one can be built for less than $1,000.

The creators of the car parts incubator - a project being promoted by the Global Health Initiative at the Center for Integration of Medicine and Innovative Technology, or Cimit, a nonprofit consortium of Boston teaching hospitals and engineering schools - say it could prevent millions of newborn deaths in the developing world.

The main causes of newborn death - infections, preterm birth and asphyxiation - are readily treatable with the right expertise and equipment, said Dr. Kristian Olson, principal investigator on the project. He called them the "low-hanging fruit" of global health interventions.

"It's so frustrating to see these preventable deaths," he said. "They won't name babies in Aceh, Indonesia, until they're two months old. It's a cultural adaptation to expect a death."

Mechanically, incubators are simple devices, providing a warm, clean, womblike environment in which a baby can mature (though state-of-the-art models may have accessories like built-in X-ray machines and rotating mattresses). Low birth weight and other problems make it especially difficult for newborns to regulate their body temperature, a condition that can lead to organ failure.

In the car parts incubator, infants born at 32 weeks' gestation or longer can receive supplemental oxygen while their lungs gain strength, antibiotics if they have infections, and low-lit quiet in which to sleep if their mothers are away or are otherwise unable to hold them. In an emergency, the incubator's bassinet can be removed and carried to another part of the building or even to another hospital.

In truth, experts say, the developing world doesn't need more incubators. It needs incubators that work. Over the years, thousands have been donated from rich nations, only to end up in "incubator graveyards" - most broken, some never opened. According to a 2007 study from Duke University, 96 percent of foreign-donated medical equipment fails within five years of donation - mostly because of electrical problems, like voltage surges or brownouts or broken knobs, or because of training problems, like neglecting to send user manuals along with the devices.

To compensate for this philanthropic shortsightedness, medical staffs either crank up the temperature in "incubator rooms" to 100 degrees or more, or swaddle babies in plastic to hold in body heat.

Such makeshift solutions led the Boston team to ask: How can we make an incubator for the developing world that will get fixed?

One person pondering that question in 2006 was Jonathan Rosen, then director of Cimit's technology implementation program. A proponent of sustainable biomedical technology, Dr. Rosen, now at the Boston University School of Management, uses the term "organic resourcing" to describe the principle of fashioning medical devices from whatever materials were locally abundant.

In his discussions with doctors who practice in impoverished settings, Dr. Rosen learned that no matter how remote the locale, there always seemed to be a Toyota 4Runner in working order.

It was his "Aha!" moment, he recalled later: Why not make the incubator out of new or used car parts, and teach local auto mechanics to be medical technologists?

Cimit then hired Design That Matters, a nonprofit firm in Cambridge, Mass., to design the machine. “The idea was to start with a 4Runner,” said Timothy Prestero, the firm’s founder and chief executive, “and take away all the parts that weren’t an incubator.”

What resulted was a serious-looking gray-blue device that conjures up a cyborg baby buggy, but fits comfortably in hospitals and clinics with few resources. For one thing, the supply of replacement parts is virtually limitless, because the modular prototype can be adapted to any make or model of car.

“Junkyards are great sources for parts,” said Robert Malkin, director of Engineering World Health, a program based at Duke University, who is not affiliated with the incubator project. “We have designs for pumps and a surgical aspirator that are based on car parts.”

And the repair people will be right on the scene. “The future medical technologists in the developing world,” Dr. Malkin said, “are the current car mechanics, HVAC repairmen, bicycle shop repairmen. There is no other good source of technology-savvy individuals to take up the future of medical device repair and maintenance.”

Not everyone agrees that the car parts incubator is the best solution for infant deaths. Skeptics cite a 2005 series of articles in the British journal The Lancet listing proven interventions - including outreach visits during pregnancy, skilled care at delivery and emergency treatment afterward - that could eliminate up to 72 percent of neonatal deaths worldwide.

“Even if we just do what we know now, we could save roughly two-thirds of the infants who are dying,” said Dr. Stephen Wall, a senior research adviser at Save the Children, an independent nonprofit organization.

In his work in resource-poor countries, Dr. Wall has strongly promoted a strategy called kangaroo mother care, in which an infant is placed on the mother’s chest immediately and continuously after birth, ensuring warm skin-to-skin contact and breast-feeding.

The method has been documented to raise survival in low-birth-weight babies who are medically stable, and Dr. Wall says global health practitioners should promote the practice more strongly before endorsing a new device. He notes that most babies in the developing world are born not in hospitals but at home.

“For now,” he said, “there’s an urgent need to provide simple solutions that can be used by families, information that can be shared through community health workers, women’s groups or other community mechanisms.”

But others view the issue differently. “Mothers who are sick and can’t handle their kid, and mothers who can’t nurse, typically don’t take to kangaroo care,” said Dr. Malkin, at Duke. Nor do mothers who have to return to work to support their families, or whose cultures practice carrying infants on the back rather than the chest.

And by itself, the kangaroo method is not enough to help the smallest or sickest babies. Although low-birth-weight infants make up only 14 percent of babies born, they account for 60 percent to 80 percent of neonatal deaths.

“The bottom line is yes, we need more simple technologies in hospitals for the complicated cases,” said Dr. Renée Van de Weerdt, chief of maternal, newborn and child health at Unicef. “At the same time, we need to accelerate efforts to get skin-to-skin care more widely used for the noncomplicated cases.”

The car parts incubator has received $150,000 in initial financing from Cimit. The project team is looking for foundation support to develop a working prototype. Because it does not rely on original products or processes, the incubator will most likely not be patented, though Massachusetts General Hospital (Dr. Olson’s home institution) and Design That Matters will share intellectual property rights.

Meanwhile, the team is refining its business model and solidifying business partnerships abroad. “The technology is the least difficult part of the problem,” Mr. Prestero said. “Manufacturing, financing, distribution, regulatory approval: those are major barriers. There aren’t many examples of a successfully scaled product to serve the poor.”

If international health care bodies like the World Health Organization and the United Nations Population Fund endorse the incubator, he said, it could speed developing countries’ adoption of the device, even without approval of the Food and Drug Administration in the United States.

Dr. Olson says his determination to create a cheap, reliable incubator - and medical training to go with it - was reinforced on a trip this year to Cut Nyak Dhien Hospital, a one-story concrete building in the tsunami-stricken city of Meulaboh, Indonesia.

“When I walked in the incubator room,” he said, “a whole family was sobbing around a crib.” Their 7-day-old baby boy, who was born slightly underweight and suffering from infection, had just died, after lying for hours on a cold cot. With warmth and proper care, he would have survived.

Crowding the room were six donated high-tech incubators from the West. None of them worked.

Medical myths for the holiday season: True, false or unproven?

INDIANAPOLIS – In a study published in the Christmas 2008 issue of the British Medical Journal, Aaron Carroll, M.D., M.S., and Rachel Vreeman, M.D., M.S., of the Indiana University School of Medicine, explore the science behind six myths commonly associated with the holidays yet relevant year-round.

* Sugar makes kids hyperactive.	* You lose most of your body heat through your head.
* Suicides increase over the holidays.	* Eating at night makes you fat.
* Poinsettias are toxic.	* You can cure a hangover with…

These beliefs are commonly accepted as true, not only by the general public, but also by many physicians. To the surprise of the authors, who are health services researchers with the Indiana University Center for Health Policy and Professionalism Research, the Regenstrief Institute, and Indiana Children's Health Services Research, they found all six myths to be false or unsupported by medical research.

Does sugar make kids hyperactive? This is without a doubt false, report Dr. Vreeman and Dr. Carroll, who are both pediatricians at Riley Hospital for Children. They write that "in at least 12 double-blinded, randomized, controlled trials, scientists have examined how children react to diets containing different levels of sugar. None of these studies, not even studies looking specifically at children with attention deficit-hyperactivity disorder, could detect any differences in behavior between the children who had sugar and those who did not." This includes sugar from candy, chocolate and natural sources. Even in studies of children who were considered "sensitive" to sugar, children did not behave differently after eating sugar-full or sugar-free diets.

But what is most amazing, says Dr. Carroll, is that in studies in which parents think their children have consumed sugar, parents rate their children's behavior as more hyperactive, even if in fact no sugar was consumed. "Obviously the differences in the children's behavior were all in the parents' minds," he says.

This doesn't mean that sugar is good for children, it only means that it doesn't make them hyperactive. "There are many good reasons for parents to restrict their children's sugar consumption, including risks for obesity and cavities," Dr. Vreeman notes.

Does the number of suicides increase over the holidays? The holidays can bring out the worst in people, and the stresses of family get-togethers, loneliness, and the cold, dark winter months are commonly thought to increase the number of suicides at Yule time. But studies conducted around the globe show that, while the holidays may be a difficult time for some, there is no scientific evidence to suggest a holiday peak in suicides, according to Dr. Vreeman and Dr. Carroll. Furthermore, suicides are actually more common during warm and sunny times of the year. They emphasize that suicidal thoughts should be taken seriously at all times.

Are poinsettias toxic? Dr. Vreeman and Dr. Carroll found that the largest study of poinsettia "toxicity" to date involved an analysis of 849,575 plant exposures reported to the American Association of Poison Control Centers. None of the 22,793 poinsettia cases revealed significant poisoning. No one died from poinsettia exposures or ingestions, and more than 96 percent did not even require treatment in a health care facility. Another study, looking at poinsettia ingestion by rats, could not find a toxic amount of poinsettia, even at doses which would be the human equivalent of consuming 500-600 poinsettia leaves or a pound and a half of the plant's sap. Dr. Vreeman cautions, though, that you should always call a poison control center if someone eats a plant not intended for consumption.

Do you lose most of your body heat through your head? Both Dr. Vreeman and Dr, Carroll assumed this one was true. After all, mothers have been repeating it for decades. But, in fact, it is not true.

They believe this myth likely originated with an old military study where scientists put subjects in arctic survival suits without hats and measured their heat loss in cold temperatures. They did lose the most heat through their heads, but only because it was the only bare part of their body. Vreeman and Carroll found that more contemporary experts say that, had this same experiment been performed with subjects wearing only swimsuits, with much of their bodies exposed, the subjects would not have lost more than 10 percent of their body heat through their heads.

"Any uncovered part of the body loses heat and will drop the core body temperature proportionally," the IU researchers note. They recommend keeping all parts of the body warm when out in the cold, but the head does not require special attention. As pediatricians, they counsel parents to dress their children appropriately for the weather year round.

Does eating at night make you fat? Dr. Vreeman and Dr. Carroll write that at first glance, some scientific studies seem to support this idea. But just because obesity and eating more meals at night are associated, it does not mean that one causes the other. People gain weight because they take in more calories overall than they burn up. Eating more meals, and taking in more calories makes you gain weight regardless of when calories are consumed.

The bottom line, say Dr. Vreeman and Dr. Carroll, is that the time of day or night when one eats is irrelevant. People gain weight because they take in more calories overall than they burn, regardless of when these calories are consumed.

Can one cure a hangover with…fill in the blank? Both Dr. Vreeman and Dr. Carroll believed that neither "hair of the dog" or any other remedy could alleviate a hangover. And they were right. They found no scientific evidence supporting any cure for alcohol hangovers. A hangover is caused by excess alcohol consumption. Thus, the most effective way to avoid a hangover is to consume alcohol only in moderation or not at all.

Why did they do this study? "Examining common medical myths reminds us to be cognizant of when evidence supports our advice [as physicians or as parents], and when we operate based on unexamined beliefs. This was not a systematic review of either the evidence to refute these medical myths or of doctors' beliefs. Nonetheless, we applied rigorous search methodology to compile data, and evidence of the prevalence of these medical beliefs is readily available. Only by investigation, discussion, and debate can we reveal the existence of such myths and move the field of medicine forward," they write.

In 2009, St. Martin's Press will publish their book Don't Swallow Your Gum: Myths, Half-truths, and Outright Lies About Your Body and Health. In the meantime, don't swallow your gum.

Should the Pope be worried that Wales won the rugby Grand Slam this year?

Research paper: Rugby (the religion of Wales) and its influence on the Catholic Church: Should Pope Benedict XVI be worried?

Doctors in the Christmas issue published on bmj.com today are urging the Vatican's medical team to keep a special watch over the Pope this Christmas, after their research investigating the link between papal deaths and Welsh rugby performance suggests that he has about a 45% chance of dying by the end of 2008.

Dr Gareth Payne and his team from Cardiff found no evidence to support the urban legend that "every time Wales win the rugby Grand Slam, a Pope dies", but they did find limited data linking Welsh rugby performance and papal deaths. Worryingly for Pope Benedict XVI, Wales won the Grand Slam in 2008.

The researchers charted all northern hemisphere rugby championships since 1883, but discarded the years 1885, 1888-9, 1897-8 and 1972 because not all the scheduled matches were played. For the purposes of their research, a Grand Slam was defined as one nation beating all other competing teams.

Since 1883, eight Pontiffs have died, five in Grand Slam years - three deaths happened when Wales completed the sweep, and two others occurred when Wales won the tournament but not the Grand Slam.

Interestingly, say the authors, although the deaths did not always coincide with a Welsh Grand Slam win, they did correspond with a victory of a predominantly Protestant nation (England, Scotland or Wales), rather than a Roman Catholic nation (France, Ireland, or Italy).

The authors comment that the link between Popes and Grand Slams "is nothing more than an urban myth…This comes as something of a relief as we are at a loss to see how the events could be linked, especially given the continuing rapprochement between Catholic and Protestant churches."

However, given that the research suggests a link between the success of the Welsh rugby union team and papal deaths, the authors believe that the Vatican medical staff "can't fully relax until the new year arrives".

Moon's polar craters could be the place to find lunar ice, scientists report

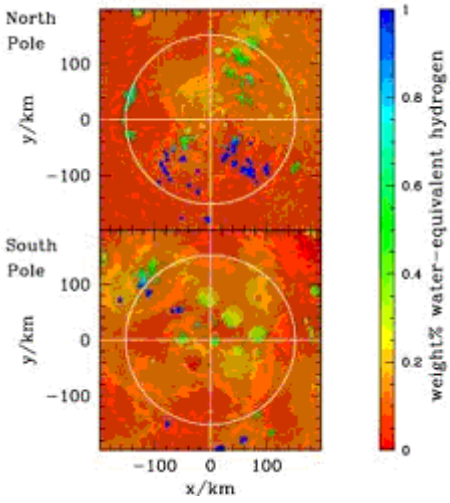
Scientists have discovered where they believe would be the best place to find ice on the moon.

Astrophysicists, led by an expert at Durham University, say if frozen water exists then it is most likely to be found near to the moon's poles in craters that are permanently shaded from the sun.

Their findings are based on a new computer analysis of data from the Lunar Prospector, a space probe sent to the moon in 1998 by NASA. The researchers showed that hydrogen on the moon is concentrated into polar craters where temperatures are colder than minus 170 degrees Celsius.

Hydrogen, together with the oxygen that is abundant within moon rock, is a key element in making water.

If ice is present in the craters then the researchers say it could potentially provide a water source for the eventual establishment of a manned base on the moon. A moon base could be used as a platform for exploration into the further reaches of our solar system.



A map showing the north and south polar regions of the moon. The dark blue shaded areas represent the highest concentrations of hydrogen. **Dr. Vincent Eke, Durham University/NASA**

The findings are published in the International Journal of Solar System Studies, Icarus.

They show that if the hydrogen is present as water ice, then the average concentration in some craters corresponds to ten grams of ice in each kilogram of moon rock. However the researchers say that instead of being water ice, hydrogen may be present in the form of protons fired from the sun into the dusty lunar surface.

Dr Vincent Eke, in the Institute for Computational Cosmology, at Durham University, said: "This research applies a newly developed technique to data from the Lunar Prospector mission to show that hydrogen is actually concentrated into the permanently shaded polar craters. "Water ice should be stable for billions of years on the moon provided that it receives no sunlight. "If the hydrogen is present as water ice then our results imply that the top metre of the moon holds about enough water to fill up Kielder Water."

Kielder Water, in Northumberland, UK, holds 200,000 million litres of water, making it the largest UK manmade reservoir in Northern Europe.

The research may be of immediate use in lunar exploration. Dr Richard Elphic, in the Planetary Systems Branch, NASA Ames Research Center, said: "These results will help NASA's soon-to-be launched Lunar Crater Observation and Sensing Satellite (LCROSS) and Lunar Reconnaissance Orbiter (LRO) missions.

"For example, LCROSS aims to liberate water by impacting into permanently shadowed polar terrain where ice may exist, and our improved maps of hydrogen abundance can help LCROSS select a promising impact site.

"These maps will also help focus LRO's search for possible polar ice by identifying hydrogen-rich locales".

The research was led by Dr Eke together with colleagues from the University of Glasgow and the Planetary Systems Branch, Space Science and Astrobiology Division, of NASA Ames Research Center in California, USA.

The research was funded by a Royal Society University Research Fellowship, a Leverhulme Research Fellowship and the NASA Lunar Reconnaissance Orbiter Participating Scientist Programme.

Autism and schizophrenia share common origin

First month of pregnancy forms the basis for disrupted development

Schizophrenia and autism probably share a common origin, hypothesises Dutch researcher Annemie Ploeger following an extensive literature study. The developmental psychologist demonstrated that both mental diseases have similar physical abnormalities which are formed during the first month of pregnancy.

Peculiar toes

Developmental psychologist Annemie Ploeger has investigated whether there is a connection between disorders in the first month of pregnancy and the development of schizophrenia and autism. Interestingly, many physical abnormalities of autistics are also prevalent in schizophrenics. For example, both autistics and schizophrenics sometimes have protruding ears and peculiar toes. There are also differences: a large head and intestinal problems, for example, are typical traits occurring in autistics. From this, Ploeger concluded that the two disorders share a common origin. The same error that occurs very early in pregnancy develops into autism in one individual and schizophrenia in another.

Early vulnerability

Ploeger's research reveals that in the period between 20 and 40 days after fertilisation, the embryo is highly susceptible to disruptions. In this period, early organogenesis, there is a lot of interaction between the different parts of the body. If something goes wrong with a given part of the body, it greatly influences the development of other parts of the body. As people with schizophrenia and autism frequently have physical abnormalities to body parts formed during early organogenesis, Ploeger concluded that the foundation for these psychiatric disorders is laid very early during pregnancy.

The existence of a relationship between unhealthy behaviour during pregnancy and the subsequent development of schizophrenia and autism in the child was already known. However, Ploeger's hypothesis that the early organogenesis stage is the most critical, is new. Ploeger bases her hypothesis on an extensive study of scientific literature in this area. She often had to make use of related studies; although a lot of research has been done into prenatal influences on the development of schizophrenia and autism, little is known about the influence that the period between 20 to 40 days after fertilisation has.

Toxic pregnancy medicine

For example, she acquired information about autism from a study into softenon use. Softenon is a drug against morning sickness that was administered to women in the 1960s and 1970s. Later it was discovered that severely disabled children were born as a result of this medicine. Autistic children were born in four percent of pregnancies in which softenon was used, whereas normally this figure is 0.1 percent. Women could state exactly when they started to take softenon. The women who had taken softenon between the 20th and 24th day of the pregnancy had the greatest chance of giving birth to an autistic child.

Ploeger advises women to stop risky behaviour such as smoking, medicine use and stressful activities before they even become pregnant. If you only start to live healthily once you know that you are pregnant, the basis for a disrupted development of your child could already have been laid.

Ploeger's research was partly financed by NWO is within the research programme Evolution and Behaviour.

How to make cheap wine taste like a fine vintage

* 17 December 2008 **by Stephanie Pain**

MOST people have got one lying around somewhere: a bottle of cheap, nasty wine left over from a dinner party just waiting to be offloaded on someone else - or quaffed late one night when the good stuff has run out. But what if you could turn that bargain-basement plonk into fine wine in minutes? In these straitened times it could be just the thing a wine lover needs.

Traditionalists, of course, would insist that nothing can replace genuine quality plus long, slow ageing in an oak barrel and years of storage in cool, cobwebby cellars. But could there be a short cut?

Over the years, inventors have come up with dozens of widgets that they claim can transform the undrinkable or bring the finest wines to perfection without the long wait. Sadly, there's little scientific evidence that most of them work (see "Faking it"). Looks like you're stuck with the plonk.

Or are you? Fortunately, there is one technique that stands out from the rest. It is backed by a decade of research, the results have been published in a peer-reviewed journal and the end product has passed the ultimate test- blind tasting by a panel of wine experts. No fewer than five wineries have now invested in the technology.

The secret this time is an electric field. Pass an undrinkable, raw red wine between a set of high-voltage electrodes and it becomes pleasantly quaffable. "Using an electric field to accelerate ageing is a feasible way to shorten maturation times and improve the quality of young wine," says Hervé Alexandre, professor of oenology at the University of Burgundy, close to some of France's finest vineyards.

No matter how impatient or undiscriminating you may be, fresh wine is undrinkable and can have horrible after-effects. Expect an upset stomach, a raging thirst and the world's nastiest hangover. The youngest a wine can be drunk is six months. Most, especially reds, take longer to achieve the required balance and complexity. The finest can take 20 years to reach their peak.

During ageing, wine becomes less acid as the ethanol reacts with organic acids to produce a plethora of the fragrant compounds known as esters. Unpleasant components precipitate out and the wine becomes clearer and more stable. Red wines mellow as bitter, mouth-puckering tannin molecules combine with each other and with pigment molecules to form larger polymers, at the same time releasing their grip on volatile molecules that contribute to the wine's aroma. These reactions take time and need a small but steady supply of oxygen. In barrel-aged wines, oxygen leaks through the wood, while wine matured in steel tanks is often helped along by introducing microscopic oxygen bubbles.

There are good commercial reasons why winemakers would love get their hands on a speedier alternative, especially in places like China where the industry is young and booming. It would allow them to get their wines into the shops faster to meet ever-increasing demand, and cut the cost of storage.

The food industry has experimented with electric fields as an alternative to heat-treating since the 1980s, and 10 years ago Xin An Zeng, a chemist at the South China University of Technology in Guangzhou, decided to see what he could do for wine. Early results were promising enough for Zeng and his colleagues to develop a prototype plant in which they could treat wine with fields of different strengths for different periods of time.

They pumped the wine through a pipe that ran between two titanium electrodes, fed with a mains-frequency alternating supply boosted to a higher voltage. For the test wine, the team selected a 3-month-old cabernet sauvignon from the Suntime Winery, China's largest producer. Batches of wine spent 1, 3 or 8 minutes in various electric fields (see diagram). The team then analysed the treated wine for chemical changes that might alter its "mouth feel" and quality, and passed it to a panel of 12 experienced wine tasters who assessed it in a blind tasting (Innovative Food Science and Emerging Technologies, vol 9, p 463).

The results were striking. With the gentlest treatment, the harsh, astringent wine grew softer. Longer exposure saw some of the hallmarks of ageing emerge- a more mature "nose", better balance and greater complexity. The improvements reached their peak after 3minutes at 600 volts per centimetre: this left the wine well balanced and harmonious, with a nose of an aged wine and, importantly, still recognisably a cabernet sauvignon.

Analysis revealed some significant chemical changes. Most obviously, there was a marked increase in reactions between alcohols and acids to produce esters. This led to a reduction in concentrations of the long-chain alcohols known to be responsible for nasty odours and a burning mouth feel, while the increase in the concentration of esters boosted the aroma and the perception of fruitiness.

Two other good things happened: the breakdown of proteins produced free amino acids that contribute to taste and there was a noticeable reduction in the levels of aldehydes, which are responsible for "off" flavours. You can have too much of a good thing, though. Upping the voltage and applying it for longer brought new and unwanted changes, including the generation of new undesirable aldehydes. Zap it too much and the result, the panel found, was worse than the untreated original.

Although Zeng cannot yet explain how exposure to an electric field alters the wine's chemistry, his results show that under the right conditions the technique can accelerate some aspects of the ageing process. "Not only can it shorten a wine's normal storage time, it can also improve some lower-quality wine," he says. "It works just as well with other grape varieties such as merlot and shiraz." Five Chinese wineries have begun trials.
A quick blast with an electric field can improve lower-quality wine and shorten storage time

Sadly for wine drinkers feeling the pinch, there's no immediate prospect that you can try this for yourself. "I have thought of designing a set of equipment for use at home," admits Zheng "...but not yet."

Faking it

Hervé Alexandre, professor of oenology at the University of Burgundy, rates some of the latest attempts to speed-age wine.ULTRASOUNDDevices based on ultrasound pop up regularly. October saw the launch of the Quantum Wine Ager, which its inventor claims will turn a £3.99 bottle of plonk into something that tastes as if it costs hundreds. Verdict: "I'm a bit sceptical. Ultrasound might increase some reactions but a lot of rigorous experiments must be done before concluding that it works. When the wine is of low quality there is no miracle that will transform it into a bottle of the finest vintage."UNDERSEA CELLARAGEChampagne house Louis Roederer has consigned several dozen bottles of champagne to the ocean floor, where it reckons the cool water and gentle rocking by currents will accelerate ageing.Verdict: "By lowering the temperature you slow down chemical reactions, so storage in cold water will slow the ageing process. Corks are permeable to oxygen, which helps ageing. While in water, no oxygen will enter the bottle."GAMMA RADIATIONAccording to Chinese researchers, an hour's treatment improved the flavour of new rice wine. In Canada the technique has been used to get rid of "ladybeetle taint"- nasty off flavours that result from ladybeetles (ladybirds) being pressed along with the grapes.Verdict: "It sounds technically interesting, but I'm not sure consumers are ready for irradiated wine."

Researchers compile 'molecular manual' for 100s of inherited diseases

First catalog of tissue-specific changes could improve understanding, help treatment

An international research team has compiled the first catalogue of tissue-specific pathologies underlying hundreds of inherited diseases. These results provide information that may help treat conditions such as breast cancer, Parkinson's disease, heart disease and autism. The report from scientists at the Technical University of Denmark and Massachusetts General Hospital (MGH) will appear in the Proceedings of the National Academy of Sciences and has been published online.

"Disease processes in humans are far from being exhaustively understood and characterized, in part because they are the result of complex interactions between many molecules that may take place only in specific tissues or organs. Experiments to directly study these interactions in human patients would not be possible, which limits our understanding of how diseases arise and which molecules and genes are involved," says co-lead author Kasper Lage, PhD, of the MGH Pediatric Surgical Research Laboratories.

Co-lead author Niclas Tue Hansen, MSc, from the Center for Biological Sequence Analysis, Technical University of Denmark, adds, "We let supercomputers model biological processes in tissues across the human organism, based on the knowledge from millions of already published articles. In this way we were able to create an extensive map of the interactions of molecules in many diseases – a sort of molecular manual – without carrying out experiments in patients." The catalogue, which is freely available on the Center for Biological Sequence Analysis web page (http://www.cbs.dtu.dk/), should help physicians and researchers investigating many serious disorders, he notes.

"It has been extremely exciting to integrate the disease expertise of researchers at MGH and Harvard Medical School with the work of leading systems biologists at the Technical University of Denmark," says Patricia Donahoe, MD, director of Pediatric Surgery Research at MGH and co-corresponding author of the PNAS study. "This current study brought together the strengths of both teams and resulted in a unique way of analyzing inherited diseases. Our findings have the potential to advance the knowledge of pathways, genes and proteins involved in hundreds of human disorders and perhaps contribute to better treatment strategies for some of these serious diseases," Donahoe is the Marshall K. Bartlett Professor of Surgery at Harvard Medical School.

Søren Brunak, PhD, director of the Center for Biological Sequence Analysis at the Technical University of Denmark is co-corresponding author of the PNAS report. Additional authors are Olof Karlberg, PhD, Aron Eklund, PhD, Francisco Roque, MSc, Zoltan Szallasi, MD, and Thomas Skøt Jensen, PhD, all affiliated with the Technical University of Denmark. The study was supported by grants from the Villum Kann Rasmussen Foundation, the Simon Spies Foundation, the National Institute of Child Health and Development, and the National Institutes of Health.

Are Power and Compassion Mutually Exclusive?

The fact that many cultures emphasize the concept of “noblesse oblige” (the idea that with great power and prestige come responsibilities) suggests that power may diminish a tendency to help others. Psychologist Gerben A. van Kleef (University of Amsterdam) and his colleagues from University of California, Berkeley, examined how power influences emotional reactions to the suffering of others.

A group of undergraduates completed questionnaires about their personal sense of power, which identified them to the researchers as either being high-power or low-power. The students were then randomly paired up and had to tell their partner about an event which had caused them emotional suffering and pain. Their partners then rated their emotions after hearing the story. In addition, the researchers were interested in seeing if there were physical differences in the way high-power people and low-power people responded to others' suffering; specifically they wanted to test if high-powered individuals would exhibit greater autonomic emotion regulation [or respiratory sinus arrhythmia (RSA) reactivity]. When we are faced with psychological stress, our RSA reactivity increases, resulting in a lower heart rate and a calmed, relaxed feeling. To measure RSA reactivity and heart rates, all of the participants were connected to electrocardiogram (ECG) machines during the experiment.

The results, reported in the December issue of Psychological Science, a journal of the Association for Psychological Science, reveal that individuals with a higher sense of power experienced less compassion and distress when confronted with another's suffering, compared to low-power individuals. In addition, high-power individuals' RSA reactivity increased (as indicated by lower heart rate) as they listened to the painful stories; that is, high power participants showed more autonomic emotion regulation, which buffered against their partner's distress.

Analysis of the participants' final surveys (where they rated their thoughts about their partners) revealed that high-power individuals reported a weaker desire to get to know and establish a friendship with their partner. In other words, powerful people were not motivated to establish a relationship with distressed individuals. This idea is supported by the fact that the distressed participants reported less of a social connection with high-power partners compared to low-power partners. The authors suggest that powerful people's tendency to show less compassion and distress towards others reinforces their social power.

These results do not just apply to how powerful people react to strangers; the authors note that this study "suggests that high-power individuals may suffer in interpersonal relationships because of their diminished capacity for compassion and empathy. The many benefits enjoyed by people with power may not translate to the interpersonal realm."

Earth's original ancestor was LUCA, not Adam nor Eve

University of Montreal and University of Lyon research study on origins of life in Nature

This release is available in French.

Montreal – Here's another argument against intelligent design. An evolutionary geneticist from the Université de Montréal, together with researchers from the French cities of Lyon and Montpellier, have published a ground-breaking study that characterizes the common ancestor of all life on earth, LUCA (Last Universal Common Ancestor). Their findings, presented in a recent issue of Nature, show that the 3.8-billion-year-old organism was not the creature usually imagined.

The study changes ideas of early life on Earth. "It is generally believed that LUCA was a heat-loving or hyperthermophilic organism. A bit like one of those weird organisms living in the hot vents along the continental ridges deep in the oceans today (above 90 degrees Celsius)," says Nicolas Lartillot, the study's co-author and a bio-informatics professor at the Université de Montréal. "However, our data suggests that LUCA was actually sensitive to warmer temperatures and lived in a climate below 50 degrees."

The research team compared genetic information from modern organisms to characterize the ancient ancestor of all life on earth. "Our research is much like studying the etymology of modern languages so as to reveal fundamental things about their evolution," says professor Lartillot. "We identified common genetic traits between animals, plant, bacteria, and used them to create a tree of life with branches representing separate species. These all stemmed from the same trunk – LUCA, the genetic makeup that we then further characterized."

Reconciling conflicting data

The group's findings are an important step towards reconciling conflicting ideas about LUCA. In particular, they are much more compatible with the theory of an early RNA world, where early life on Earth was composed of ribonucleic acid (RNA), rather than deoxyribonucleic acid (DNA).

However, RNA is particularly sensitive to heat and is unlikely to be stable in the hot temperatures of the early Earth. The data of Dr. Lartillot with his collaborators indicate that LUCA found a cooler micro-climate to develop, which helps resolve this paradox and shows that environmental micro domains played a critical role in the development of life on Earth.

From RNA to DNA: Proof of evolution

"It is only in a subsequent step that LUCA's descendants discovered the more thermostable DNA molecule, which they independently acquired (presumably from viruses), and used to replace the old and fragile RNA

vehicle. This invention allowed them to move away from the small cool microclimate, evolved and diversify into a variety of sophisticated organisms that could tolerate heat," adds Dr. Lartillot.

About the study:

The article, "Parallel adaptations to high temperatures in the Archaean eon," published in Nature (www.nature.com/nature/journal/vaop/ncurrent/full/nature07393.html), was authored by Bastien Boussau (CNRS, Université Lyon), Samuel Blanquart (LIRMM, CNRS: France), Anamaria Necsulea (CNRS, Université Lyon), Nicolas Lartillot (Université Montreal), and Manolo Gouy (CNRS, Université Lyon).

Partners in research:

This study was funded through grants from Action Concerteé Incitative IMPBIO-MODELPHYLO and ANR PlasmoExplore.

Sex difference on spatial skill test linked to brain structure

Men consistently outperform women on spatial tasks, including mental rotation, which is the ability to identify how a 3-D object would appear if rotated in space. Now, a University of Iowa study shows a connection between this sex-linked ability and the structure of the parietal lobe, the brain region that controls this type of skill.

The parietal lobe was already known to differ between men and women, with women's parietal lobes having proportionally thicker cortexes or "grey matter." But this difference was never linked back to actual performance differences on the mental rotation test.

UI researchers found that a thicker cortex in the parietal lobe in women is associated with poorer mental rotation ability, and in a new structural discovery, that the surface area of the parietal lobe is increased in men, compared to women. Moreover, in men, the greater parietal lobe surface area is directly related to better performance on mental rotation tasks. The study results were published online Nov. 5 by the journal Brain and Cognition.

"Differences in parietal lobe activation have been seen in other studies. This study represents the first time we have related specific structural differences in the parietal lobe to sex-linked performances on a mental rotation test," said Tim Koscik, the study's lead author and a graduate student in the University of Iowa Neuroscience Graduate Program. "It's important to note that it isn't that women cannot do the mental rotation tasks, but they appear to do them slower, and neither men nor women perform the tasks perfectly."

The study was based on tests of 76 healthy Caucasian volunteers -- 38 women and 38 men, all right-handed except for two men. The groups were matched for age, education, IQ and socioeconomic upbringing. When tested on mental rotation tasks, men averaged 66 percent correct compared to 53 percent correct for women. Magnetic resonance imaging (MRI) revealed an approximately 10 percent difference between men and women in the overall amount of parietal lobe surface area: 43 square centimeters for men and 40 square centimeters for women.

"It's likely that the larger surface area in men's parietal lobes leads to an increase in functional columns, which are the processing unit in the cortex," said Koscik. "This may represent a specialization for certain spatial abilities in men."

The findings underscore the fact that not only is the brain structure different between men and women but also the way the brain performs a task is different, said Peg Nopoulos, M.D., a study co-author and professor of psychiatry and pediatrics at the University of Iowa Carver College of Medicine.

"One possible explanation is that the different brain structures allow for different strategies used by men and women. While men appear able to globally rotate an object in space, women seem to do it piecemeal. The strategy is inefficient but it may be the approach they need to take," said Nopoulos, who also is a psychiatrist with University of Iowa Hospitals and Clinics.

"The big question remains whether this is nature or nurture. On the one hand, boys, compared to girls, may have opportunities to cultivate this skill, but if we eventually see both a strong performance and parietal lobe structural difference in children, it would support a biological, not just environmental, effect," Nopoulos added.

Life on Mars? Brown-led research team says elusive mineral bolsters chances

PROVIDENCE, R.I. [Brown University] - Over the last several years, scientists have built a very convincing case that Mars hosted water, at least early in its history. Recent observations from the Mars Phoenix lander and other spacecraft show that the planet still holds vast deposits of water as ice at its poles and in soil-covered glaciers in the mid-latitudes.

What is less known is how much water occupied the red planet and what happened to it during its geological march to the present. Mostly, evidence has pointed to a period when clay-rich minerals were formed by water, followed by a drier time, when salt-rich, acidic water affected much of the planet. Assuming that happened, the thinking goes, it would have been difficult for life, if it did exist, to have survived and for scientists to find traces of it.

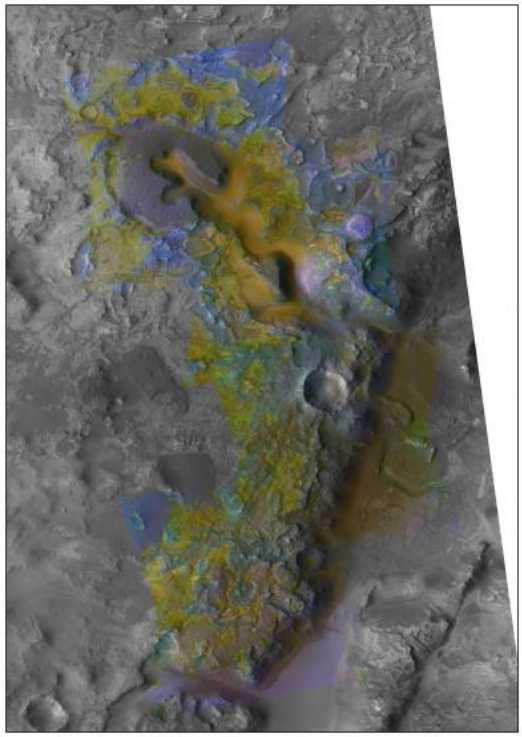
Now a research team led by Brown University has found evidence of carbonates, a long-sought mineral that shows Mars was home to a variety of watery environments - some benign, others harsh - and that the acidic bath the planet endured left at least some regional pockets unscathed.

If primitive life sprang up in pockets that avoided the acidic transformation, clues for it may remain.

"Primitive life would have liked it," said Bethany Ehlmann, a Brown graduate student and lead author of the paper that appears in the Dec. 19 edition of Science. "It's not too hot or too cold. It's not too acidic. It's a 'just right' place.'

Finding carbonates indicates that Mars had neutral to alkaline waters when the minerals formed in the mid-latitude region more than 3.6 billion years ago. Carbonates dissolve quickly in acid, therefore their survival challenges suggestions that an exclusively acidic environment later cloaked the planet.

The carbonates showed up in the most detail in two-dozen images beamed back by the Compact Reconnaissance Imaging Spectrometer for Mars, an instrument aboard the NASA Mars Reconnaissance Orbiter. Scientists found the mineral near a trough system called Nili Fossae, which is 667 kilometers (414 miles) long, at the edge of the Isidis impact basin. Carbonates were seen in a variety of terrains, including the sides of eroded mesas, sedimentary rocks within Jezero crater and rocks exposed on the sides of valleys in the crater's watershed. The researchers also found traces of carbonates in Terra Tyrrhena and in Libya Montes.



A Brown-led team found carbonate-bearing rocks in the sides of eroded mesas in the Nili Fossae region. Scientists believe the carbonates may have been formed at the surface when olivine-rich rocks were exposed, and altered, by running water. **NASA/JPL/JHUAPL/University of Arizona/Brown University**

NASA's Phoenix Mars Lander recently found carbonates in soil samples, and researchers had previously found them in Martian meteorites that fell to Earth and in windblown Mars dust observed from orbit. However, the dust and soil could be mixtures from many areas, so the origins of carbonates have been unclear. The latest observations indicate carbonates may have formed over extended periods on early Mars and also point to specific locations where future rovers and landers could search for possible evidence of past life.

"This is opening up a range of environments on Mars," said John "Jack" Mustard, a Brown professor of geological sciences and a co-author on the Science paper. "This is highlighting an environment that to the best of our knowledge doesn't experience the same kind of unforgiving conditions that have been identified in other areas."

The researchers, including Brown graduate student Leah Roach and scientists from NASA, the Johns Hopkins University Applied Physics Laboratory, the Institut d'Astrophysique Spatiale at the University of Paris, the U.S. Geological Survey, Cornell University and the University of Nevada, have multiple hypotheses for how the carbonate-bearing rocks were formed and the origin of the water that shaped them. They may have been formed by slightly heated groundwater percolating through fractures in olivine-rich rocks. Or, they may have been formed at the surface when olivine-rich rocks were exposed and altered by running water. Yet another theory is the carbonates precipitated in small, shallow lakes. Either way, such environments would have boded well for primitive life forms to emerge.

"We know there's been water all over the place, but how frequently have the conditions been hospitable for life?" Mustard said. "We can say pretty confidently that when water was present in the places we looked at, it would have been a happy, pleasant environment for life."

NASA and the National Science Foundation funded the research.

Mouse trap? Stanford immunologist calls for more research on humans, not mice

STANFORD, Calif. - The fabled laboratory mouse - from which we have learned so much about how the immune system works - can teach us only so much about how we humans get sick and what to do about it, says a leading researcher at the Stanford University School of Medicine.

The time has come for immunologists to start weaning themselves from experimental rodents and to embark on a bold, industrial-scale assault on the causes and treatment of specifically human disease, writes immunologist Mark Davis, PhD, in an essay to be published Dec. 19 in Immunity. Davis, director of the Stanford Institute for Immunity, Transplantation and Infection, proposes that the current mouse-centered, small-

laboratory approach be supplemented by a broad, industrial-scale "systems biology" approach akin to the one that unraveled the human genome. "We seem to be in a state of denial, where there is so much invested in the mouse model that it seems almost unthinkable to look elsewhere," Davis, the Burton and Marion Avery Family Professor and professor of microbiology and immunology, writes in the essay.

Over the past several decades, the little mouse has proven immensely helpful in generating a fundamental understanding of how the mammalian immune system works, Davis said in an interview. "The mouse has been incredibly valuable," he added. "That's part of the problem."

Experimental manipulations that are commonplace with lab mice, such as genetically engineering them to express a foreign protein or to be deficient in the expression of one of their own, would be unthinkable in a human. Because experimental mice can be used to get quick answers, Davis argues, researchers look to the mouse to tell them everything. "In humans it often takes years to find out anything. There are a lot more regulatory, financial and ethical hurdles," he said.

But when it comes to adapting therapeutic interventions that seem to cure all kinds of infectious disease, cancers and autoimmune conditions in mice for use in human beings, the record is not so good. The vast majority of clinical trials designed to test these interventions in people end in failure.

"Mice are lousy models for clinical studies," Davis asserts in his essay. There are probably some good reasons for this, said Davis. For starters, mice are rodents, separated from humans by some 65 million years of evolutionary divergence from our common ancestor.

That's not all. While it takes about 20 years for a person to reach sexual maturity, a mouse gets there in three months. The roughly 100 years during which the furry, diminutive animals have been domesticated and bred in labs are, therefore, the mouse equivalent of 8,000 human years, during which they have been inbred and kept relatively disease-free. They would never survive in the wild, said Davis.

Meanwhile, the past 8,000 years have seen humans crowded into cities, he said. "We've been selected by urbanization, with plagues such as the bubonic plague and smallpox that routinely killed huge numbers of people, and modern scourges like HIV and malaria that still infect and kill millions each year. Most humans are infected with six different herpes viruses, and who knows what else. And while we're suffering away, getting colds and flu, the mice are living in the lap of luxury in miniature condominiums, with special filters on the cage tops to keep bad things out." They're in such pristine shape, Davis notes drily, that researchers have to induce facsimiles of human disease in them. These conditions may or may not accurately mirror ours.

"We can't depend on the mouse for all the answers, because in some cases it's not giving us the right answers," Davis said. "But think about what we can do with people. People come to hospitals, get vaccinations, give blood and tissue samples for routine lab tests and clinical trials. We're not learning nearly as much as we could from these samples. As with the recent history of human genetics, we could be much bolder."

The Human Genome Project, which has radically accelerated the pace of human genetics, was conducted as a large industrial operation carried out mainly in a small number of large centers, including one at Stanford. In a spirited debate attending that project's initial conception, many academics objected strenuously on the basis that doing the same thing over and over isn't a good way to train students and researchers, said Davis. But, he added, "The Human Genome Project didn't destroy the small lab. It complemented it."

In his Immunity essay, Davis writes: "Although the small academic labs as we know and love them are great for innovation and out-of-the-box thinking, some problems in biology, particularly those that involve a great deal of repetitive assays and data collection, are much better suited to a larger-scale organization and execution. The data are both more uniform and considerably cheaper."

Davis sees the need for a national or even international infrastructure to capture information from blood and tissue samples. A local template is Stanford's Human Immune Monitoring Core, run by Davis' colleague David Hirschberg. Affiliated investigators send human samples to this facility, where copious assays of cell types and immune secretions in blood and tissues extract data about experimental subjects' immune status, in a relatively short time. "This information goes back to the principal investigators, but it also gets captured in a database we're developing," Davis said.

The creation of high-throughput assays that could quickly and cheaply measure vast numbers of immunologic variables (many of them first elucidated in the mouse) in a standardized fashion among very large groups of people - some in excellent health, others suffering from one or another disease - would greatly advance immunological discovery, said Davis.

"What if we could define the normal range for all these parameters, and then see how they're changed by any of the over 100 infectious diseases, or 90-odd autoimmune disorders, or more than 120 inherited immune deficiencies that afflict us - or, for that matter, by aging or even vaccination? Maybe we could see something

coming early on and start applying remedies to restore the normal balance and prevent the disease's progression."

Davis envisions routine clinical tests that, analogous to the serum lipid tests we take to learn our predisposition to cardiovascular disease, tell us what shape our immune system is in or what disease we're starting to get. "The game here is that we don't know quite what we're looking for yet," he said. "But some of this information is going to be useful."

Find the aphid

Molted carapaces act as protective decoys for aphids

An aphid being parasitized by an aphidiinae wasp. **Muratori et al., BMC Evolutionary Biology 2008**

By leaving the remains of their old exoskeletons, called 'exuviae', in and around their colonies, aphids gain some measure of protection from parasites. Research published in the open access journal BMC Evolutionary Biology has shown that parasitoid wasps are likely to attack the empty shells, resulting in a lower attack rate on their previous occupants – much like in the popular 'shell game' confidence trick.

Frédéric Muratori and his collaborators from the Université catholique de Louvain, Belgium, and McGill University, Canada, studied the insects in an effort to explain the aphids' tendency to leave exuviae around their colonies, behaviour the authors describe as 'bad housekeeping'. He said, "By leaving exuviae around the colony, aphids make detection easier for the parasite wasps. As such, this behaviour has been thought counter-selective. Here we show that the exuviae act as a decoy, and the time the wasps spend investigating the old shells limits the damage done to the aphid population".

Aphidiinae wasps use an ovipositor at the rear of their abdomen to lay their eggs inside aphids. Eventually, the development of the parasitoid larva is fatal for the aphid concerned. The authors predicted that the areas littered with exuviae decoys would be seen as poor hunting grounds by the wasps who would move on to other patches. In fact, Muratori describes how, "We found that parasitoid females spent more time in patches that contained exuviae than in patches that contained only aphids, suggesting that these females either did not recognize exuviae as low quality hosts or needed time to correctly identify them".

The potential gain for the individual aphids comes from the increased time available to escape from the colony while the wasps are investigating the decoys. According to the authors, "Aphids release an alarm pheromone when they are under parasitoid attack, giving other aphids time to escape. In nature this is achieved by dropping off the plant".

Blocking the spread of antibiotic resistance in bacteria

It's as simple as A, T, G, C. Northwestern University scientists have exploited the Watson-Crick base pairing of DNA to provide a defensive tool that could be used to fight the spread of antibiotic resistance in bacteria -- one of the world's most pressing public health problems.

The resistant nasty pathogens cause thousands of deaths each year in the United States. Particularly virulent is methicillin-resistant Staphylococcus aureus (MRSA), which often cause hospital- and community-acquired infections. The Centers for Disease Control and Prevention calls antibiotic resistance one of its top concerns.

The Northwestern researchers have discovered that a special DNA sequence found in certain bacteria, called a CRISPR locus, can impede the spread of antibiotic resistance in pathogenic staphylococci. It blocks the DNA molecules (plasmids) that move from one cell to another, spreading antibiotic resistance genes. With the plasmids disabled, which the researchers believe is a result of the DNA itself being destroyed, the resistance cannot spread.

The blocking mechanism takes advantage of the fact that a small sequence of this CRISPR locus matches staphylococcal conjugative plasmids, including those that confer antibiotic resistance in MRSA strains.

The findings will be published in the Dec. 19 issue of the journal Science.

"If this mechanism could be manipulated in a clinical setting, it would provide a means to limit the spread of antibiotic resistance genes and virulence factors in staph and other bacterial pathogens," said Erik Sontheimer, associate professor of biochemistry, molecular biology and cell biology at the Weinberg College of Arts and Sciences. Sontheimer and postdoctoral fellow Luciano Marraffini carried out the study. Both are authors of the paper.

Generally, antibiotic resistance is spread through a process called horizontal gene transfer, the simple passing of genes from one individual to another. Bacteria are very adept at this, thus the interest among scientists in identifying biological pathways that limit horizontal gene transfer, particularly the process called conjugation, which is most commonly associated with the spread of antibiotic resistance.

Sontheimer and Marraffini studied the CRISPR locus in a clinically isolated strain of Staphylococcus epidermidis, bacteria that cause infections in patients whose immune systems are compromised or who have indwelling catheters.

The two found that the CRISPR locus can block the transfer of plasmids from one S. epidermidis strain to another or between S. epidermidis and S. aureus strains. The researchers' experiments show that the CRISPR locus limits the ability of the S. epidermidis strain to act as a plasmid recipient, essentially denying entry to the genes carrying the resistance.

They also found that "CRISPR interference," as this phenomenon is known, involves the targeting of the incoming plasmid or virus DNA directly. The CRISPR locus gives rise to RNA molecules (chemical cousins of DNA) that apparently recognize the incoming plasmid or virus DNA by the classic base pairing defined by Watson and Crick. This recognition then appears to lead to DNA destruction by unknown mechanisms.

Virtually any DNA molecule could be targeted with CRISPR interference. This blocking mechanism can, in principle, be "programmed" by incorporating into the CRISPR locus any desired A, T, G, C sequence that would match a target. It could potentially be used to fight antibiotic resistance in other pathogenic bacteria, including those that cause anthrax, tuberculosis, cholera and plague.

The programmable nature of CRISPR interference makes it analogous to RNA interference (RNAi), which has received much attention for its ability to block the functions of specific genes in human cells. Unlike RNAi, however, CRISPR interference operates naturally in bacteria.

The Science paper is titled "CRISPR Interference Limits Horizontal Gene Transfer in Staphylococci by Targeting DNA."

Where did Venus's water go?

Venus Express has made the first detection of an atmospheric loss process on Venus's day-side. Last year, the spacecraft revealed that most of the lost atmosphere escapes from the night-side. Together, these discoveries bring planetary scientists closer to understanding what happened to the water on Venus, which is suspected to have once been as abundant as on Earth.

The spacecraft's magnetometer instrument (MAG) detected the unmistakable signature of hydrogen gas being stripped from the day-side. "This is a process that was believed to be happening at Venus but this is the first time we measured it," says Magda Delva, Austrian Academy of Sciences, Graz, who leads the investigation.

Thanks to its carefully chosen orbit, Venus Express is strategically positioned to investigate this process; the spacecraft travels in a highly elliptical path sweeping over the poles of the planet. "At Venus, the solar wind strikes the upper atmosphere and carries off particles into space. Planetary scientists think that the planet has lost part of its water in this way over the four and a half thousand million years since the planet's birth."

Water is a key molecule on Earth because it makes life possible. With Earth and Venus approximately the same size, and having formed at the same time, astronomers believe that both planets likely began with similar amounts of the precious liquid. Today, however, the proportions on each planet are extremely different. Earth's atmosphere and oceans contain 100 000 times the total amount of water on Venus. In spite of the low concentration of water on Venus Delva and colleagues found that some 2x1024 hydrogen nuclei, a constituent atom of the water molecule, were being lost every second from Venus's day-side.

Last year, the Analyser of Space Plasma and Energetic Atoms (ASPERA) on board Venus Express showed that there was a great loss of hydrogen and oxygen on the night-side. Roughly twice as many hydrogen atoms as oxygen atoms were escaping. Because water is made of two hydrogen atoms and one oxygen atom, the observed escape indicates that water is being broken up in the atmosphere of Venus.

The Sun not only emits light and heat into space, it constantly spews out solar wind, a stream of charged particles. This solar wind carries electrical and magnetic fields throughout the Solar System and 'blows' past the planets.

Unlike Earth, Venus does not generate a magnetic field. This is significant because Earth's magnetic field protects its atmosphere from the solar wind. At Venus, however, the solar wind strikes the upper atmosphere and carries off particles into space. Planetary scientists think that the planet has lost part of its water in this way over the four-and-a-half-thousand million years since the planet's birth.

"We do see water escaping from the night-side but the question remains, how much has been lost in the past in this way," says Stas Barabash, Swedish Institute of Space Physics, Kiruna and Principal Investigator of ASPERA, that looked at night-side data.

The discovery takes scientists a step towards understanding the details, but it does not provide the last piece of the puzzle. To be certain that the hydrogen is coming from water, Delva and colleagues must also detect the loss of oxygen atoms on the day-side and verify that there are approximately half as many leaving Venus as hydrogen.

So far, this has not been possible. “I keep looking at the magnetometer data but so far I can’t see the signature of oxygen escaping on the day-side,” says Delva.

It also highlights a new mystery. “These results show that there could be at least twice as much hydrogen in the upper atmosphere of Venus than we thought,” says Delva. The detected hydrogen ions could exist in atmospheric regions high above the surface of the planet; but the source of these regions is unknown.

So like a true lady, Venus still retains some of her mystery.

Medical acupuncture gaining acceptance by the US Air Force

New Rochelle, NY, - Medical acupuncture, which is acupuncture performed by a licensed physician trained at a conventional medical school, is being used increasingly for pain control. Richard Niemtzow, MD, PhD, MPH, Editor-in-Chief of Medical Acupuncture, a peer-reviewed journal (www.liebertpub.com/acu) and the official journal of the American Academy of Medical Acupuncture, is at the forefront of these efforts in the military.

The technique developed by Dr. Niemtzow has been so successful that the Air Force will begin teaching "Battlefield Acupuncture" to physicians deploying to Iraq and Afghanistan in early 2009. "Battlefield Acupuncture" can relieve severe pain lasting several days.

Based on modern neurophysiological concepts, Niemtzow developed a variation of acupuncture that involves inserting very tiny semi-permanent needles into very specific acupoints in the skin on the ear to block pain signals from reaching the brain. This method can lessen the need for pain medications that may cause adverse or allergic reactions or addiction.

"This is one of the fastest pain attenuators in existence," said Dr. Niemtzow, who is the Consultant for complementary and alternative medicine for the Surgeon General of the Air Force, and is affiliated with Uniformed Services University of the Health Sciences in Bethesda. "The pain can be gone in five minutes."

Medical Acupuncture is an authoritative peer-reviewed journal published quarterly in print and online, written for physicians by physicians, that presents evidence-based clinical papers, case reports, and research findings that integrate concepts from traditional and modern forms of acupuncture with Western medical training. Tables of contents and a free sample issue may be viewed online at www.libertpub.com/acu

Not Just for Depression Anymore

TAU research shows Prozac can fight cancer drug resistance

Prozac is regularly prescribed to ease the emotional pain of patients who are being treated for cancer. But can this common anti-depressant help to fight cancer itself?

Dr. Dan Peer of the Department of Cell Research and Immunology at Tel Aviv University is proving that it can. A study he and his colleagues recently completed validates that Prozac (chemical name fluoxetine) dramatically enhances the effectiveness of a widely used anti-cancer drug. “The good news is that the medical community won't have to wait - Prozac can be used for this purpose right away,” says Dr. Peer, noting that doctors in the U.S. already prescribe it to treat depression in chemotherapy patients.

Fighting Drug Resistance in Colon Cancer Patients

“Prozac is a very interesting non-specific blocker of cancer resistance,” says Dr. Peer, whose study focused on colon cancer and the anti-cancer drug doxorubicin.

In their laboratory experiments, the Tel Aviv University scientists led by graduate student Mirit Argov together with Prof. Rimona Margalit, found that Prozac enhanced doxorubicin's efficacy more than 1,000%. Prozac, in effect, worked to block the cancer drug from leaving the interior of the cancer cell and poisoning the healthy non-cancerous cells that surrounded it.

In animal models, a mild doxorubicin-fluoxetine treatment combination slowed down tumor progression significantly. These results suggest that pairing Prozac with chemotherapeutic drugs to curb drug resistance warrants further clinical study, says Dr. Peer.

His research was just published in Cancer Letters, and his suggestions are now listed as recommendations in the latest version of Cancer Encyclopedia.

Working Backward to Make Great Advances

“Working with a major drug developer, we have validated Prozac's potential, and now Tel Aviv University can lead a humanitarian effort to save lives around the globe,” he says.

Since it is very hard to protect this patent because any clinician can prescribe Prozac, it is impossible for Tel Aviv University to commercialize its research, says Dr. Peer. Instead, he suggests that researchers join forces internationally to implement retrospective studies of all the types of cancer treatment in which Prozac was prescribed. And further clinical experiments to validate the use of Prozac with chemotherapy is also needed, he stresses. “The next step is to take the files of chemo patients and determine whether they received Prozac for their depression,” says Dr. Peer. “This will streamline the understanding in the scientific community of whether,

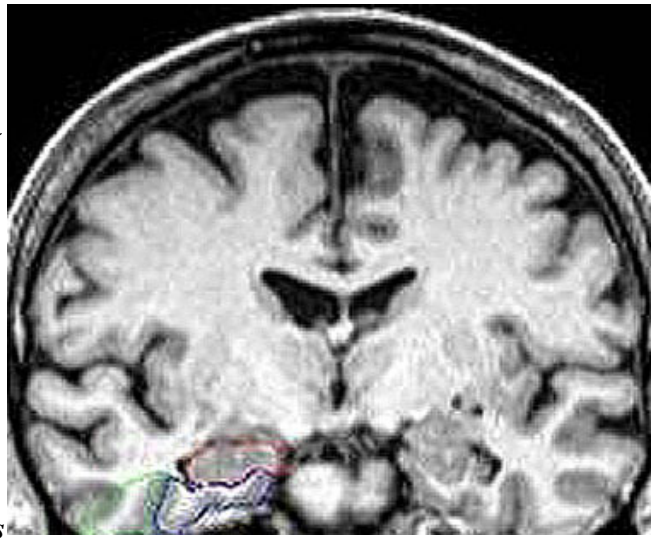
how and for which cancer-fighting drugs Prozac can be an effective partner. It will also give us invaluable information on how to design new drugs."

Dr. Peer's Tel Aviv University lab is also developing several new drug delivery nanotechnologies to bring novel therapeutics into breast, blood, pancreatic and brain cancers. A recent technological breakthrough to reprogram immune cells involved in ulcerative colitis and Crohn's disease was reported in Science earlier this year and it is the basis of a new platform technology developed in his group.

MRI brain scans accurate in early diagnosis of Alzheimer's disease

Researchers advocate including imaging technology as diagnostic test

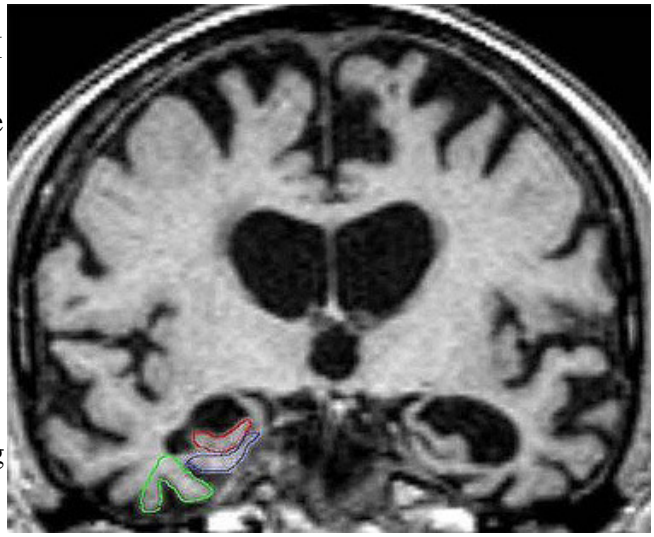
Tampa, FL -- MRI scans that detect shrinkage in specific regions of the mid-brain attacked by Alzheimer's disease accurately diagnose the neurodegenerative disease, even before symptoms interfere with daily function, a study by the Florida Alzheimer's Disease Research Center (ADRC) in Miami and Tampa found.



The study, reported earlier this month in the journal Neurology, adds to a growing body of evidence indicating MRI brain scans provide valuable diagnostic information about Alzheimer's disease.

The findings are important in light of many new disease-modifying drugs in trials -- treatments that may prevent mild memory loss from advancing to full-blown dementia if administered early enough.

The normal MRI brain scan above, showing no atrophy, depicts the three areas of interest in the brain's medial temporal lobe: hippocampus (outlined in red); entorhinal cortex (blue) and perirhinal cortex (green). MRI scan below shows severe atrophy indicative of Alzheimer's pathology in all areas, except the right perirhinal cortex, which has moderate atrophy.



"We advocate, based on these findings, that the criteria for the diagnosis of Alzheimer's disease should include MRI scans," said the study's lead author Ranjan Duara, MD, medical director of the Wien Center for Alzheimer's Disease and Memory Disorders at Mount Sinai Medical Center who is affiliated with the University of Miami Miller School of Medicine and University of South Florida College of Medicine. "By incorporating MRIs into the assessment of patients with memory problems, early diagnosis can be standardized and done far more accurately."

"This study demonstrates that MRI brain scans are accurate enough to be clinically useful, both in diagnosing Alzheimer's disease itself at an early stage and in identifying people at risk of developing Alzheimer's," said Florida ADRC Director Huntington Potter, PhD, a neuroscientist at the Byrd Alzheimer's Center and Research Institute, University of South Florida.

Alzheimer's disease, the most common cause of dementia, is characterized by memory loss, disorientation, difficulty with reasoning and the decline of language and thinking skills. Alzheimer's is diagnosed by a process of elimination since many other diseases and related disorders can mimic its symptoms, and autopsy is currently the only definitive way a diagnosis can be confirmed. The diagnosis often includes a medical history, mental status tests, neurological evaluations and blood tests. Physicians typically use brain scans only to exclude conditions that can also cause memory deficits, such as strokes and brain tumors.

The Florida researchers used a new visual rating system to evaluate the severity of shrinkage, or atrophy, in the brain's medial temporal lobe – specifically in three structures essential for the conscious memory of facts and events. They compared the MRI brain scans of 260 people -- a group with probable Alzheimer's disease, two groups with varying degrees of mild cognitive impairment (mild memory problems), and a control group of normal elderly with no discernable memory loss. They found that scores generated by this MRI-facilitated test accurately distinguished each group from the other and correlated with the types of memory problems most frequently caused by Alzheimer's disease. The more extensive the brain atrophy, the more advanced the clinical stage of Alzheimer's disease.

The researchers even found brain atrophy in some people without memory complaints at the study's onset who demonstrated memory decline when assessed a year or two later. This suggests MRIs could predict who will get the disease well before signs of dementia become apparent by other diagnostic methods as well as rule out an Alzheimer's diagnosis in people experiencing memory problems, Dr. Duara said. "If you don't have changes in these three particular areas of the brain, then you don't have Alzheimer's, Dr. Duara said.

Researchers at centers like Miami's Wien Center and USF's Byrd Institute are developing new Alzheimer's drugs that attack mechanisms leading to the death of nerve cells and their connections. The emergence of these disease-modifying treatments has made an earlier diagnosis of Alzheimer's increasingly important, Dr. Duara said. "Having an accurate diagnosis will allow us to start using drugs earlier. The earlier treatment begins, the more likely you are to stop disease progression and benefit the patient."

Most participants in the MRI study were enrolled in the clinical arm of the Florida ADRC, which is supported by a grant from the National Institute on Aging.

The Florida ADRC, the first statewide, multi-center ADRC in the United States, was critical for the successful implementation of the study, said Dr. Potter, the study's senior author. "To validate any new diagnostic test or treatment, you need a large number of diverse volunteers for good comparisons. Alzheimer's research is a partnership between the scientific community and study volunteers; we need both to solve the complexities of Alzheimer's disease."

A simple fusion to jump-start evolution

Appearing in JBC online Dec. 19

With the aid of a straightforward experiment, researchers have provided some clues to one of biology's most complex questions: how ancient organic molecules came together to form the basis of life.

Specifically, this study, appearing online this week in JBC, demonstrated how ancient RNA joined together to reach a biologically relevant length.

RNA, the single-stranded precursor to DNA, normally expands one nucleic base at a time, growing sequentially like a linked chain. The problem is that in the primordial world RNA molecules didn't have enzymes to catalyze this reaction, and while RNA growth can proceed naturally, the rate would be so slow the RNA could never get more than a few pieces long (for as nucleic bases attach to one end, they can also drop off the other).

Ernesto Di Mauro and colleagues examined if there was some mechanism to overcome this thermodynamic barrier, by incubating short RNA fragments in water of different temperatures and pH.

They found that under favorable conditions (acidic environment and temperature lower than 70 C), pieces ranging from 10-24 in length could naturally fuse into larger fragments, generally within 14 hours.

The RNA fragments came together as double-stranded structures then joined at the ends. The fragments did not have to be the same size, but the efficiency of the reactions was dependent on fragment size (larger is better, though efficiency drops again after reaching around 100) and the similarity of the fragment sequences.

The researchers note that this spontaneous fusing, or ligation, would a simple way for RNA to overcome initial barriers to growth and reach a biologically important size; at around 100 bases long, RNA molecules can begin to fold into functional, 3D shapes.

From the JBC article: Nonenzymatic RNA Ligation in Water" by Samanta Pino, Fabiana Ciciriello, Giovanna Costanzo and Ernesto Di Mauro Article link: http://www.jbc.org/cgi/content/abstract/M805333200v1

New study shows that a cough medicine ingredient could effectively treat prostate cancer

Baltimore, MD -- A study published today in the December issue of the European medical journal Anticancer Research demonstrates that an ingredient used in a common cough suppressant may be useful in treating advanced prostate cancer. Researchers found that noscapine, which has been used in cough medication for nearly 50 years, reduced tumor growth in mice by 60% and limited the spread of tumors by 65% without causing harmful side effects.

Prostate cancer is the most common cancer among men in the United States. The American Cancer Society estimates that 186,320 men will be diagnosed with prostate cancer in 2008 and 28,660 will die from it. One man in 6 will get prostate cancer during his lifetime. Although slow-growing in most men, the cancer is considered advanced when it spreads beyond the prostate. There is no known cure.

The laboratory study was a joint effort by Dr. Israel Barken of the Prostate Cancer Research and Educational Foundation, Moshe Rogosnitzky of MedInsight Research Institute, and Dr. Jack Geller of The University of California San Diego. Noscapine has previously been studied as a treatment for breast, ovarian, colon, lung and brain cancer and for various lymphomas, chronic lymphocytic leukemia and melanoma. This study, however, is the first to demonstrate its effectiveness in treating prostate cancer.

Noscapine is a naturally-occurring substance, a non-addictive derivative of opium. As a natural substance, noscapine cannot be patented, which has limited the potential for clinical trials. Rogosnitzky notes that drug companies are generally unwilling to underwrite expensive clinical trials without being able to recoup their investment. A synthetic derivative of noscapine has been patented but has not yet reached the clinical testing phase.

Since noscapine is approved for use in many countries as a cough suppressant, however, it is available to doctors to prescribe for other uses as well. This common practice is known as "off-label" prescription. Noscapine is increasingly being used off-label to treat a variety of cancers. Dr. Barken used noscapine to treat a handful of prostate cancer patients before retiring from clinical practice. Encouraged by the success of these treatments, his foundation funded the laboratory study being reported in the December 2008 edition of Anticancer Research.

As founder and medical director of the Prostate Cancer Research and Educational Foundation in San Diego, Dr. Barken is encouraging academic institutions to follow up this successful laboratory research with a human clinical trial. He has pioneered a web-based patient tracking system that will greatly reduce the cost of the trial while cutting the time necessary to complete the study. Using the web-based tracking system will also allow doctors outside the U.S. to enroll patients in the research.

Rogosnitzky, director of research at MedInsight Research Institute, points out the significant advantages that noscapine could present as a treatment for prostate cancer. "Noscapine is effective without the unpleasant side effects associated with other common prostate cancer treatments. Because noscapine has been used as a cough-suppressant for nearly half a century, it already has an extensive safety record. This pre-clinical study shows that the dose used to effectively treat prostate cancer in the animal model was also safe."

Hormone therapy and chemotherapy, along with radiation and surgery, are currently used to slow the progression of advanced prostate cancer. Side effects resulting from these treatments include impotence, incontinence, fatigue, anemia, brittle bones, hair loss, reduced appetite, nausea and diarrhea. No toxic side effects were observed in the laboratory study of noscapine.

Breathing life into injured lungs: World-first technique will expand lung donor organ pool

Toronto – For the first time in the world, transplant surgeons at Toronto General Hospital, University Health Network used a new technique to repair an injured donor lung that was unsuitable for transplant, and then successfully transplanted it into a patient. The use of this technique could significantly expand the lung donor organ pool and improve outcomes after transplantation.

In their ground-breaking research, a team of lung transplant surgeons led by Dr. Shaf Keshavjee in the Lung Transplant Program at Toronto General Hospital (TGH) developed an "ex vivo" or outside the body technique capable of continuously perfusing or pumping a bloodless solution containing oxygen, proteins and nutrients into injured donor lungs. This technique, the Toronto XVIVO Lung Perfusion System, allows the surgeons the opportunity to assess and treat injured donor lungs, while they are outside the body, to make them suitable for transplantation.

Unlike current cooling lung preservation techniques which inhibit cell metabolism and the possibility of any active repair processes prior to transplantation, the Toronto technique maintains donor lungs at a normal body temperature of 37 degrees Celsius, allowing for future organ repair and gene and cell therapy strategies to be used on them. Although lung perfusion systems have been used in Sweden and England, these systems were blood-based, short-term assessment strategies which were not capable of long-term maintenance or techniques to repair or recondition the lungs.

The Toronto System was used on donor lungs for Andy Dykstra, 56, who received his transplant on December 5, 2008. He had been waiting for a transplant since July 30, 2008, and was told of the clinical trial testing the new system on December 4, 2008. Recalling his difficulty breathing when walking to the front door in his home, Andy said that he waited only two seconds before deciding to be the first patient to receive the reconditioned lungs, which would not have been suitable for transplant without undergoing perfusion by the Toronto System. "When I was given this chance, the hair on my arms stood up, I was so excited. I knew it was right. I just had to go for it," he said, with his wife Chris standing by his side and nodding for emphasis.

Andy is part of an ongoing clinical trial which uses the novel Toronto strategy to identify donor lungs which do not meet current transplant criteria, repair them, and then transplant them into patients. To date, four patients in total have received lungs treated using this technique, and all have done well. But Andy was the first patient who received lungs which did not meet standard transplant criteria and which could not have been used if they had not been repaired first by the Toronto System. (The three others received donor lungs which met transplant criteria and which were further improved by the Toronto System.) All TGH patients waiting for a lung

transplant are eligible to be part of this clinical trial, and the lung transplant team will assess all those who are interested.

"We are extremely pleased that Andy is doing so well," said Dr. Keshavjee who is Director of the Lung Transplant Program at TGH, Senior Scientist, The McEwen Centre for Regenerative Medicine, Director, Latner Thoracic Research Laboratories, and Professor and Chair, Division of Thoracic Surgery, University of Toronto, adding that Andy was able to breathe without any mechanical assistance just four days after the transplant and was discharged from hospital 12 days after the procedure. "This achievement was the result of years of research and pre-clinical planning by a large team of researchers, surgeons, physicians, nurses and other specialists. It means that many more donor lungs which we could not have used before can now potentially be used safely, and it sets the stage for more sophisticated molecular and cellular repair techniques to be applied in the Toronto XVIVO Perfusion System so that transplant outcomes can be further improved. The potential exists to immunologically pre-prepare the organ before it even sees the recipient's immune system."

He explained that currently only about 15%-20% of donor lungs are acceptable for transplantation since lungs are susceptible to injuries during the brain-death process or from intensive care unit-related lung complications. These numbers can easily be doubled with this technique to treat and improve donor lungs.

Dr. Marcelo Cypel, a transplant surgical fellow at TGH, echoed Dr. Keshavjee's sentiments. "This new technique heralds the beginning of a new era in transplantation since it has allowed us to progress from preserving donor lungs to actually being able to repair some of the injury before transplantation. And we have done this using a unique strategy on donor lungs outside the body."

After the donor lungs are removed from a deceased donor and taken to the hospital, they are carefully transferred to a protective, transparent bubble-like chamber that the Toronto team developed in collaboration with Vitrolife, a company specializing in developing lung preservation solutions To avoid injuring the lungs, a series of precise steps are followed when connecting them to a circuit composed of a pump, ventilator and filters through which flow oxygen, nutrients and a special solution. The temperature is incrementally increased until it reaches 37 degrees Celsius over about 30 minutes, and ventilation of the lungs is begun during that time. Lung function is evaluated regularly on key indicators, such as how easily the lungs can exchange oxygen, airway pressure and lung compliance. Previously published research by Drs. Keshavjee and Cypel on this system (December 2008 issue of the Journal of Heart and Lung Transplantation) has shown that lungs can be safely kept on this circuit for 12 hours in order to assess, maintain and treat them before successfully transplanting them.

Currently, about 80 patients are waiting for either a lung or heart-lung transplant in Ontario. About 20% of those on the wait list will die before they receive a lung transplant. In Canada, the number of people waiting for a lung transplant has doubled in the past 10 years, with 252 Canadians waiting to receive a lung transplant in 2006, compared to 119 in 1997. Two hundred and ninety-nine (299) Canadians died while waiting for a lung transplant between 1997 and 2006.

Groundbreaking, inexpensive, pocket-sized ultrasound device can help treat cancer, relieve arthritis

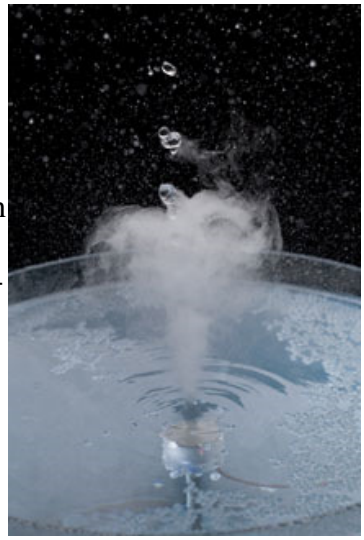
By Anne Ju

A prototype of a therapeutic ultrasound device, developed by a Cornell graduate student, fits in the palm of a hand, is battery-powered and packs enough punch to stabilize a gunshot wound or deliver drugs to brain cancer patients. It is wired to a ceramic probe, called a transducer, and it creates sound waves so strong they instantly cause water to bubble, spray and turn into steam.

Tinkering in his Olin Hall lab, George K. Lewis, a third-year Ph.D. student in biomedical engineering and a National Science Foundation fellow, creates ultrasound devices that are smaller, more powerful and many times less expensive than today's models. Devices today can weigh 30 pounds and cost $20,000; his is pocket-sized and built with $100. He envisions a world where therapeutic ultrasound machines are found in every hospital and medical research lab. "New research and applications are going to spin out, now that these systems will be so cheap, affordable and portable in nature," Lewis said.

The development of one of his portable devices is detailed in the journal Review of Scientific Instruments (79-114302), published online Nov. 11. Lewis, whose paper is co-authored by his adviser, William L. Olbricht, Cornell professor of chemical and biomolecular engineering, also presented his research in a talk at the November meeting of the Acoustical Society of America.

Ultrasound is commonly used as a nondestructive imaging technique in medical settings. Sound waves, inaudible to humans, can generate images through soft tissue, allowing, for instance, a pregnant woman to view images of her baby. But the higher-energy ultrasound that Lewis works with can treat such conditions as prostate tumors or kidney stones by breaking them up. His devices also can relieve arthritis pressure and even help treat brain cancer by pushing drugs quickly through the brain following surgery.



Lewis suggests that his technology could lead to such innovations as cell phone-size devices that military medics could carry to cauterize bleeding wounds, or dental machines to enable the body to instantly absorb locally injected anesthetic.

Lewis miniaturized the ultrasound device by increasing its efficiency. Traditional devices apply 500-volt signals across a transducer to convert the voltage to sound waves, but in the process, about half the energy is lost. In the laboratory, Lewis has devised a way to transfer 95 percent of the source energy to the transducer.

Ultrasound waves created by one of Lewis' devices leave the transducer, submerged under water, causing the water to bubble, spray and turn into steam. **Robert Barker/University Photography**

His new devices are currently being tested in a clinical setting at Weill Cornell Medical College. Under the direction of Jason Spector, M.D, director of Weill Cornell's Laboratory for Bioregenerative Medicine and Surgery and assistant professor of plastic surgery, Peter Henderson, M.D., the lab's chief research fellow, is using one of the devices in experiments that aim to minimize injury that occurs when tissues do not receive adequate blood flow.

Their lab is performing tests in animals to determine whether low doses of the chemical hydrogen sulfide, known to be toxic at high doses, might be able to minimize such injury by slowing cellular metabolism. Doctors are hopeful that the ultrasound from Lewis' portable device will enable hydrogen sulfide to be targeted to specific parts of the body, allowing doctors to use less of it, and cutting down on toxicity risks, Henderson explained. The medical doors that Lewis' device may one day open are groundbreaking, Henderson said.

"People are realizing that when harnessed appropriately, you can use ultrasound to treat things as opposed to just diagnose them," Henderson said. "It's a wide-open field right now, and George's device is going to play a huge role in catalyzing the discovery of new and better therapeutic applications."

Caltech scientists create titanium-based structural metallic-glass composites

The new alloys are lighter and less expensive, but are still tough and ductile enough for use in aerospace applications

PASADENA, Calif.--Scientists from the California Institute of Technology (Caltech) have created a range of structural metallic-glass composites, based in titanium, that are lighter and less expensive than any the group had previously created, while still maintaining their toughness and ductility--the ability to be deformed without breaking.

A paper describing these breakthrough metallic-glass alloys is now online in the Proceedings of the National Academy of Sciences (PNAS) Early Edition in advance of an upcoming print publication.

Earlier this year, the same Caltech group had published a paper in the journal Nature, describing new strategies for creating the liquid-metal composites. This research resulted in "alloys with unrivaled strength and toughness," notes Douglas Hofmann, visiting scientist and lead author on the PNAS paper that, along with the Nature paper, describes work he did while a graduate student at Caltech. "They are among the toughest engineering materials that currently exist."

Samples of the new titanium-based metallic-glass composites showing their toughness and ductility. **PNAS/Douglas Hofmann, Caltech**

Still, there were shortcomings to the alloys presented in Nature. Because they were created for use in the aerospace industry--among other structural applications--they needed to have very low densities. Ideally, the alloys would have had densities in or around those of crystalline titanium alloys, which fall between 4.5 and 5 grams per cubic centimeter (g/cc). The original alloys, made predominantly of zirconium, fell between 5.6 and 6.4 g/cc, putting them "in a no-man's-land of densities for aerospace structures," says Hofmann.

And so Hofmann and his colleagues--including William Johnson, Caltech's Ruben F. and Donna Mettler Professor of Engineering and Applied Science, and a pioneer in the creation of metallic glass--began tweaking

the components in their composites, eventually coming up with a group of alloys with a high percentage of titanium, but which maintained the properties of the previously created zirconium alloys.

"Despite being based in titanium," Hofmann notes, "these alloys exhibit the same impressive properties as the zirconium alloys. They are still tough--in other words, they resist cracking--and they are still ductile. In fact, they are even more ductile than the alloys we'd created in the past."

This decrease in density also resulted in a reduction in cost, adds Hofmann, since zirconium is a more expensive metal than is titanium.

The work detailed in the paper, "Development of tough, low-density titanium-based bulk metallic glass matrix composites with tensile ductility," was supported by the U.S. Office of Naval Research. Hofmann was supported by the U.S. Department of Defense through the National Defense Science and Engineering Graduate Fellowship program.

The paper's coauthors included Johnson; Caltech graduate students Jin-Yoo Suh and Aaron Wiest; Mary-Laura Lind, a visitor in materials science; and Marios Demetriou, a senior research fellow in materials science.

Flexible bridge bounces back after quake test

* 16:02 19 December 2008 **by Colin Barras**

Video: A concrete bridge weighing 181 tonnes is subjected to the effects of an 8.0 earthquake

After spending nine months carefully building a 33.5-metre (110-foot) bridge, US engineers then tried their best to knock it down again.

That apparently paradoxical behaviour was designed to test a new bridge able to "remember" its shape after a quake modelled on the 1994 Northridge Earthquake in Los Angeles, which killed 72 people and injured 9000.

Earthquakes put bridge supports under enormous stresses because of the way one end is hit by a quake before the other. Simulating that effectively requires nothing short of a large-scale replica of the bridge.

So engineers at the University of Nevada used three large shake tables to test a 33.5-metre-long, 181-tonne (200-ton) bridge sporting an exotic new design. The bridge, a quarter-scale replica of its projected real-life size, was subjected to 10 seconds of shaking like that created by an earthquake of magnitude 8.0 (see video, top).

Critical support

The concrete used in the bridge was reinforced with "smart" nickel titanium - Nitinol - a "shape-memory" alloy commonly used in bendable spectacle frames. The alloy retains a memory of the shape it was cast into and, after deformation, springs back to its intended form. "The nickel-titanium rods replace steel bars in critical segments of bridge columns," says Saiid Saiidi, a member of the research team.

Concrete with "dumb" steel inside is designed to yield to a quake's shocks, flexing to reduce the force it experiences, says Colin Taylor, an earthquake engineering specialist at the University of Bristol in the UK, who was not involved in the study.

But although that can help the bridge to remain upright during the quake, the steel inside can remain distorted after the quake, possibly meaning the bridge might need rebuilding from scratch. Using shape-memory alloys should mean that, after the quake, a bridge support attempts to return to its former shape instead, and can remain usable.

Longer life

The preliminary results of the earthquake test confirm that theory. During the 10-second quake simulation, 400 movement sensors mounted at various critical points along the bridge measured the structure's response.

"Our results show that not only [did] the Nitinol/concrete combination reduce the residual tilt [after the earthquake] to near zero, the damage was negligible and repairable," says Saiidi.

The test suggests that Nitinol-reinforced concrete could be used to build bridges that don't just avoid collapse during a strong earthquake, but also remain usable afterwards. "The ultimate goal is to improve the emergency response by keeping bridges open, and minimize interruption to the highway network operation to avoid major economic losses," Saiidi says.

Earlier this year, shake table tests on scaled-down sections of a suspension bridge suggested that using Nitinol to make suspension cables could also make those bridges more resilient to quakes.

Roger Penrose and Frank Wilczek lectures now available online

'Before the Big Bang' and 'Anticipating A New Golden Age' are now available to view online

Roger Penrose on "Before the Big Bang" and Frank Wilczek on "Anticipating A New Golden Age" Are Now Available to View Online Sir Roger Penrose and Prof. Frank Wilczek share their scientific views in two new presentations, now viewable online.

"Before the Big Bang: Is There Evidence For Something And If So, What?" features Sir Roger Penrose, Oxford, examining a great deal of evidence confirming the existence of a very hot and dense early stage of the universe. Much of this data comes from a detailed study of the cosmic microwave background (CMB) - radiation from the early universe that was most recently measured by NASA's WMAP satellite. But the

information presents new puzzles for scientists. One of the most blatant examples is an apparent paradox related to the second law of thermodynamics. Although some have argued that the hypothesis of inflationary cosmology solves some of the puzzles, profound issues remain. In this multi-media presentation, Professor Penrose shows a very different proposal, one that suggests a succession of universes prior to our own. He also presents recent analysis of the CMB data that could have profound bearing on these issues.

"Anticipating A New Golden Age" with Nobel Laureate Prof. Frank Wilczek, MIT, begins with a Core Theory of matter (aka "standard model"), born in the 1970s, a Golden Age for fundamental physics. To date it has passed every experimental test, extending – by many orders of magnitude – to higher energies, shorter distances, and greater precision than were available in the 1970s. Yet we are not satisfied, because the Core Theory postulates four separate interactions and several different kinds of matter, and its equations are lopsided. In this online PI Public Lecture, Prof. Wilczek shows powerful and extremely beautiful ideas for restoring unity and symmetry to the fundamental laws. These ideas are firmly rooted in empirical reality, but at present the evidence for them is circumstantial. The Large Hadron Collider (LHC) will provide critical tests. If Nature has been teaching, not teasing, discoveries at the LHC will inaugurate a new Golden Age, bringing our fundamental understanding of the physical world to a new level. *To view these and other presentations, visit* *http://www.perimeterinstitute.ca/Outreach/Public_Lectures/View_Past_Public_Lectures/*

Judges junk bogus neuroscience

JUDGES in the US are waking up to the potential misuse of brain-scanning technologies. Last month, Judge John Kennedy of the New Jersey Judiciary rallied 50 of his peers to discuss protecting courts from junk neuroscience.

In September, an Indian court jailed a murder suspect for life, partly on the basis of a brain scan. Meanwhile Cephos of Tyngsboro, Massachusetts, is one of several US companies that claim to be able to show whether someone is lying using a functional MRI brain scan. Ethical issues aside, many neuroscientists say the scans have not been tested rigorously enough to be admitted in court, and that they could produce false positives.

Now judges are coming to the same conclusion. Kennedy's gathering, at the New Jersey Judicial College in Teaneck, agreed that brain scans, if accompanied by the opinion of a medical professional, can reveal if a person is in pain or mentally competent to stand trial, but cannot be used to determine a state of guilt.
Scans can reveal if a person is in pain or mentally competent to stand trial, but not guilt

No judge in the US has yet accepted fMRI scans in a trial, but Kennedy expects attempts to admit them to increase. "We're taking a peek over the horizon to see what's coming," he says.

Such considerations are spurred in part by the "Daubert standard" - a Supreme Court ruling that extended a judge's authority to challenge the credibility of scientific evidence in court.

New 'smart' materials for the brain

Research done by scientists in Italy and Switzerland has shown that carbon nanotubes may be the ideal "smart" brain material. Their results, published December 21 in the advance online edition of the journal Nature Nanotechnology, are a promising step forward in the search to find ways to "bypass" faulty brain wiring.

The research shows that carbon nanotubes, which, like neurons, are highly electrically conductive, form extremely tight contacts with neuronal cell membranes. Unlike the metal electrodes that are currently used in research and clinical applications, the nanotubes can create shortcuts between the distal and proximal compartments of the neuron, resulting in enhanced neuronal excitability.

The study was conducted in the Laboratory of Neural Microcircuitry at EPFL in Switzerland and led by Michel Giugliano (now an assistant professor at the University of Antwerp) and University of Trieste professor Laura Ballerini. "This result is extremely relevant for the emerging field of neuro-engineering and neuroprosthetics," explains Giugliano, who hypothesizes that the nanotubes could be used as a new building block of novel "electrical bypass" systems for treating traumatic injury of the central nervous system. Carbon nano-electrodes could also be used to replace metal parts in clinical applications such as deep brain stimulation for the treatment of Parkinson's disease or severe depression. And they show promise as a whole new class of "smart" materials for use in a wide range of potential neuroprosthetic applications.
Henry Markram, head of the Laboratory of Neural Microcircuitry and an author on the paper, adds: "There are three fundamental obstacles to developing reliable neuroprosthetics: 1) stable interfacing of electromechanical devices with neural tissue, 2) understanding how to stimulate the neural tissue, and 3) understanding what signals to record from the neurons in order for the device to make an automatic and appropriate decision to stimulate. The new carbon nanotube-based interface technology discovered together with state of the art simulations of brain-machine interfaces is the key to developing all types of neuroprosthetics - sight, sound, smell, motion, vetoing epileptic attacks, spinal bypasses, as well as repairing and even enhancing cognitive functions."

Two cardiovascular proteins pose a double whammy in Alzheimer's

Researchers have found that two proteins which work in tandem in the brain's blood vessels present a double whammy in Alzheimer's disease. Not only do the proteins lessen blood flow in the brain, but they also reduce the rate at which the brain is able to remove amyloid beta, the protein that builds up in toxic quantities in the brains of patients with the disease.

The work, described in a paper published online Dec. 21 in the journal Nature Cell Biology, provides hard evidence directly linking two processes thought to be at play in Alzheimer's disease: reduction in blood flow and the buildup of toxic amyloid beta. The research makes the interaction between the two proteins a seductive target for researchers seeking to address both issues.

Scientists were surprised at the finding, which puts two proteins known for their role in the cardiovascular system front and center in the development of Alzheimer's disease. "This is quite unexpected," said Berislav Zlokovic, M.D., Ph.D., a neuroscientist and a senior author of the study. "On the other hand, both of these processes are mediated by the smooth muscle cells along blood vessel walls, and we know that those are seriously compromised in patients with Alzheimer's disease, so perhaps we shouldn't be completely surprised."

The new findings are the result of a seven-year collaboration between two laboratories. Zlokovic heads the Center for Neurodegenerative and Vascular Brain Disorders, looking at molecular roots of diseases like Alzheimer's. Several years ago, after he found that several genes well known to cardiovascular researchers seemed to be especially affected in Alzheimer's patients, he turned to Joseph Miano, Ph.D. to help analyze the findings. Miano is interim director of Aab Cardiovascular Research Institute and associate professor of Medicine, and he is senior co-author of the new study.

"To some, it might seem odd that a cardiovascular group would intersect with a neuroscience group to study Alzheimer's disease," Miano said. "But there's a great deal of evidence to suggest that Alzheimer's disease is a problem having much to do with the vascular plumbing. And Rochester is the type of institution where partnerships like these are easy to strike up."

For 15 years Zlokovic's laboratory has focused on the molecular mechanisms regulating blood supply and the role of the blood-brain barrier in the development of Alzheimer's disease. It's not simply that reduced blood supply hurts brain cells by causing a shortage of oxygen and other nutrients. Rather, deterioration of blood flow seems to gum up the brain's ability to remove toxic amyloid beta.

Normally, amyloid is picked up efficiently by blood vessels that then whisk the toxic trash away. But in Alzheimer's disease, the system no longer is able to keep up with the body's production of the substance. The molecular trash accumulates, and Zlokovic and others believe the buildup kills brain cells.

The current work focuses on two proteins well known to cardiovascular researchers, SRF (serum response factor) and myocardin. The two work together within smooth muscle cells that line blood vessels to activate genes that are necessary for smooth muscle to function properly. SRF binds to certain snippets of DNA called CArG boxes and serves as an anchor, while myocardin piggybacks along and turns on the genes to which SRF sticks. Together they act as a master switch that determines whether smooth muscle cells contract – one of many ways the body controls just how much blood is flowing in the body.

Two years ago, Zlokovic and Miano published a study showing that the two proteins are much more active in the blood vessels of brains of people with Alzheimer's disease than in people who do not have the disease. They showed that when they reduced the activity of the proteins, blood flow in the brain increased, and when the genes were more active, blood flow decreased.

The latest report goes further, implicating the molecular duo in the slowed removal of amyloid beta. The team found that SRF and myocardin working together turn on a molecule known as SREBP2. That protein inhibits a molecule known as LRP-1, which helps the body remove amyloid beta. In other words, when SRF and myocardin are active, toxic amyloid beta accumulates.

The findings came primarily from the team's studies of brain cells taken from people who had Alzheimer's disease and comparing them to cells from healthy elderly people.

Compared to the smooth muscle cells from healthy adults, the cells from patients with Alzheimer's disease had about five times as much myocardin and four times as much SRF, about five times as much SREBP2, and about 60 percent less LRP-1. That translated into a reduced ability to remove amyloid beta: Cells taken from patients with the disease had only about 30 percent of the ability to remove the substance as cells taken from their healthy counterparts.

When the team lowered levels of SRF to the same level that exists in healthy cells, the cells from Alzheimer's patients improved in their ability to remove amyloid beta, doing it just as well as cells from healthy individuals. Conversely, when the team boosted levels of SRF and myocardin in the healthy cells, the changes lowered by about 65 percent those cells' ability to remove amyloid beta.

In mice, the team found parallel results. When the team boosted SRF or myocardin in healthy mice, those mice had about twice as much SREBP2 in their smooth muscle cells in the brain's blood vessels. They also had 90 percent less LRP-1, three times as much amyloid beta in their arteries, and 70 percent more amyloid beta in their brain tissue. When the team reduced SRF and myocardin in mice prone to developing Alzheimer's disease, those mice had 60 percent less SREBP2, about four times as much LRP-1, and a 50-percent reduction in amyloid beta in their blood vessels.

The first author of the study is Robert Bell, a graduate student in Zlokovic's laboratory who is in Department of Pathology and Laboratory Medicine's graduate program. He had searched for months, without success, for evidence of a direct effect on LRP-1 by SRF/myocardin. A subsequent literature search turned up findings that the molecules might affect SREBP2. With that finding, the team was able to move forward and put the whole picture together.

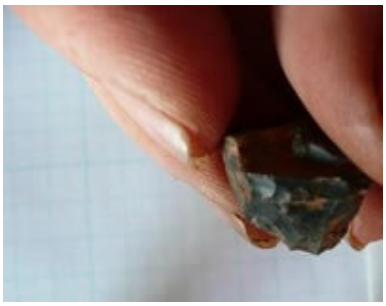
Now the team has turned its attention to studying the role of hypoxia, which seems to play a role in turning on myocardin, as well as searching for molecules that block the hookup between SRF and myocardin.

The work was funded primarily by the National Institute on Aging. Other funding came from the National Institute of Neurological Disorders and Stroke, and from Socratech Laboratories, a company founded by Zlokovic that is seeking to commercialize discoveries related to his work on Alzheimer's disease and stroke. Both Zlokovic and Miano hold a significant equity stake in the company.

In addition to Bell, Miano and Zlokovic, other authors of the paper include Rashid Deane, Ph.D., research professor; Nienwen Chow, Ph.D., a scientist at Socratech; Xiaochun Long, Ph.D., research assistant professor; Abhay Sagare, Ph.D., instructor; post-doctoral associate Itender Singh, Ph.D.; Jeffrey Streb, Ph.D., a former graduate student and now a post-doctoral researcher at UCLA; Huang Guo, Ph.D., research assistant professor; pathologist Ana Rubio, M.D., Ph.D.; and William Van Nostrand, Ph.D., of Stony Brook University Medical Center.

Archaeological Discovery: Earliest evidence of our cave-dwelling human ancestors.

A research team led by Professor Michael Chazan, director of the University of Toronto's Archaeology Centre, has discovered the earliest evidence of our cave-dwelling human ancestors at the Wonderwerk Cave in South Africa.



Stone tools found at the bottom level of the cave - believed to be 2 million years old - show that human ancestors were in the cave earlier than ever thought before. Geological evidence indicates that these tools were left in the cave and not washed into the site from the outside world.

Archaeological investigations of the Wonderwerk cave - a South African National Heritage site due to its role in discovering the human and environmental history of the area - began in the 1940s and research continues to this day. ***More info about this discovery***

One of the early stone tools from Wonderwerk Cave **(Photo M. Chazan)**

Ancient African exodus mostly involved men, geneticists find

BOSTON, Mass - Modern humans left Africa over 60,000 years ago in a migration that many believe was responsible for nearly all of the human population that exist outside Africa today.

Now, researchers have revealed that men and women weren't equal partners in that exodus. By tracing variations in the X chromosome and in the non-sex chromosomes, the researchers found evidence that men probably outnumbered women in that migration. The scientists expect that their method of comparing X chromosomes with the other non-gender specific chromosomes will be a powerful tool for future historical and anthropological studies, since it can illuminate differences in female and male populations that were inaccessible to previous methods.

While the researchers cannot say for sure why more men than women participated in the dispersion from Africa—or how natural selection might also contribute to these genetic patterns—the study's lead author, Alon Keinan, notes that these findings are "in line with what anthropologists have taught us about hunter-gatherer populations, in which short distance migration is primarily by women and long distance migration primarily by men."